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Western Geography

Western Geography – Editors' Note

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You will notice some key differences in this latest volume of Western Geography from previous issues. This is the first-ever to be published entirely as an online journal, a decision that was made at the Western Division, Canadian Association of Geographers (WDCAG) Conference in Victoria (2014). This decision makes for a more cost-effective publication and reduces the footprint of our publication, but also allows for full colour production. We hope you enjoy the new format.

This volume also organized differently, with two forms of publications: Research Papers and Research Notes. The former are full length articles while the latter are new, short summaries of research that was presented at the WDCAG. The Research Notes provide a means of disseminating information on a wide range of topics and readers are encouraged to follow up with the authors for further information.

As always, the documents published in Western Geography are peer-reviewed and illustrate the high quality of work of our membership. We look forward to working with the WDCAG community on future volumes and encourage the submission of Research papers throughout the year and Research Notes following the next WDCAG Conference (Prince George, 2015).

The Editors

Craig Coburn, University of Lethbridge
Tom Waldichuk, Thompson Rivers University
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Research Articles

Re-Locating the orchards of Victoria, BC: Re-connecting with the land

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Abstract: *In these days of food security and the 100 mile diet, here in Victoria, BC we have the opportunity of a 20 yards diet. Victoria has had fruit orchards and trees throughout the region since the mid nineteenth century. Using the first aerial photos of Victoria in the 1920s, these orchards can be re-located and mapped. Being aware of the recent past landscape of Victoria and land use change connects us to the land and we are more likely to care and plan better in its use.*
Because some remnant orchards and trees still exist local organisations such as LifeCycles Fruit Tree Project were contacted to contribute to the harvesting of fruit from residents' yards. Maps and data from this study can assist.

Introduction

"To know a place is also to know the past.

Place…is the past and the present...Every row of trees…" (Tuan, 1975)

In these days of food security and the 100 mile diet, here in Victoria, BC we have the opportunity of a 20 yards diet. Victoria has had fruit orchards and trees throughout the region since the mid nineteenth century. Using the first aerial photographs of Victoria in the 1920s, these orchards can be re-located and mapped. Some remnant orchards and fruit trees still exist. Knowing where the former orchards of Victoria were can assist the local food movement, make us more aware of land use changes, and overall connect us with Victoria's recent past cultural landscape.

Cutler (2012) stated that it is essential to comprehend the past in order to plan for the future. However, because Barnett (1995) warned that the best place to start is "here and now" this project on re-locating and mapping the past orchards of Victoria, BC does not simply want to acknowledge and remember the past just for the sake of nostalgia. Being aware of the recent past landscape and land use change reminds us of our connection to the land and we are more likely to care and plan better in its use.

Victoria's orchard landscape

Due to Victoria's Pacific coast temperate climate, early Anglo-European settlers realized fruit trees would thrive and they were planted as early as 1846 (BC Fruit Growers Association, 1890). In regards to Victoria's past landscape First Peoples have been in the area and on Vancouver Island utilizing the land for thousands of years. (Arima and Hoover, 2011; Keddie, 2003). Turner and Hebda (2012), and Turner (1995) have written about Vancouver Island's native food plants while others have written of the Island's native vegetation (Bjorkman and Vellend,

2010; Gedalof et al, 2006; McMinn et al, 1976). However, this research project's focus was to map the recent past fruit trees and orchards landscape of the Victoria area. Anglo-European settlers cleared the land to establish the orchards and it must be recognized that the planting of these orchards required the uprooting and removal of native vegetation perhaps even native crab apples (Wyllie de Echeverria, 2013). Nonetheless, these planted orchards were part of Victoria's recent past landscape.

After Victoria was established as the capital of the Crown Colony of Vancouver Island in 1858, more Anglo-European settlers arrived and the demand for fruit trees increased as demonstrated by the sale of sapling fruit trees in the [Victoria] *British Colonist* (1860). When compared to the rest of the province, Victoria's fruit trees and orchards were planted in the mid to late nineteenth century (Dendy & Kyle, 1990) and the number of acres and total production of apples, pears, plums and cherries was the highest in the province until the turn of the twentieth century (*Census of Canada 1880-81: Volume III,* 1883; *Census of Canada 1890-91: Volume III*, 1893). However by 1901 the Victoria area fruit industry was surpassed in terms of acres and production by the Okanagan in the southern interior of BC (*Fourth Census of Canada 1901*, *Volume II Natural Products,* 1904).

Overall the Victoria area orchard industry declined in fruit tree acres and production throughout the twentieth century from the highpoint in 1931 to its low in 1951. Because of changing census geographic boundaries over a large span of censuses it is difficult to accurately compare Census agricultural statistics over time. British Columbia's *Department of Agriculture Statistics Reports* (1929; 1951) were consulted which showed a production high of 46,804 boxes of apples in 1929 through a consistent steady decline over the years to only 18,568 boxes in 1951 (British Columbia *Department of Agriculture Statistics Reports*, 1913-1951).

By the time BC's Agricultural Land Commission (ALC) was established in 1974 many of the Victoria area orchards were already gone due to competition from orchards in the Okanagan and perhaps more important, land use changes due to rapid population growth of 135% from 1931 to 1961 in the Victoria area (*Censuses of Canada*, 1931-1961). However reduced in numbers, fruit trees and orchards were part of the recent landscape of Victoria and remnant orchards and trees remain. In contrast, and although nowhere near the figures of 1931, the acres of fruit trees and orchards have increased by 65% between the 2001 Census figure of 210 acres to 346 acres in 2011 (*Census of Agriculture* 2001; 2011).

Web map of Victoria's past and remnant orchards

I began this paper by stating a community can benefit from being aware of the past cultural landscape in the local area. Tuan (1975) stated "People's largely unformulated desire to know more about place remains not entirely assuaged by the offerings of specialists" (p.151) so a public accessible web map

(http://maps.library.uvic.ca/VictoriaOrchards.html) displaying the former and remnant orchards of Victoria was created in order to portray Victoria's recent past cultural landscape.

Lowenthal stated when we attempt to comment on the past "We need to be sure we dealing with the actual past, not with a modern simulacrum" (1975: 27). Scouring through hundreds of the first aerial photographs of Victoria from 1926 and 1928, orchards were identified using Payne and Kiser (2012) criteria of "regular spacing and alignment of trees [in rows] near human occupancy" as opposed to nature's random distribution of trees. See figure 1 for an example of a clipped 1926 aerial photo BA24-37 displaying orchards. The aerial photographs that displayed orchards were geoeferenced and georectified to a current geospatial road network dataset using road intersections. In addition, Canada's Department of National Defence 1934 map *415a Victoria* which was created from the late 1920s aerial photography, and at a scale of 1:25,000 also showed orchards, was likewise geoeferenced and georectified. See figure 2 for a clipped section of *Map 415a Victoria*, 1934 that details the same area as figure 1.

The 1926 and 1928 aerial photographs and 1934 map were clipped to sections that just revealed orchards in order to reduce their digital sizes. The clipped late 1920s aerial photographs and 1934 map were uploaded as two separate layers and overlaid on current satellite imagery of the Victoria area served up by MapBox. (MapBox utilizes a number of open source applications and serves up rapid display tiled imagery.) The clipped late 1920s aerial photos and 1934 map layers can be clicked on and off on to reveal past and current land use. As an example, at http://maps.library.uvic.ca/VictoriaOrchards.html aerial photo BA24-37, 1926 and the accompanying clipped 1934 map layer displays the 1926 and 1934 landscape over contemporary imagery which reveals present-day land use.

Connections with the local community

To the end of community engagement and encouraging the local food movement, Victoria's non-profit LifeCycles organization was contacted because of their Fruit Tree Project in which they harvest and pick fruit from private residences' mostly single family backyard properties. Both this writer and LifeCycles hope more fruit can be harvested because if the public view the web map and see former orchards in the area, even perhaps where they currently live, the public might be motivated to care for any fruit trees they have and call LifeCycles to harvest the fruit. Viewers of the web map are encouraged to contact the author if they know of other orchards or have historical terrestrial photographs of orchards from the Victoria area. In addition, the web map also reveals almost 100 years of land use change from the late 1920s to current.

In summary this project fully concurs with the view of Burgi *et al* (2007) that ecologists, planners, politicians, and the general public

need to be aware of landscape history in order to plan for current and future needs. In addition, Pretty (2002) wrote that agriculture is a common heritage to humans and that we can re-create the connection to the land between consumers and local agriculture. Finally, Yi-Fu Tuan (1975) said it well when he stated "Place…is sustained…by the quality of human awareness" and it is hoped that this project and its web map will add to the understanding of the recent past orchard landscape of Victoria.

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Figures

Figure 1. Section of aerial photograph *BC24-37*, 1926 displaying orchards.

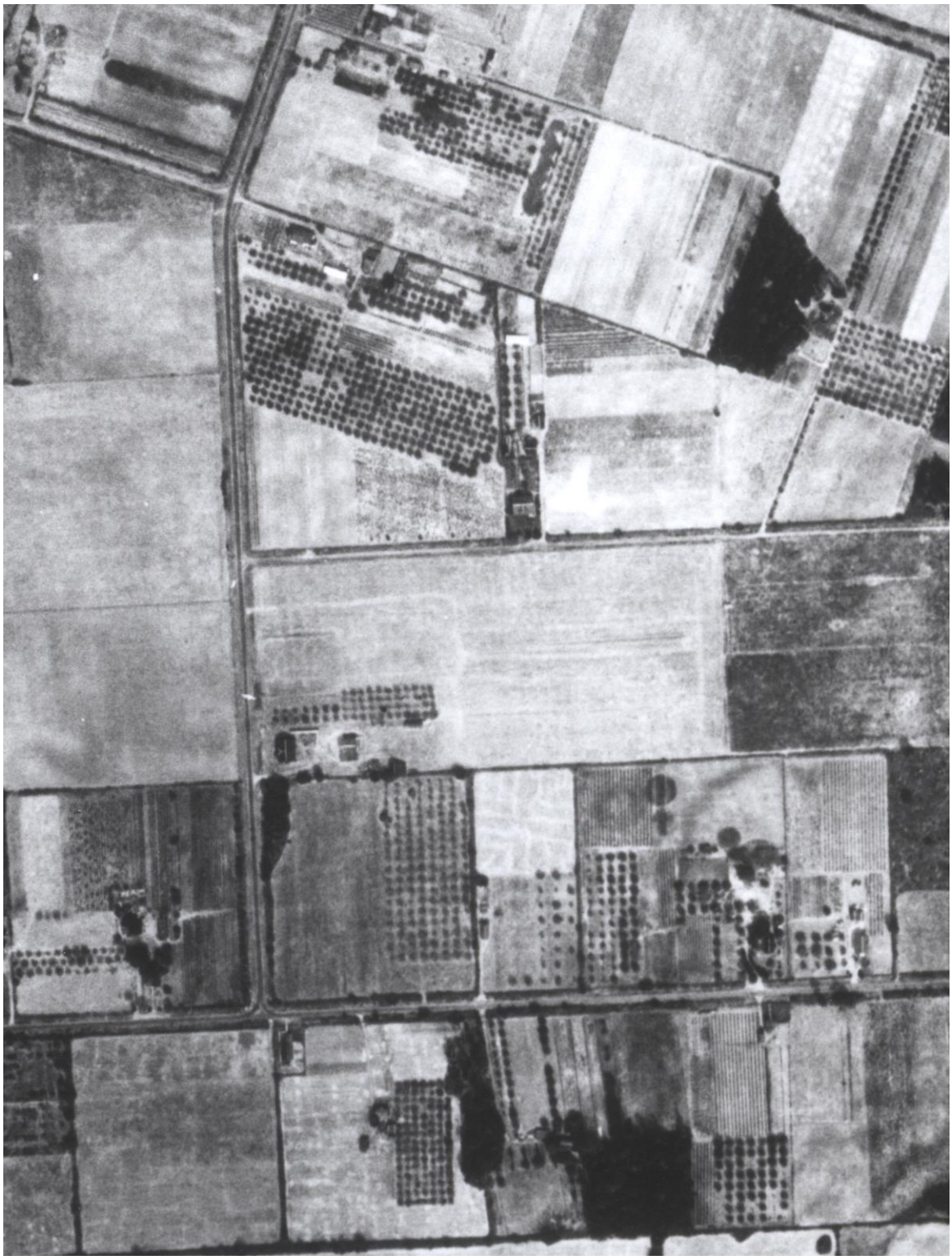
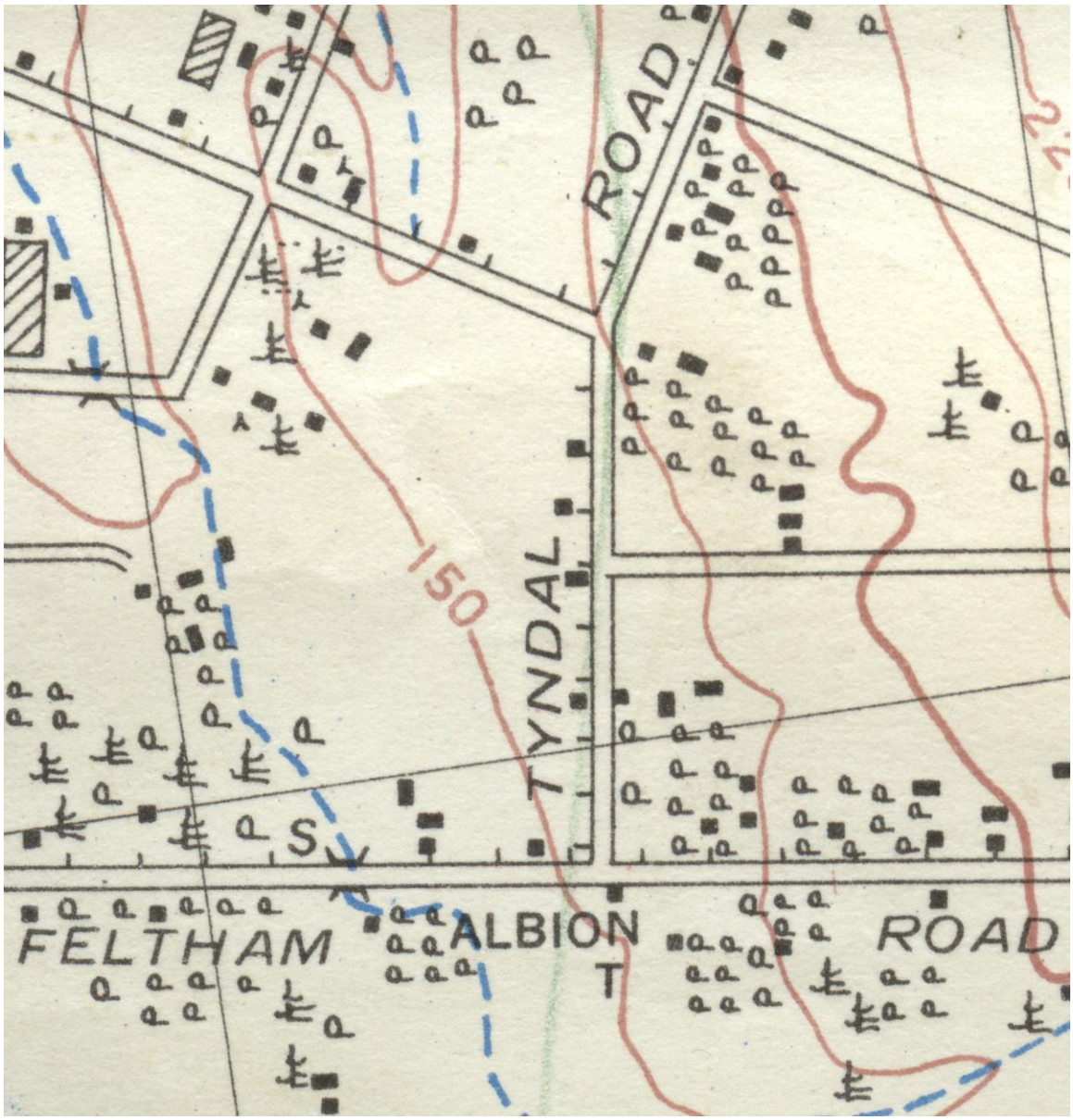


Figure 2. Section of Map *415a Victoria*, 1934 displaying same area of Figure 1. Orchards displayed as recumbent "P" symbols.



Feminicidio: Placing Gendered Violence in Guatemala

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Abstract: *Guatemala is one of the most dangerous countries in Latin America, and increasingly so for women. Since 2000, a plague of violence has been sweeping Guatemala, and its capital Guatemala City, in particular, where approximately half of the homicides are concentrated. One central aspect of contemporary violence sees Guatemalan women targeted for murder and mutilation in urban and rural areas – a phenomenon called femicidio/femicide and/or feminicidio/feminicide – simply for being women 'out of place.' In this paper we argue that the individual and collective violent experiences of women in Guatemala are important for understanding how violence affects the negotiation of space and security (Pain & Smith, 2008) and how the State largely enables the murderers to live in a "killer's paradise" (Portenier, 2006).*

Keywords: Guatemala; femicide; feminicide; women; murder

Introduction

> *We are a society that has gotten used to death…. Women are not seen as great contributors to the country, so violence against them seems to be acceptable.*
>
> Norma Cruz (in Bo, 2009, ¶25-27)

Guatemala is one of the most dangerous countries in Latin America, and increasingly so for women. In June 2009, Guatemalan Human Rights Ombudsman Sergio Morales (Latin American Herald Tribune, 2009) speculated that "'it's very probable that the year [2009] will close with more than 1,000 murders' beyond the 6,292 that occurred last year." Morales was close with his estimate. This 'post-conflict' Central American country recorded 6500+ homicides in 2009 which is more than during any year of the 36-year internal armed conflict which officially ended with the 1996 signing of the Peace Accords (International Crisis Group, 2010: i). "Everyday violence has reached epidemic proportions," Beatriz Manz (2008: 151) highlights, in this country where violence escalated to "genocidal proportions" in the early 1980s. The UNDP (2007: 9) document that homicides increased, since 2000, more than 120%, from 2,655 homicides in 1999 to 5,885 in 2006, moving from a rate of 28 to 48 murders per 100,000 (UNDP, 2010: 69). The year 2009 closed as Guatemala's "most violent year in history" with "17 murders per day" (Méndez Villaseñor, 2009), a sorry statistic which marks Guatemala as producing one of the highest murder rates in the world at 48 murders per 100,000 in 2009 (UNDP,

2010: 69)[1] and one of the lowest rates of investigation and conviction with only two percent reaching trial and of which only 146 cases were solved in 2008 (Littlefield, 2009).[2]

Since 2000, a plague of violence has been sweeping Guatemala, and its capital Guatemala City, in particular, where approximately half of the homicides are concentrated (PDH, 2008: 14). As Carey (2007: 1) makes clear, even though men are ten times more likely to be killed than women, the rapid escalation of unsolved female murder cases is "astonishing." This phenomenon of terror, in which women are intentionally sought out and brutally murdered in the hundreds each year, shows no sign of slowing (Sanford, 2008a; 2008b; 2008c). Instead, as depicted in Figure 1, the statistics and accompanying concern carry with them a sense of uncontrollable escalation and is covered by a veil of impunity so entrenched that citizens, lawmakers and human rights workers are close to a dead stop, for various reasons, on improving the situation or moving towards any achievement of justice (Beltrán, 2007; Guatemala Human Rights Commission/USA, 2009; Torres, 2008: 5).

The reality of both everyday and extraordinary violence which permeates Guatemala's public and private sectors is deeply rooted in the country's colonial and post-colonial histories (Carey, Jr., 2006; Grandin, 2004, 2007; Lovell, 2000), actions taken by the militaristic authoritarian government of the mid-late 20th century (Snodgrass Godoy, 2006; Taylor, 2007), and neoliberal development (Abell, 1999; Benson, Fischer & Thomas, 2008; Stephens, 2005). The internal armed conflict and resulting genocide, which reached its height between 1978 and 1982, produced a cycle of violence and a systemic tolerance for, and perhaps support of, injustice and impunity (Lovell, 2008; Oglesby & Ross, 2009; Steinberg & Taylor, 2003), a level, according to the Inter-American Commission on Human Rights (CIDH, 2009: 1) which reaches 98% on the "impunity index." The lack of prosecution of that violent era's leadership, who planned and dictated the innumerable individual killings and over 600 massacres, has taken the country down the path towards lawlessness and repetition of past events (Amnesty International, 2009; Casas-Zamora, 2009). As Paul Farmer (2008: 167) points out, this is what Carolyn Nordstrom (2004: 224) means when she writes that "violence has a tomorrow." One central aspect of contemporary violence sees Guatemalan women targeted for murder and mutilation in rural and urban areas – a phenomenon called *femicidio*/femicide and/or

[1] The UNDP (2010: 69) document that, in 2009, the country had a national homicide rate of 48 per 100,000 inhabitants, rising to 108 per 100,000 in Guatemala City - rates that position Guatemala as one of the world's most violent countries.

[2] As a point of comparison, the 2008 murder rate in the United States is 5.9 per 100,000 people (Casas-Zamora, 2009) and 1.8 per 100,000 (or 594 murders) in Canada (Li, 2008: 5).

feminicidio/feminicide – simply for being women 'out of place' (Aguilar & Grupo Guatemalteca de Mujeres, 2006; Cresswell, 1996; Russell, 2001; Shephard-Durini, 2008).

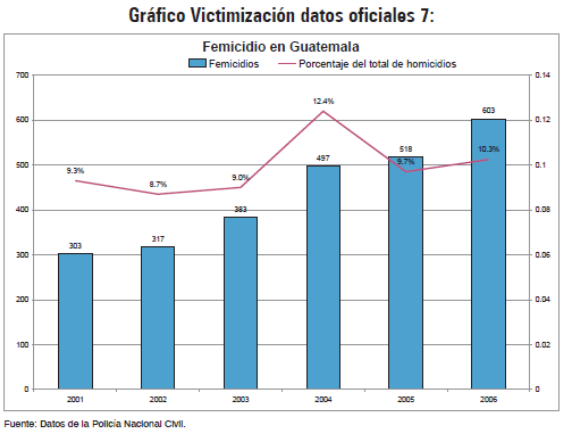

Figure 1. Femicide in Guatemala showing increase in rate over time.

In this paper, we argue that this contemporary and/or continuation of extreme violence takes place at different scales, in public and private spaces, in order to victimize a specific portion of the population, its women; a group that is still highly marginalized and often excluded from recognition as legitimate and autonomous citizens (Berger, 2006; Reade & Nolin, 2008). Our analysis is based on: (1) a review of literature and media coverage of the killing of women and contemporary analyses of political and social violence in Guatemala; and (2) meetings with individuals and social organizations in Guatemala City and the rural countryside in the summer months of 2006 and 2008. Our interest in this topic emerged while meeting with grassroots organizations, non-governmental organizations (NGOs), *campesinos*, and women in the human rights and feminist movements within Guatemala.[3] Our interest during these fieldwork periods was more broadly focused on human rights, rethinking 'development,' and political violence in Guatemala, but mention of concern and outrage regarding the brutal murder of women peppered almost every conversation from Zone 1 of Guatemala City to quiet reaches of the mountain communities of San Marcos.[4]

The increase in numbers of women living and working in the capital due to social and economic factors has created an environment of physical and social insecurity for this group (Berger, 2006). Their social and physical mobility increases the perceived threat to the male population within a poverty-stricken, 'post-conflict' society struggling to negotiate traditionally gendered roles in an increasingly 'globalized' environment (Menjívar, 2006;

[3] During our research, we met with several organizations working on the issues of feminicide and violence against women, including: CCDA, CONAVIGUA, ECAP, FAFG, GGM, GHRC/USA, and MuJER.

[4] Unfortunately, a truly systematic analysis of this phenomenon has proven impossible to accomplish both within and beyond the country due to the repression within the country, the parallel powers that operate within, and lack of rigour with which the escalating number of homicides are recorded and catalogued across various organizations and institutions. The issue is too important to leave alone despite these obstacles and therefore we focus our attention to the need to understand the geographic nature of the phenomenon.

Paterson, 2006; Sunderland, 2002).[5] The concentration of murders in densely populated Guatemala City is happening due to factors which include the increased entry of women into the city for employment, the changing capacity and increasing mobility of the perpetrators, the changing status of women in Guatemala in the fallout of the genocide, and the overlapping urban violence of organized crime, drug trafficking, and gang brutality (Aguilar 2005).

Femicide and Feminicide

The Guatemalan Human Rights Commission/USA (2009: 1) documents that more than 4000 women were brutally murdered between 2000 and 2008 in ways reminiscent of the internal armed conflict and in years long before the genocide (Silva, 2008). [6] The GHRC/USA (2009: 2) document that 2008 was the "most violent year to date for women in Guatemala" with 722 violent deaths reported while Kanakarajavelu (2010: 1) finds that number surpassed in 2009 with 796 women murdered. The term *femicide* is used to describe this phenomenon of violence in Guatemala due to the misogynistic nature of the killings and the alarming rate of increase at which murders continue to take place (Moran, 2006; Ruhl, 2006: 9; Torres, 2007; 2008). Whereas the term *genocide* refers to the intent to destroy, in whole or in part, a national, ethnic, racial, or religious group, the term *femicide* is used to describe the killing of women because of the fact that they are women (Russell, 2001: 13).

Hom (2001: 140) uses the broader term "*social femicide*" to describe how social institutions and orders are implicit in creating structures that "result in death and devaluation of female lives." Hom (2001: 141) uses this term to explain and identify practices of female infanticide in China, for example, where "systems and preferences" of a patriarchal society lead to a politically entrenched social phenomenon. Shalhoub-Kevorkian (2002: 581), too, uses a broader definition of *femicide* to include not only the act of killing and the long-term societal experiences of this phenomenon, but also the pre-existing conditions and "arduous process" leading up to the deaths. Using this expanded definition, the responsibility for the continuation of

[5] These factors are similarly found throughout Latin America and Mexico, in particular. Paterson (2006: ¶10) highlights that feminicide victims in Ciudad Juarez, in northern Mexico, include "housewives, professionals, students, domestic employees, unskilled workers, sex workers, former and current street gang members, and migrants from other countries." Geographer Melissa Wright (2001a, 2001b, 2004, 2008) writes extensively on the issue of feminicide from a feminist geographical perspective in the context of the US-Mexico border violence.

[6] Beltrán & Freeman (2007: 2) indicate that, according to police statistics, between 2001 and the March 2007, more than 2,500 women were brutally murdered. Therefore, firm statistics on this phenomenon are difficult to cite as the source of record keeping, from the National Police to various NGOs, vary widely.

femicide within a society is placed on the particular structures of law or society that constitute, recreate and maintain social beliefs and actions. The individuals and organizations that perpetuate victimization through "inaction-tolerance and, at-times, total muteness" are thus justifiably implicated in the atrocity (Shalhoub-Kevorkian, 2002: 584). In Guatemala, we see this expanded definition labelled *feminicidio*/feminicide.

Victoria Sanford (2008a; 2008b; 2008c) and Sandra Moran (2006), among others, explain that the concept of *feminicide* builds on the term femicide and is a decidedly political term. We agree with Sanford (2008a: 21) who argues that:

> Conceptually, it encompasses more than femicide because it holds responsible not only the male perpetrators, but also the state and judicial structures that normalize misogyny. Feminicide connotes not only the murder of women by men because they are women, but also indicates state responsibility for these murders whether through the commission of the actual killing, toleration of the perpetrators' acts of violence, or failure to ensure the safety of its female citizens. In Guatemala, feminicide exists because of the absence of state guarantees to protect the rights of women. Impunity, silence and indifference each play a role in feminicide.

Warren (1993), Rich (1996), Zur (1998), Green (1999), and Reade & Nolin (2008) believe that women in Guatemala represent the centre of family and community. This cultural position, however, "provides no actual respect or physical and emotional protection … gender specific exploitation, discrimination, violence and oppression exist in laws, cultural and moral norms and daily behaviour of the society" (Rich, 1996: ¶4). As cited by Yakin Ertürk, the United Nations Special Rapporteur on Human Rights (2005: 2), in Guatemala, violence towards women is sanctioned through the blatant impunity that exists for perpetrators of violence and by making violence against women invisible or seen as a source of shame for the female victims. During a 2004 visit to Guatemala, Portenier (2006), in her film *Killer's Paradise*, captures Ertürk stating that "continued inequality and discrimination between genders and the abuse of authority is the cause of the violence."

Critical Scales of Murder and the Body Count

As with other contemporary work on murder, gender and racial violence (Razack, 2002; Warf & Waddell, 2002), critical analysis of the femicide and feminicide facilitates movement beyond a merely "descriptive" dialogue; it is used here to identify some of the underpinning causes of inequalities, to root out

ineffective and discriminatory policies and ideologies that exacerbate the deterioration of human rights, especially the rights of women. This paper is framed from the perspective that the individual and collective experiences of women in Guatemala are important for understanding how violence affects the negotiation of space and security (Pain & Smith, 2008) and how the State largely enables the murderers to live in a "killer's paradise" (Frenkiel, 2006; Portenier, 2006). We identify some of the ways in which the private and public spaces in which feminicide takes place is controlled by largely ineffective police and judiciary bodies - post-colonial remnants whose actions reflect pressures from external economic and political powers with vested interest in resources and capital available for exploitation within the country (Clark & North, 2006; Gordon & Webber, 2008; Nolin & Stephens, 2010; Rights Action, 2008). With these economic interests and external pressures in mind, the Guatemalan government avoids facing its ongoing role in maintaining and perpetuating the structural causes of feminicide (Ertürk, 2005).

Scales of Feminicide

The numbers of women killed each year and the geographic context of those murders (specifically abductions / enforced disappearance and 'body dumps' where murders are committed somewhere in between), have escalated significantly each year, most markedly since 2001 (see Figure 1; Robinson, 2006; Reade & Nolin, 2008: 20; Sanford, 2009). The intensifying trends indicate not only the changing nature of violence in the country but also reflect the socio-economic dynamics of Guatemala City (Robinson, 2006). Alan Robinson (2006) of the Fundación de Antropología Forense de Guatemala / Guatemalan Forensic Anthropology Foundation (FAFG) suggests that the change in the geographic location and temporal frequency of the assassination of women demonstrates the shift (or sharing) of power from state to private parties (private security forces, for example), and the melding of common and political crime (Snodgrass Godoy, 2005: 606). By comparing similarities in contemporary and historical methods of violence, patterns between Guatemala's feminicide, the genocide, and historically-rooted gendered violence are revealed. Through a critical geographic lens (Giles & Hyndman, 2004; Springer, 2009; Sundberg, 2004), we critique the common approach of viewing murders taking place in private settings as 'domestic violence' (femicide) versus murders in public settings as 'political murders' (feminicide), and what these methods and locations of violence signify in light of the broader social dynamic of the capital's urban spaces. Various uses and abuses of space, especially by perpetrators, reveal some of the motives for feminicide, which include social control through the terrorization of the female population. We highlight relationships between organized groups with vested interests in social, physical, and economic spaces in order to pinpoint areas where change is needed that may impede the activities of those who currently target and murder women with impunity.

The negotiation of space by women in Guatemala City is hampered when violence is not sufficiently addressed by those in power (Torres, 2008). In performing their roles and enforcing existing legislation, organizations and government bodies especially, can begin to counteract violence that affects women at multiple scales (Drysdale Walsh, 2008). We want to take into account feminist notions of security beyond a merely geopolitical definition, to include various scales and forms of human security (Hyndman, 2001). These include a focus on security at the scale of the body (fear for one's life) to security defined at the societal scale including "freedom from consequences of conflict" (Hyndman, 2004: 313). Patterns emerge which reveal how directed violence and murders of women, the government's passive disengagement from effective investigation of murders or enforcement of law, and finally their inability to provide social support to women and families victimized by violence in Guatemala City act to strip women and society of the right to security (Menjívar, 2008). We spoke with Norma Cruz, Executive Director of the Survivors' Foundation (*Fundación Sobrevivientes*) on the eighth and final day of her hunger strike on the steps of the Guatemalan National Palace organized to bring attention to these vary issues; a desperate act aimed to shine a light on government inaction and lack of funding to support victims and their families (Cruz, 2008: personal correspondence).

Contemporary and historic contexts are important to discuss in relation to the now-escalating wave of feminicide that was the worst-yet seen by the end of 2009 (Figure 1). Reasons for this targeting of women particularly over the past nine years can be attributed to factors based on cultural, economic and demographic change (Benson & Fischer, 2009). They are linked to the acceleration of judicial processes against those responsible for the genocide (and the subsequent threat this presents to those responsible for human rights violations). Feminicide is affected by the continued relationship between patriarchy and tightly embedded structures of impunity dominating the social fabric of Guatemala (CCPDH, 2006: 246; Grais-Targow, 2004).

Geographic patterns of violence in Guatemala City provide illustration of how public versus private crime differs across the urban landscape and across time, in relation to the manner in which similar crimes were carried out in the 1980s (Godoy-Paiz, 2008). While the internal armed conflict formally ended in 1996 with the United Nations-brokered Peace Accords, Steinberg et al. (2006: 62) state that because "so few perpetrators of violence have been brought to justice, it would be premature to say that Guatemala as a whole has had any sort of closure related to the violence. Among some sectors of Guatemalan society, there is still wholesale denial and rejection of past violent events." Though beyond the scope of this paper, a spatial analysis of violent events, both during the genocide and as they unfold today in the feminicide, is important to unravel and explain, at some level, how and why such events take place

(Clouser, 2009). Further to this goal, identifying the geographic scale of the murders of women can provide another level of analysis and reveal important patterns. Acknowledgement of the significance of place and the vulnerabilities of women in the various spaces they occupy on a daily basis (Domosh & Seager, 2001) enables and enhances the efforts of individuals and organizations to provide solidarity and improvement of the situation through policy enforcement and political pressure. The development of feminicide as a significantly urban phenomenon indicates a relationship between the changing socio-structural composition of the capital (Menjívar, 2006: 94) and the intensification of murders of women. The physical manner in which the murders take place is vital to understanding parallels between the individual murders and massacres that took place during the genocide, and contemporary violence and murders of women in the urban environment. Violence translates across time, revealing disturbing similarities among perpetrators of crimes against women through the decades (Silva & Nolin, 2009).

The absence of the rule of law, a result of the chaos and political instability of post-war/pre-peace Guatemala, fosters a continuum of violent acts against women, including murder, rape, domestic violence, sexual harassment and commercial sexual exploitation. Increasing number of violent murders of women in Guatemala City, among other violent crimes, is an explicit example of the long-term effects of conflict on a struggling society (Amnesty International, 2005; CEH, 1999; Nolin Hanlon & Shankar, 2000; REMHI, 1999). Structural instability hinders the actions of women's organizations that work to bring about justice. Sandra Moran (2006), director of *Sector de Mujeres* (Women's Sector) in Guatemala City, argues that this instability results from the cultural aversion to recognition of women's rights and from fallout effects of the internal armed conflict, whose perpetrators continue to operate within the country as leaders, guards, and police (Moran, 2006). According to 1996 Nobel Peace Prize winner Guatemalan Rigoberta Menchú, the current wave of violence against women is "one of the echoes" of the genocide, which left in its wake "footprints of violence and deep resentment" (Sauer, 2005: 36).

The body count

Geographers focus on the body as a space and understand that "our bodies make a difference to our experiences of place (Rich, 1986: 212). Critical geographical work examines why and how particular bodies are defined as "other" and marginalized. In this case, the bodies of women are central objects of personal concern and embody a key social issue (Valentine, 2001: 15). Cházaro & Casey (2005: ii) indicate that girls and women in Guatemala between the ages of approximately 13 and 36 are targeted in and around the nation's capital because of their gender, not only because of isolated incidences of violence that are differently motivated case-by-case (as the current legal system attempts to convey). The girls and women are sexually assaulted,

physically tortured, killed, and usually left in public places (Amnesty International, 2005: 4; Grais-Targow, 2004: 29). The prevalence of violence against women now receives substantial, though not systematic, newspaper attention. Due to rapidly rising numbers, Guatemala now leads Latin America for rates of violence against women (Mora, 2004; PDH & Morales Alvarado, 2009). The general trends on numbers from various sources, year-to-year, agree, save for a few whose sources may be questionable, such as government agencies hoping to downplay the issue (Amnesty International, 2005: 3; Ruhl, 2006: 8). In a city population of approximately two million, the rate of women murdered between 2003 and 2005 rose 56%; 20% higher than that of males (Ruhl, 2006: 9).

Amnesty International's ground-breaking report *Guatemala: No Protection, No Justice: Killings of Women in Guatemala* (2005) demonstrates that in recent years, the number of women murdered annually in Guatemala has increased; confirmed, unfortunately, in their more recent *State of the World's Human Rights* (2009) report. Between 2001 and the end of January 2005, 1,300 women were murdered (Davis, 2005) with 424 women murdered in 2003 and only 22 of these cases investigated (Tuckman, 2004). In the first half of 2004, 225 women were found murdered (GHRC/USA, 2004) with the victims primarily between the ages of 16 and 35, poor and primarily Indigenous Maya females (Glaister, 2004). Silva (2008) indicates that statistical information from the *Ministerio Publico* (Public Ministry) showed convictions of "only twelve men of the 1,227 registered deaths of women between 2002 and 2004."

The Office of the Human Rights Ombudsman carried out a study of violent crimes committed between January and September 2003, collecting information from death certificates, police reports and the *Ministerio Público* (Ertürk, 2005). These revealed that of the 272 violent deaths of Guatemalan women reported between January and September "53 per cent had bullet wounds, 12 per cent had stab wounds, 8 per cent had been beaten and 5 per cent had been strangled" (Ertürk, 2005: 10). The regions of the body most frequently injured were the head and thorax and in two cases, the upper extremities had been almost amputated (Ertürk, 2005: 10).

Freddy Peccerelli (2008), FAFG Executive Director in Guatemala City, indicates that the evidence of assault seen on victims' bodies are often confirmed to be inclusive of both peri-mortem and post-mortem assault; not only is the woman killed, but her body is revealed to the public by the perpetrator in order to "transmit the message that they have the power" (Morales qtd. in Tuckman, 2004). The manner of death and the use of the body as a place of control and violence is as important to the understanding of feminicide as the meanings behind the death, because the manner indicates motive. When such violence is enacted on a woman's body, it confirms a disregard and lack of respect for women in the most basic sense. Galdos (2009) spoke with doctors at the Guatemala City morgue

and found that "doctors are shocked by the condition of the bodies."

Placing murder

All of the individuals and organizations with which we met recounted to us that feminicide victims are often abused, assaulted and killed in *private locations* away from the public eye. The acts of violence themselves, for the most part, are *private*. However, our contacts recounted how women are often *kidnapped in broad daylight* and their bodies are later left in *public locations* such as street corners, public squares and roadways, where they may be found by strangers and family alike. As crudely revealed in countless media reports and compassionately represented by Portenier (2006) in her documentary film, *Killer's Paradise*, the visible brutality of their wounds illustrates the violence of the actual incident leading to death (and post-mortem violence as well, since the objective is not only to terrorize the woman, but to terrorize the public). Therefore, the act and illustration of violence on the space or surface of the body is as important to the killer before the victim's death in causing fatal harm as it is in creating a message to the public and inflicting visible terror as was practiced during the genocide to silence remaining communities. Assault takes place behind walls or under the cloak of darkness, mostly serving to protect the perpetrator, who does not enjoy the same complete impunity under which the military acted during their State-ordered "counter-insurgency" campaigns. The body's attack symbolizes the misogynist nature of the perpetrator, who acts of his own free will, though driven by, and as a product of, deeply rooted cultural tendencies. Contempt for women in a broad sense is represented physically on the space of the body, a space that the perpetrator can control by force (Russell, 2001; Shalhoub-Kevorkian, 2002).

Issues of privately-versus-publicly committed crimes are descriptive of motive and purpose in the killings of women. The complex geographies of highly congested and concentrated Guatemala City lend a certain level of anonymity to individuals who carry out a violent crime and evade the authorities afterwards (known in crime analysis as 'the crime triangle') (Boba, 2005: 61) where there must be a "person willing and motivated to commit a crime, a vulnerable victim/target, and a place lacking sufficient oversight/guardianship." With knowledge of the city and the surrounding physical landforms (ravines, heavy vegetation, lakes and rivers), and the short supply of patrolling police in many peripheral areas, gangs and criminals face little difficulty in carrying out acts of feminicide. The brutal methods used to murder women require some amount of space, time and privacy. The dumping of bodies outside of the private sphere, however, allows for public discovery and a witnessing of the violation of the female victim's personal space and of the relative sanctity of public space.

Criminal profilers and forensic analysts believe that post-mortem trauma to the body, and subsequent display or intentional placement of the

body where it will be discovered symbolizes intent to make a point beyond the act of killing one person (Turvey, 1995; Walsh-Haney, 2009; Walsh-Haney et al., 2010). It is an attempt to establish control where a perceived lack of control exists and to elicit fear and humiliation from the victim. Through the post-crime revelation or display of the body, the intellectual author's political motivations are satisfied and the murderer temporarily quiets whatever emotions drive the act of murder. Perpetrators are well-aware of the 'window of opportunity' opened by high levels of impunity. The body's public exposure demonstrates disregard for the law, for the legislation laid out in the Peace Accords, the efforts of numerous groups such as the National Committee for Prevention of Violence against Women (Moran, 2006), and others. The inability or lack of motivation of police to pursue murderers provides incentive and assurance of what can essentially be considered state protection through their inactivity and lack of will to act despite continued international criticisms (Ordonez, 2006; Snodgrass Godoy, 2005).

The female targets of feminicide vary, based on either their associations (family, university or street-gang association), or on the associations and motivations of their attackers at the time of the abduction and death. All of the women, however, are victims because of the same rooted societal propensities and cultural norms. Two major theories dominate the considerations of why feminicide has evolved to the uncontainable intensity seen today. The first (popular with the Republic's leadership and with former intellectual authors of terror), is that the killings are related to *gang-violence* and that the victims are involved in some level of activity including drug trafficking or prostitution (Grais-Targow, 2005; Moran, 2006; Tuckman, 2004). The second is that a deeper, *institutionalized force* is behind the killings, and that while gangs contribute to a major portion of the violence, they are acting on the approval, even the order, of a group or individual within the government. Sociologist Angelina Snodgrass Godoy (2005: 602) asserts that an "unconventional enemy" exists and is acting in Guatemala, operating from the top and using common criminals to essentially 'do the dirty work.' The increasing number of death threats, raids, and acts of intimidation against human rights organizations who condemn and work against the rise of feminicide suggests that the killings are not done for the sake of themselves and are not the result of disorganized "common crime" (Snodgrass Godoy, 2005: 602).

These *modus operandi* are reminiscent of torture methods used during the genocidal "counter-insurgency" (Ertürk, 2005: 10); Latin American Weekly Report, 2004; Tuckman, 2004). The Latin American Weekly Report (2004: ¶5) points to gang violence acted out under the oversight of clandestine groups who authorize the murders in the name of social cleansing. Human rights organizations claim that despite the government's referral to gang

involvement in the majority of the deaths, the "scale and methods" (reminiscent of the brutal *modus operandi* used by the army during the genocide) suggest otherwise (Agner, 2008; Glaister, 2004: ¶4). The bodies carry marks similar to those seen during the genocide: hands are tied, defensive cuts and multiple stab wounds are evident, morgue records of these recently killed women bear disturbingly similar descriptions to those of women killed during the armed conflict (Moran, 2006; Grais-Targow, 2005), though the violence carried out surreptitiously against women differs from the publicity of the massacres and killings carried out during the genocide.

Impunity: Structurally maintained environments of violence

The impunity enjoyed by the perpetuators of violence sustains multiple structures of power which the Human Rights Ombudsman's Office (PDH, 2009), among many others, argues results in fear and lack of confidence in State apparatuses. The major problem confronting the State is its inability to provide women with legal, judicial and institutional protection from violence (Ertürk, 2005; GHRC/USA, 2009; Grais-Targow, 2005; Sanford, 2009; Sauer, 2004). Victim-blame and an ineffective, ill-trained police force contribute to the level of impunity that perpetrators can depend on when carrying out crimes of assault or murder, especially against women. Authorities continue to insist that crimes are committed against women involved in gang-related activities, though admitting to "gaps" in this claim (Ruhl, 2006: 19).

Shalhoub-Kevorkian (2002: 590) highlights how simplistic descriptions of feminicide by authorities ("crimes of passion" and "crimes of honour") avoid the truth of how entrenched political, economic, cultural and gendered factors interplay to produce and maintain discrimination. For example, denial or downplaying of the severity of Guatemala's feminicide emerges from the upper echelons of the nation's government and military. In 2004, former army general, then Presidential candidate, Otto Perez Molina denied that women are targeted, as they comprise only 8% of the murder victims in the capital, and those who are murdered are directly involved in criminal activity and/or tied to gang violence (De Leon, 2004; Lloyd, 2004: ¶9).

The structurally maintained violent environment, impunity, and historical silence in Guatemala stems from the 36-year internal armed conflict, spanning from 1960 to 1996 (Nolin Hanlon & Shankar, 2000). The 1996 Peace Accords officially ended the conflict and contained provisions specifically designed to protect the rights of women and Indigenous peoples (Ertürk, 2005). The inadequate implementation of the Peace Accords has "precluded women and Indigenous groups' benefiting from its provisions" and has contributed to the atmosphere of insecurity and violence that still characterizes Guatemalan society (Ruhl, 2006; Nelson, 2009). The Peace Accords contained a number of significant provisions on women's rights, including protection of families headed by women; rights of

Indigenous peoples with particular focus on Indigenous women; and "commitment to the principle of positive discrimination to increase women's participation in the public sphere" (Ertürk, 2005: 5). The problems of socio-economic inequality and exclusion that sparked the internal armed conflict remain unresolved, leaving women, particularly Indigenous women, at risk of violence due to the "compounded discrimination they face based on sex, ethnicity and class" (Ertürk, 2005: 2).

Violence against women is met with impunity in Guatemala as authorities fail to investigate cases, and prosecute and punish perpetrators (GHRC/USA, 2009: 2; Ertürk, 2005: 2). According to Ertürk (2005: 2), and Sanford (2008b: 113) more recently, no improvement is evident due to the failure of security and justice institutions to respond adequately. On International Women's Day 2009, Ana Gladys Ollas with the PDH reported that in the previous year, only one person was found guilty of femicide[7] (according to the new *Law of Femicide*)[8]. At the same presentation, even Marlene Blanco Lapola, the director of the National Civil Police (PNC, by its Spanish acronym) admitted these struggles, "It is frustrating for a police officer to risk their life to capture a criminal who minutes later is free to leave and mock him" (Blas & Reynoso, 2009: ¶2).

As opposed to Molina's indifferent and ill-informed view of the feminicide as the result of women's involvement in gangs, many femicide victims are students and respected community members of the city's lower *and* middle working classes. Ertürk (2005:10) identifies that the most frequent victims are housewives (24%), domestic workers (13.6%) and students (11%). These women, often Indigenous, end up in the wrong place at the wrong time and become targets for the acting out of rage and hatred which takes advantage of women in public spaces (Cevallos, 2004).

In addition to the general disorganization of the judicial system, Beltrán & Freeman (2007: 4) argue that the structure is fraught with racism and class-based discrimination. Indifference, as well as a calculated maintenance of the status quo, spreads throughout the powerful sectors of society, deeply into the formal structures of the nation since the genocide, likely due to the transition of former military personnel into police and government positions. Diego Cevallos (2004) directly implicates police and judicial authorities in the killings of women. One example of the disregard of the feminicide by the government is evident in the special female-homicide police unit formed within the PNC. It is equipped with just "fifteen officers,

[7] *The Law of Femicide* uses the terminology of femicide and not feminicide and therefore we use the term femicide here.

[8] On April 9, 2008, the Guatemalan Congress passed Decree 22-2008, the *Law Against Femicide and Other Forms of Violence Against Women* which officially recognizes 'femicide' as a punishable crime. To date, few results are evident stemming from the passage of this new law. See: Guatemala Human Rights Commission/USA. 2009

two computers, one vehicle and one mobile telephone" (Glaister, 2004: ¶9). Families are shocked at the level of investigative carelessness and the poor outcomes of their daughters' cases, few of which are resolved. In 2003, only 22 of 424 murders were "seriously investigated," according to Sergio Morales, the country's Human Rights Ombudsman (Tuckman, 2004: ¶3). The trend continues, according to Littlefield (2009, ¶3), when in 2008 only 2% of murders were solved, a fact attributed in part to the poor staffing and resources of the specialized PNC homicide squad. This unit deals with violence against women, mainly cases of domestic abuse and rape, but now covers investigations of femicide-related crimes.

Connections to genocide and historical violence against women

The way in which crimes, specifically murders and massacres, were committed during the genocide was based on the ideologies of anti-communist intellectual authors and their various inhumane motivations acted out through the military (CEH, 1999; REMHI, 1999). The strategic locations of communities had a considerable impact on where massacres and disappearances took place (Snodgrass Godoy, 2005; Steinberg et al., 2006). Approximately 83% of those killed or disappeared during the conflict were Indigenous and lived in remote, often isolated settings (Nolin Hanlon & Shankar, 2000: 273; Taylor, 2007; UNFPA, 2006). The military's orders were to carry out 'social cleansing'; a cleansing of those it considered communist, subversive, or anti-state. Targets were entire communities and included the most vulnerable: young and unborn children, seen to be the "seed" of undesirable Mayan society (REMHI, 1999: 29). The location of the killings was circumstantially-based; that is, wherever it was easiest, most convenient or depending on the level of "visible terror" the perpetrators had chosen that day to inflict on the victim(s) (Nolin Hanlon & Shankar, 2000: 278). Concerns over publicity or the presence of witnesses was hardly ever a consideration, as the objectives of such acts were to instill terror, to intimidate populations into submission and silence. The dehumanization of Maya people was the state's attempt to exert control over their communal identities and to erase meaning and individuality from their lives (Carmack, 1988).

The public manner in which people were killed, women raped, and communities massacred and left exposed, was meant to serve as much purpose after the fact as were the deeds themselves. The military sought to make examples of communities and people in order to undermine positive social change. The murder of prominent community members who were perceived as a threat to the State was in itself an elimination of the threat, and also an example to the community against further "subversion" (Nolin Hanlon & Shankar, 2000; Grais-Targow, 2005). Teachers, priests and known community members who carried influence were targeted and killed in front of their neighbours and families; murdered in public so that the army could set an example and exhibit their will to carry out further violence without any

rebellion from the remaining population (Ruhl, 2006; REHMI, 1999).

The military-led violence and the unchecked power of the authoritarian state during the genocide created an environment of terror and silence; everyday existence for many Indigenous populations was based on day-to-day survival. Guatemalans, particularly Indigenous Guatemalans, remain under a shroud of fear, insecurity and lack of dignity. Communities during the conflict could not depend on an intact or effective justice system to bring punishment to any crime in the country, whether genocide-related or 'common crime.' The military's skewed version of justice during the genocide involved a system whereby "suspects were rounded up and shot" giving the "illusion of security" (to whom?) and creating a confusing, illogical system without the use of "courts, prosecutors, public defenders or even civil society" (Snodgrass Godoy, 2005: 603). State justice was delivered through the barrel of a gun, no cause required, targeting 'criminals' whose only activities involved farming or resisting, in some form, the measures of terror and intimidation sweeping across the Guatemalan landscape. Lines between crime and political opposition were blurred, and "crime fighting tactics" used by the state involved the assassination of innocent populations based only on suspicion, or worse, ethnicity and the army's social cleansing campaigns (Snodgrass Godoy, 2005: 603). Killings "for hire" were also commonplace during the 1980s; Snodgrass Godoy (2005: 604) documents that the Treasury Police (*Guardia de Hacienda*) could be bought to kill anyone at a relatively low price. Due to this reality, communities created justice system at the local level, wherein lynching became somewhat acceptable (and today remains supported by up to 75% of the population in some areas) as an alternative to the ineffective municipal and national police (Snodgrass Godoy, 2005: 604).

Important human rights investigations and judicial proceedings languish "unless accompanied by extraordinary efforts from individual judiciary officials and civil society organizations" (Ertürk, 2005: 15). State security structures that evolved during the war are, for the most part, still present and intertwined with organized crime (Littlefield, 2009; Snodgrass Godoy, 2005: 605). International observers and locals alike have watched the continuing political involvement of former dictator Gen. Efraín Ríos Montt (President, 1982-1983) in Guatemala's Guatemalan Republican Front / *Frente Republicano Guatemalteco* (FRG) party, a clear demonstration that even the worst acts and the strongest opposing public will has little effect on the punishment of the guilty. The perversion of the political system by Montt is apparent in his ability to manipulate the most votes from the regions in which he exacted the worst terror during the genocide, such as the departments of El Quiché and Huehuetenango (Preti, 2002: 118; Snodgrass Godoy, 2005: 602). In Guatemala, criminals know that crime goes unpunished and that the justice system exists in name only except to the advantage of the most privileged and those in positions of

power (Hunt & Yackman, 2006). The State's complacency in pursuing human rights violators of the past suggests that those currently in power have underlying motives for or shuffling around the truth of the State's implicit role in the genocide, and suggests involvement of currently employed government personnel in the terrorizing and violent actions of the internal armed conflict (International Crisis Group, 2010).

Yakin Ertürk (2005: 10) documents that the well-known murder case of 40-year-old Guatemalan anthropologist Myrna Mack "illustrates the obstacles present in obtaining justice for women who have been victims of violent crimes." On September 11, 1990, while conducting anthropological studies on the Army's mistreatment, displacement and destruction of internally displaced communities, Mack was attacked in front of her Guatemala City office and stabbed 27 times, subsequently bleeding to death in the street (Oglesy, 1995). While the Guatemalan government recently came forward to accept responsibility for this murder, the police initially informed Mack's relatives that she was killed in a traffic accident and suppressed a report produced by their own investigators which concluded that her murder was a "political killing, linking the military to the crime" (Ertürk, 2005: 10). Lack of political will impedes processes of investigation and prosecution of the perpetrators of the genocide. It has allowed similar crimes to continue, suggesting that the same groups (clandestine and organized crime) are implicit in the intense patterns of violence seen between the genocide and the present-day feminicide (Torres, 2007).

Sandra Moran (2006) argues that "a systemic tolerance of violence against women, including domestic violence, remains entrenched in Guatemala's legislation and in its male-dominated culture." The ideological causes behind the feminicide are many, argues Doctors without Borders (2009), and they begin at the very base level, ingrained in the country's population, particularly the attitudes of many of Guatemala's men, who witness or were raised around violence against women and a toleration of violent behaviour in general (McCreery, 1986; Carey Jr., 2007). This entrenched attitude towards the treatment of women is rooted in the male population's utter lack of respect for the body of a woman, and second, in the concept that women are the property of men; as Moran (2006) states "people feel they can treat women however they want."

At a deeper level, many men's ability to fulfill culturally significant *machista* roles as providers are damaged or removed due to the psychological impacts of the internal armed conflict and the sustained poverty levels throughout Guatemala. The outcomes include family abandonment, unstable relationships and alcoholism, all of which can resurface in the form of violence against women in and outside of the home (Ruhl, 2006; Ertürk, 2005; Reade & Nolin, 2008). Alcoholism among males, unemployment / underemployment and attempts to

preserve patriarchal power over women contribute to domestic violence and undermine opportunities for the promotion of non-violent relationships in future generations (Reade & Nolin, 2008: 19). According to conservative estimates cited by Beltrán & Freeman (2007: 2), in Guatemala, "36 percent of women who live with a male partner suffer domestic abuse, including physical, sexual, or psychological abuse." Additionally, Thale & Falkenburger (2006) highlight that many youth are turning to gangs as alternative support networks as their home lives disintegrate due to violence and poverty.

Women have little recourse to protection or justice due to barriers within their social environments and the legal system due the lack of recognition of women's rights, especially outside of the traditional male-female family structure (Ruhl, 2006). In April 2008, the Guatemalan Parliament approved the new "Law against Femicide and Other Forms of Violence against Women" which establishes 25-50-year prison terms for femicide charges and 5-12 years in jail for sexual, physical or psychological violence (GHRC, 2009: 1). Unfortunately, as of August 2010, only three people have been convicted and sentenced for this crime (Blas & Reynoso, 2009; Zaunbrecher, 2010).[9]

As women take on remunerated work in order to survive, in maquiladoras, for example, the socially taboo nature of their entrance into the public realm often leads to ostracization by their community support systems.[10] They are made targets of attention and sexual advances, in the workplace especially, and by other male family members and supposed figures of trust and authority (Ertürk, 2005). Owing to insufficient regulation of this sector, human rights violations are common. Women are subjected to physical, sexual and psychological violence. Sunderland (2002) of Human Rights Watch reports widespread gender-based discrimination, including inquiries about employees' reproductive status, post-hire penalization of pregnant workers, and failure to enforce maternity protections.

In order for Guatemala to succeed in curbing the escalating rate of the feminicide and improve the rule of law, the new Femicide Law must be taken seriously and acted upon. Apart from this new piece of legislation, Guatemalan law predominantly represents the interests of male citizens, including that related to household property ownership and weak penalties for rape and/or battery and assault against a female. Such legislation must be abolished in

[9] Zaunbrecher (2010; ¶ 7) argues that "[d]espite the law's symbolic innovations, it has done virtually nothing to stem Guatemala's rising femicide rates. During its first year on the books, only three perpetrators were convicted and sentenced under the law, while 26 women were murdered in the first two weeks of 2009 alone."

[10] Human Rights Watch (2002, ¶ 8) documents that "an estimated 80 percent of the 80,000 maquila workers in Guatemala are women."

order to deinstitutionalize structures within government that maintain harmful cultural perceptions and enable violence and impunity. The situation of immense poverty in Guatemala will cause domestic inequalities to worsen before improvement is seen as women increasingly enter into various forms of paid labour within the formal workplace. The loss of perceived (economic) control by male heads of households as primary breadwinners gives rise to often violent forms of assertion of dominance within the traditionally *machismo* environment (Moran, 2006).

Until recently, since the colonial era Guatemala's Penal Code did not consider many forms of violence against women as crimes (Komisaruk, 2008). NGOs, such as the National Committee for the Prevention of Violence Against Women, petitioned Congress to include sexual harassment in the Penal Code, as it did not appear. Other major discriminatory provisions, listed by Ertürk (2005) and referenced by the Inter-American Court of Human Rights, precluded women from having the full protection of the law. For example, chapter VII, article 200, of the Penal Code exonerated perpetrators of rape if the aggressor married the victim, provided that the victim was over 12 years of age. In June 2006, the Guatemalan government successfully abolished this "Rape Law." Legislation such as this, showed exactly how Guatemala's legal system enables further physical and psychological trauma by condemning women to a life with their rapist. Perpetrators of sexual crimes, most of which are committed against women, are highly likely to be pardoned. When a case does reach the courts, whether or not a perpetrator is sentenced in accordance with the rule of law often depends on the personal criteria used by the individual applying the law. Most attention towards improvement of the diminishing situation comes, not from the government and its executive divisions, but as Sandra Moran (2006) explains, from human rights organizations whose own members are under daily threat of violence.

Structures of organized crime and unethical but highly successful elite interests represent a significant obstacle to the implementation of the Peace Accords. They act as barriers to progress, preventing the establishment of accountability within the justice system, each achievement, such as the Femicide Law of 2008, though important, is minor in the face of a broken system. It is painfully apparent through the country's contemporary problems that the "demons of Guatemala's past were never fully exorcised" (Snodgrass Godoy, 2005: 602). From the State-sponsored violence of the internal armed conflict and the unfinished, still silenced reality of the events and effects of that terrible era, a fusion of common crime (both petty and organized) and political crime has developed (Snodgrass Godoy, 2005). The dynamic of crime in Guatemala has grown from their authoritarian-dictated status, which was composed of and run by a "deformed public security apparatus," as discussed previously in terms of the "delivery of

(in)justice at the barrel of a gun." Those in the military, now living within civil society as largely unpunished civilians, came "to understand justice and concepts of human dignity as they were taught and conditioned in their units by a manipulative and criminal command" (Preti, 2002). The social order was maintained through the "hyper-repressiveness of the military state" and excesses were justified based on the "peculiar exigencies of counter-insurgency warfare" (Snodgrass Godoy 2005, 604).

The extreme abnormality of the current state of violence is normalized in the wake of continued socio-economic difficulty and pressures and in the inability to effectively heal from Guatemala's past (as it is still present in daily life). According to Sanford (2003, 143) "for both victims and victimizers, the experience and survival of particular instrumentations of state violence have fused discrete experiences of physical and psychological violence." The physical and psychological violence acted out on the streets of Guatemala City and on the bodies of its female citizens illustrates that perpetrators' violent actions are enabled by the unresolved history of the country. The culture of impunity has swelled to allow another wave of violence, now specifically against women, one of the most vulnerable populations in the city's capital. The continuum of victimization and survival is a long-term reality under which communities and individuals continue to exist.

Need for spatial analysis

While social and historical impacts on the current state of affairs is crucial to understanding contemporary events and situations, physical barriers and geographic concentrations, among other influences, may have a major impact on the movement of ideas and phenomena. Feminicide is not merely a movement of violence towards women as a sector of society, but an action on places within the spatial areas of the capital. Perpetrators abuse public space for their purposes of control and social manipulation, using different scales of space to send a message. Beginning at the scale of the female body, control and contempt is written out for the public to see. Beyond the body, the street and neighbourhood are contaminated with barriers of fear and spaces of danger, inhibiting social freedom to engage freely with the physical and civic environments. Whether gang activity or higher-level sanctioned violence is responsible for the murders of women, these groups relay the message that they watch, target and therefore control the use and activities of particular spaces. The inability of police and government to fully acknowledge or follow through on cases reinforces historical and contemporary barriers, exacerbate fearful perceptions of place that, in turn, inhibit social and physical freedom,

A spatial analysis of crime scenes (kidnapping and body dump locations) is necessary to enable police to improve, monitor, anticipate and prevent future violence, particularly in areas where murders of women occur in high-concentration.

The geographic overlay of social characteristic data on spatial data for abduction and dump locations has potential for reaching a wider audience both within Guatemala (perhaps even in government offices and embassies) and throughout the international community. As we learned, no such detailed data are available, the social mapping of Guatemala City that has taken place assists in creating a general understanding of areas at-risk for higher crime rates (Rugg & Wu, 2002; Steinberg et al., 2006). Social status of feminicide victims often corresponds with the socio-economic structures of neighbourhoods linked to crime and parallel economic and social disparity, whereas, predictably, neighbourhoods of higher socioeconomic status are noted for the intensity of violence and receive better civic investment and police attention.

Murders are taking place mainly in the city's poorest districts, but socioeconomic and ethnic status of the victim is also an indicator of risk; the area where the actual abduction takes place cannot be the only factor in consideration of risk. The woman's ethnicity (Indigenous versus Ladina) make her a potential target, and as many of the city's Indigenous are among the most poor, this finding suggests that there is a connection between the socioeconomic position of a community and their propensity to be targeted for crimes of femicide. Therefore, with better data and more accurate population profiles at the sub-city level, it may be possible to project levels of risk across communities within the urban landscape. It would be useful to obtain victim count data delineated by Guatemala City zone; however, the budgets and technological capacities of interested organizations and the relatively short amount of time in which this phenomenon has accelerated has not allowed for anything but the most basic levels of data analysis and information generation.

The future

The growing violence and lack of rule of law in Guatemala have created a climate where "human rights guarantees become a secondary priority behind security and other concerns" (WOLA, 2006). Curtailing the root of violence requires a change in culturally accepted values by government and executive agencies that have historically supported measures of violence and terror for the purposes of social and economic control. The tolerance of feminicide by police and legislators will destroy any existing social stability. Gang violence must be met with strong opposing force and an improvement of social conditions for the nation's youth. According to Thale & Falkenburger (2006) of WOLA, the issues of gang spread and violence can only be resolved by a comprehensive policy approach that responds with appropriate and effective law enforcement strategies which will maintain progress that the region has made over the last decade in police and judicial reform (if any). Improvement and increase in social support programs, Sandra Moran (2006) argues, must be implemented in order to address the improvement of human rights and "due process of law." Thale & Falkenburger (2006: 23) argue that an investment must be

made in both long-term and short-term prevention and treatment programs, along with a committed and substantial investment in rehabilitation programs for youth who wish to leave gangs and/or for those in prison for gang activity.

Current legislation must be brought back to the table and addressed in partnership with all government and non-governmental agencies involved (such as the special investigations unit, which must be properly outfitted, and the National Committee for the Prevention of Violence Against Women) (Ertürk, 2005; Moran, 2006). Women need to be protected, supported and empowered in order to build awareness and familiarity with a life that is characterised by social equality and dignity. Impunity must be ended through the reform of the Republic's legislative, investigative and judicial bodies. Ertürk (2005) states that through the ratification and passage of international, regional and domestic instruments, Guatemala has committed itself to the protection of women's rights and therefore must follow through on these stipulations in order to maintain good standing within the democratic community. These instruments include the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW), and its Optional Protocol, the Interamerican Convention to Prevent, Sanction, and Eradicate Violence against Women, the 1996 Peace Accords, and Article 4 of the Guatemalan Constitution guaranteeing equal rights for men and women (Moran, 2006; Ertürk, 2005; Grais-Targow, 2005).

Finally, the truth of the country's history must be brought to light in order to heal and renew the collective identities of Guatemalans, both Indigenous and ladino. Without continued and profound acknowledgement by the State of the innocence of the abused Maya population during the genocide, those living in fear today in the midst of the feminicide will face a similar era of brutality. Hope for both victimized populations lies in the actions of the State regarding their harboured war criminals, particularly Gen. Ríos Montt, whose 2003 presidential campaign and 2007 successful bid for a seat in Congress, only added to the confusion of guilt, truth and responsibility (Granovsky-Larsen, 2007; Oglesby, 2007: 78; Snodgrass Godoy, 2005).

Feminicide currently taking place at the hands of husbands, boyfriends, and strangers alike is part of the overarching force of socially cemented values that devalue and dehumanize mothers, sisters and daughters. Their value is reduced to their (limited) role as productive citizens by their own government, whose failure to protect them is a factor in the maintenance of fear and hostility. Parallels abound among the centuries-old mistreatment of women, horrors of the genocide, and the mass murders of contemporary urban women in Guatemala City. Similarities in perpetrator motive (new forms of social cleansing), *modus operandi*, causes of death and disappearance tactics strike a chord with the nation still raw from its recent era of conflict.

A spatial analysis of violent events, both during the genocide and as they unfold today, is important to unraveling and explaining, at some level, how and why such events take place. Every additional layer of analysis provides both tools of solidarity and empowerment to women in situations of fear, as well as the reinforcement of evidentiary support for the implementation and enforcement of law. Without aggressive action against those who commit murder, through changed political structures, more accountable leadership and actual implementation of legislation, the status and safety of women in Guatemala will continue as, what is already, a global atrocity.

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The Impact of a Local Bypass in the Tokyo Urban Fringe on One Small Hamlet in Ushiku City, Japan

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Abstract: *In Japan, bypasses are commonly constructed around cities to improve traffic flow. Ushiku is a commuter city northeast of Tokyo that experiences heavy automobile traffic along National Highway Route 6 that connects with Tokyo. This paper looks at the history of the Route 6 bypass proposal around Ushiku City, and the possible impacts of the southern section on residents and the local rural and historic landscape. The research is based on interviews and a review of planning documents and maps. The bypass has been a topic for over twenty years, and its proposed routing and design have changed. A new road acting as an alternative bypass has been constructed incrementally. The southern bypass may impact pedestrians and a traditional farm and former castle landscape in Jochu district. Hopefully, good community consultation will result in changes that will appease all parties.*

Introduction:

In Japan, metropolitan Tokyo continues to grow (Ichikawa 2003) as do the populations of some adjoining prefectures[11]. Most recently Tsukuba Science City in Ibaraki Prefecture to the northeast of the centre of Tokyo has seen massive population growth[12] and regional development (Miura, 2012)[13]. Many communities have tried to solve their traffic problems with bypasses going around their city core[14]. Such is the case of Ushiku City, which is about 15 kilometres southeast of Tsukuba City and is the focus of this paper[15] (Figure 1).

Ushiku City is a commuter city of Tokyo and had a population of

[11] According to the Japan Statistical Yearbook for 2015, Saitama and Kanagawa Prefectures have continued to grow; however, Ibaraki Prefecture overall declined in population by 1.5 percent from 2005 to 2013; Tsukuba City is an exception to this decline.

[12] According to the Japan Statistics Bureau home page and the 2015 Statistical Yearbook, Tsukuba's population increased from 200, 528 in 2005 to 218, 864 in 2014.

[13] This growth has been due to the introduction of the Tsukuba Express commuter train line in 2005 (Miura, 2012).

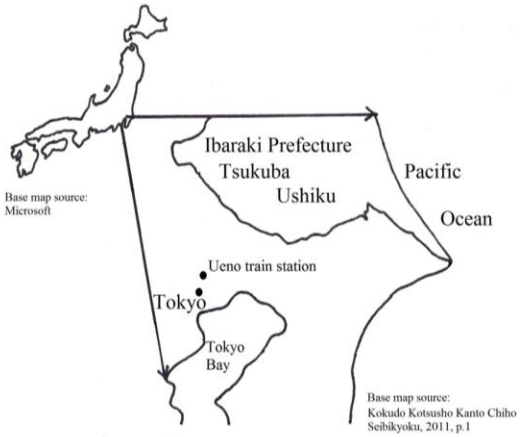
[14] Bypasses along with road widening are typical road projects (see, e.g., Ministry of Land, Transportation, Infrastructure and Tourism, 2014, p.17).

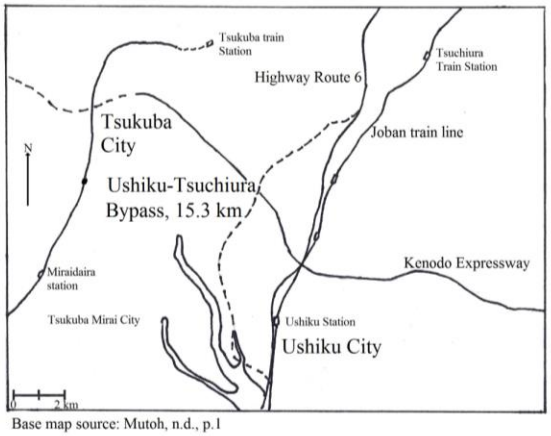
[15] The subject of the bypass in Ushiku has been dealt with in part in Waldichuk (2013).

83,990[16] in 2014, and straddles the Japan Railway Joban line and National Highway Route 6[17]. Ushiku is located about 55 km northeast from the start of the highway in Tokyo. The traffic along Route 6 is commonly backed up as it passes through central Ushiku (Miura, 2012).

A Route 6 bypass around Ushiku has been planned since about 1990 (Figure 2). Whereas the entire 15.3 km bypass has not yet been completed, sections of a road acting as an alternative bypass around Ushiku have been incrementally built. The purpose of this paper is to examine the history of the planning of this bypass, and some of the potential impacts. In particular, I focus on a 1.3 km section of the bypass that will run through Jochu district in southwestern Ushiku (Figure 2).

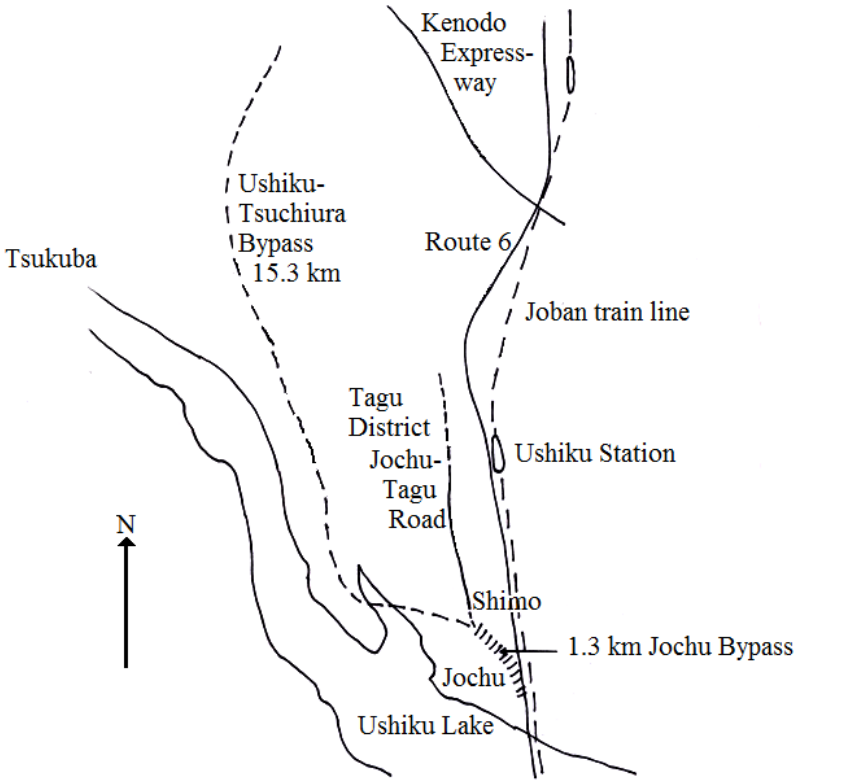
[16] Population figure taken from the Japan Statistical Yearbook for 2015.
[17] Route 6 is a two lane 375 km highway running from Tokyo to Sendai City in Miyagi Prefecture (Miura, 2012).





Base map source: Mutoh, n.d., p.1

Figure 1. Ushiku-Tsuchiura Bypass



Base map source: Kokudo Kotsusho Kanto Chiho Seibikyoku, 2011, p.2

Figure 2. Jochu-Tagu Road
1.3 km Jochu Bypass

History of the Bypass Project:

In 1994, Ushiku City approved 5.2 km of the bypass (Miura, 2012), which included the 1.3 km section. In May 2014 I interviewed a city hall employee who indicated that the larger part of the 15.3 km bypass has no timeline for completion, while the 1.3 km section is scheduled for completion by about 2015. An archeological study must be done along the proposed 1.3 km route as it passes through farmland and woodlots. If nothing is found, then construction can start soon after; however, if artifacts are discovered it may take two years to research the area before the 1.3 km road can be built.

Meanwhile, the alternate bypass of Route 6 has been partially completed between Jochu and Tagu districts (Figure 2). In 2015 this road will link up with the 1.3 km bypass from Route 6[18], thus providing a partial bypass of Route 6 through the central part of Ushiku. The Jochu-Tagu road is under the jurisdiction of Ushiku city, whereas the 1.3km section is under the control of the Japanese ministry of transportation.

[18] According to conversation with the city planning section of Ushiku City hall and the ministry of transportation office in Tsuchiura city in in May 2015.

Most recently, community consultation has taken place in March 2010 and January 2011 regarding the 1.3 km section in Jochu and the road from Jochu to Tagu (Takehi, n.d.). There was a reduction in the budget for construction, so to reduce costs both sections will initially have two lanes[19]. According to one city planning official[20] residents have wanted a decision regarding the bypass, so that they can get on with their lives. The mayor has been a driving force behind the bypass[21] (Takehi, n.d.).

Attitudes toward the bypass and possible impacts in Jochu district:

Some residents were opposed to the bypass at the two meetings while others worried that a reduced budget would result in construction delays (Takehi, n.d.). There is still some uncertainty and opposition from the head[22] of Jochu district regarding the 1.3 km section of the bypass. He was not sure about the details of the kind of road proposed and was waiting for communication from the local ministry of transportation office in Tsuchiura. There was concern about elderly people crossing the bypass to access services such as banking in adjacent Shimo district and children crossing the bypass on the way to school. He commented on how the bypass did not fit with how the farm hamlet of Jochu was zoned as a historical area in the community master plan[23] (Ushiku shi, 2011). Jochu has the remains of Ushiku castle among its traditional clustered farm hamlet[24]. The impact of the bypass on farming was not a major issue, although I spoke to one rice farmer in 2013 who said that next year he would not be planting rice next to Route 6 because he knew the bypass was soon to be built.

Summary and Conclusion:

For years the commuter city of Ushiku has been dealing with traffic jams along National Route 6, which bisects the city, and a bypass has been proposed since about 1990. This bypass involves roads under multiple jurisdictions. The planning process and actual construction have taken a long time due to budget issues, but the mayor of Ushiku has been a main proponent of the bypass. The project has been completed incrementally, with a new municipal road functioning as a bypass while most of the original Route 6 bypass has yet to be approved for construction. A 1.3 km section of the bypass under the jurisdiction of the transportation ministry may impact pedestrians trying to walk from Jochu hamlet to adjacent Shimo district for services. Also, the bypass may affect the character of Jochu hamlet, which is zoned in part as a historic area. Good community

[19] Construction can proceed sooner with the two lane bypass.
[20] Interviewed in the city planning section in June 2011.
[21] Takehi (n.d.) mentions that the mayor has had several meetings with the heads of the city districts and that in the future, it is important to have a feeling of mutual trust between city hall and the residents.
[22] I interviewed the Jochu district head and the neighbourhood leaders in June 2013.
[23] Master plans in Japanese planning are discussed by Sorensen (2007).
[24] A traditional farm hamlet is commonly known as *satoyama* in Japanese.

consultation is needed between residents and all levels of government to minimize these impacts.

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Scanning for Sustainable Community Development in the Bolivian Highlands

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Abstract: *This article describes the experience of attempting to adjust a sustainable community development planning tool, the Community Capital Scan, for use in the Bolivian highlands. We tested the Scan, which was originally developed for use in a European or North American context, with five communities in the Bolivian highlands. We found that it is useful as a participatory planning tool, with some modifications or adaptations to suit a rural, low technology, indigenous, subsistence economy context. The Scan facilitated shared understanding about stakeholder expectations and knowledge on proposed community initiatives in these five communities, and highlighted the utility of thinking about each proposed initiative as an opportunity to address not just one problem but to enhance several forms of community capital at once. It helped participants think creatively together in support of economic development, inclusiveness, environmental health, and cultural heritage, and can contribute to more effective strategic plans at local levels.*

Introduction

This article describes the results of a research partnership aimed at increasing capacity of Bolivian researchers and indigenous communities to activate sustainable community development in the Bolivian highlands. Researchers from the Centre for Sustainable Community Development at Simon Fraser University and the Centre for Graduate Studies in Development (Postgrado en Ciencias del Desarrollo, or CIDES) at the University Mayor San Andres collaborated with five indigenous communities to assess the effectiveness of a new tool—the Community Capital Scan—at engaging locals in participatory planning processes.[1]

Developed to aid planning by facilitating discussion among local stakeholders about the potential impacts of proposed initiatives on community sustainability, the Scan solicits ideas from users and helps them to identify opportunities to adjust proposals as needed to maximize benefits and avoid potentially negative impacts. The Scan displays collected stakeholder opinion

about the positive, negative or neutral impacts of a particular initiative[2] on the human, natural, and economic dimensions in a local space, using a set of inter-related, multi-levelled graphs. Although based on a sustainability framework that is meant to be applicable anywhere, the Community Capital Scan reflects the European and Canadian realities and perspectives of its developers. This article describes the sustainability framework upon which the Scan is based, the origins of the Scan, and the modifications required to use this web-based tool for use in a very different social, economic and cultural context. It also describes some of the insights gained by Scan users about the strengths, weaknesses, and possibilities of their proposed community initiatives, as well as locals preliminary feedback on the Scan's utility for planning. It concludes with some reflections on the process and underlying framework, and suggests directions for future research involving the Scan.

Community Capitals: From Theory to Practice

The Community Capital Framework

Our research is based on the Community Capital Framework, developed by Roseland (2012). Although many useful sustainability frameworks exist (e.g. see Dekker and Singer, 2011), we chose this framework for three reasons: it has long been the theoretical basis of research and courses at SFU's Centre for Sustainable Community Development; it reflects considerable researcher effort to define sustainable community development; and it has recently been integrated into a sophisticated tool for planners and facilitators of stakeholder groups.

The Community Capital Framework defines sustainable community development as the concurrent and balanced development of six forms of community capital: natural, physical, economic, human, social and cultural (Roseland, 2012). According to the Community Capital Framework, natural capital comprises "natural assets that yields a flow of valuable goods and services into the future". Physical capital is "the infrastructure that helps people obtain their basic needs". Economic capital is "the ways in which we allocate resources and make decisions about our material lives". Social capital is "community cohesion, connectedness, reciprocity, tolerance, compassion, patience, forbearance, fellowship, love, commonly accepted standards of honesty, discipline and ethics; and commonly shared rules, laws, and information". Human capital is the "knowledge, skills, competencies and other attributes embodied in individuals that facilitate the creation of personal, social and economic well-being". Last but not least, cultural capital is "the product of shared experience through traditions, customs, values, heritage, identity and history" (CSCD, n.d.a).

The Community Capital Framework builds on the work of Bebbington (1997), which highlighted the role of social capital in alleviation of poverty and environmental degradation, and Scoones (1998), which considered how four types of capital (natural, economic, human, and social) are mobilized to achieve

sustainable livelihoods. It also benefits from Brocklesby and Fisher (2003), who identified possibilities for connection between the community development approach and the more technocratic, United Nations-embraced sustainable livelihoods approach, with its analysis of five types of capital (social, human, physical, financial and natural). Roseland enriched understanding of community capital by adding a sixth capital—cultural capital—after Mexican colleagues pointed out the distinct role of local values, material culture, and language and their fundamental place in any conceptualization of sustainable community development. Roseland also emphasized the critical role of community mobilization to the enhancement of the unique capitals and objectives of each place:

> *There is no single sustainability prescription that would fit all communities, because every path forward comes with opportunity costs that need to be carefully considered, and because participatory planning is critical to the sustainable development process—from visioning through to evaluation of results (Roseland 2012: 17).*

The Community Capital Framework helps us see how to create change at local levels by identifying and employing all of their place-based capitals in order "to create viable communities that are economically robust, socially resilient, and environmentally sustainable" (Halseth, Markey & Manson, 2012: 4). In other words, appropriate and lasting transformation—key components of sustainability—can arise from identifying and mobilizing the unique set of historical, cultural, social, environmental characteristics of each place.

The Framework proposes that the health of each capital can be evaluated by looking at its essential properties, or "stocks". For example, human capital comprises the stocks *education* and *health & wellbeing*. The six capitals and their associated stocks are shown in Table 1. The Framework also proposes that the health of each stock can be defined by a set of requirements.[3] For example, the education stock has two requirements: "Education meets the needs of both society and individuals" and "Education is of high quality and easily accessible". Although the Framework suggests specific requirements for each stock, it is understood that these can and should be modified to suit local priorities.

In addition to defining the six capitals, their component stocks, and suggested stock requirements, the Framework emphasizes that each form of capital has a specific relationship with the state of each of the other capitals—and that citizens, planners, and decision-makers must be mindful of how change in any one capital plays out in changes in each of the other capitals. For example, exploitation of mineral resources may enhance economic capital but deplete

natural capital. Public education may enhance human capital but deplete cultural capital if it erodes use of indigenous languages. According to the Framework, sustainable community development occurs when the cumulative effect of local initiatives is the balanced enhancement of all six capitals.

Table 1. The Community Capital Framework: 6 Capitals and 20 Stocks

Capital Type	Associated Stocks
Natural	Land Soil Groundwater Surfacewater Air Minerals & non-renewable resources
Physical	Infrastructure Land Transportation Housing & living conditions Public facilities
Economic	Labour Financial resources Economic structure
Human	Education Health & wellbeing
Social	Citizenship Safety
Cultural	Cultural heritage Identity & diversity

The Community Capital Tool

The Community Capital Tool is the result of collaboration between the

Centre for Sustainable Community Development at Simon Fraser University in Canada and the Netherlands research institute and planning agency known as Telos: The Brabant Centre for Sustainable Development. These organizations paired Roseland's Community Capital Framework with Telos's two complementary planning instruments: the Sustainability Balance Sheet and the People-Planet-Profit Scan. The result is the Community Capital Sustainability Balance Sheet and the Community Capital Scan. Collectively, these are referred to as the Community Capital Tool.

Although it has only recently been introduced to the planning community, the Community Capital Tool is actually no neophyte. It is the intellectual product both of the historical conceptualization of community capital and practical research insights gained from years of successful use of the Dutch versions of both the Scan and the Balance Sheet, by municipal and regional governments, consultants, stakeholder groups, and nonprofit organizations in Western Europe. These have been described at length in Dagevos and Van Lamoen (2009); Hermans, Haarman, and Dagevos (2011); Knippenberg et al. (2007); and Telos (2010, 2006, and 2002). The Centre for Sustainable Community Development expects that the Tool can be applied in virtually any context, subject to thoughtful modification of the framework's stocks and requirements to suit local contexts. When used as intended, the Community Capital Tool produces a shared and locally defined agenda for change.

The Community Capital Sustainability Balance Sheet helps communities develop a snapshot of the current state of the key components of sustainable community development, using transparent baselines; select realistic and meaningful targets and indicators of progress toward sustainable community development; and record progress toward those goals.

The Community Capital Scan is an online questionnaire that has been designed to complement the Balance Sheet. The Scan is intended not as a tool of measurement but as a means of facilitating group discussion. It does this by collecting early-stage, top-of-mind opinion from stakeholders on how a proposed initiative will affect the stocks of all six capitals. For example, Scan participants will be asked how they expect Initiative X will affect the requirements of the Air stock of Natural Capital: Will it eliminate all airborne pollutants and contaminants? Will it reduce greenhouse gases? Participants respond by selecting a value on a bipolar scale with points ranging from -5 (worst possible impact) to +5 (best possible impact), and a zero midpoint that is assumed to indicate that the initiative will have no impact either way. Participants are also invited to offer their reasoning and suggestions for improvement.

After all participants have entered their responses, the Scan computes the average and range of participating stakeholder opinion for

each requirement, stock, and capital. It also groups the participants' comments and suggestions for improvement alongside colorful graphs that help facilitators, planners, officials, citizens, and stakeholders visualize the general tenor and distribution of stakeholder expectations about the initiative under discussion. This lays considerable groundwork for the facilitated group discussion that follows.

Ideally, the Scan is used to evaluate proposed projects or initiatives after a community has completed a Balance Sheet—but the Scan can also be used independently (personal communication, J. Dagevos, April 2014). Either way, the Scan can pinpoint areas of concern before they progress too far. Just as importantly for community engagement, the Scan identifies areas of agreement among stakeholders and solicits their ideas for improvement. The Community Capital Scan has been used to guide stakeholder discussion by Hernandez and Mollinedo (2012) in Bolivia and by Lowery (2013) in New Orleans.

Research Context & Methods

This research is part of a larger process of participatory action research on sustainable community development that has been underway by authors Hernandez and Mollinedo since 2012. Our ongoing work with Bolivian communities seeks to identify tools and training processes that support local people organizing and implementing initiatives for community-managed change. As our work with Bolivian communities is grounded in the Community Capital Framework, it made sense to test the Community Capital Scan in this context.

Context

Bolivia is a low- to middle-income country of 10 million people, of whom 60% self-identify with an indigenous heritage (INE, 2008). A new constitution adopted in 2009 aims to produce greater social, economic, and political equality. It recognizes social cooperative and community forms of economic organizations alongside state and private sector companies as an integral part of the country's economic model (Constitución del Estado Plurinacional de Bolivia, 2009). For Bolivia's indigenous peoples and subsistence agriculture-based communities, this means their small-scale agricultural activities and micro-enterprises are getting more planning attention from municipal and national government officials. Simultaneously, significant national funds are being devolved to municipal governments to support locally identified development priorities. New legislation, such as the Law of Popular Participation (1994), the Law of Administrative Decentralization (1995), and the Law of Autonomies (2010), has given traditional indigenous authorities greater power to participate in decisions about the use of local government funds.

Food security is another national priority, and of particular relevance to communities centred on subsistence agriculture (Gallegos, 2012). But there is limited capacity at the local levels to implement effective participatory planning and to bring community enterprises and food

security initiatives into the local municipal development plans and budgets (Hernandez, 2014). A lack of practical experience and methods among community organizations and municipal staff hinders engagement in effective participatory planning and preparation of concrete proposals for municipal funding (ibid).

The five communities that we worked with to test the Community Capital Scan are Challajahuira, Jalsuri, Lorocota, and Cheka Chinchaya (all in the Department of La Paz) and Poopó (in the Department of Oruro). They share several characteristics. All are located in rural areas of the highlands (altiplano) region. Inhabitants identify with Aymara or Uros indigenous heritage. Local economies are based on subsistence agriculture, livestock, and fishing. All of these communities experience high levels of migration to cities or other places with more income-earning potential, and express a strong desire to manage their own affairs, including economic development.

Method

To explore whether the Scan might "work" in an indigenous, rural, periphery country context, we decided that "worked" would mean three things: locals would understand and relate to the different types of capital; be able cite examples of each capital in their own local space; and find added value in using the Scan for strategic planning of sustainable community development. To investigate this, we took the following steps.

We first brainstormed adaptations that would be necessary for practical and cultural reasons. For example, the Scan is a web-based tool but these communities have little to no internet access, few or no computers, and a lack of computer skills, so we converted the Scan's data collection process to a paper-based exercise. Because average literacy levels in rural areas are at about grade four, we also simplified the Scan language. We added verbal descriptions to the bipolar scales, such that -5 became "worst possible impact", +5 "best possible impact" and zero "no impact at all". All Scan materials were translated from English into Spanish, which is spoken by the researchers and most of the inhabitants. Because participants speak (unwritten) indigenous languages first and Spanish second, we ensured translators fluent in both languages would be at meetings and took time to explain each component during the Scan process. Table 2 shows a summary of the key modifications we made to the Scan for practical, educational, and cultural reasons.

We also looked carefully at the capitals' stocks and suggested requirements. Our previous experience in Bolivia suggested that some stocks and requirements might not be appropriate for this context. To adjust them, we sought help from our advisory an advisory group of thirteen municipal staff and indigenous traditional authorities (23% female), already comfortable with the Community Capital Framework concepts.[4] Accordingly, to human capital we added the stock "knowledge and capacities" to recognize practical and traditional knowledge. Cultural capital was

modified to include the stock "material cultural heritage", referring to ruins or artisanal products which help in preserving knowledge of pre-colonial life and developing tourism. Social capital stocks were seen as under-developed in a context where community-based organizations and kinship networks are the basis of daily life; Bolivians suggested reconfiguring the social capital stocks "citizenship" and "safety" with ones that invoke existing organizations, values, and relationships that foster collaborative approaches and the ability to mobilize local and external resources. This meant adding stocks like "local organizations" and "relationships between community members". Only the "natural capital" stock remained untouched. Table 3 shows the six capitals with the associated stocks modified for the Bolivian indigenous highlands context.[3]

Table 2: Summary of Community Capital Scan Modifications

Scan As Originally Designed	**Scan As Modified for Bolivian Highlands Context**
Questionnaire is hosted on Centre website: individuals enter responses online in preparation for a later, facilitated discussion at which the aggregated data is displayed as a series of graphs and anonymized comments	*Translated questionnaire is reproduced in a paper-based format: individuals enter responses by hand during a group discussion; researchers later enter data by hand into web-based tool and return to communities with the Scan's graphic output to discuss as a group*
Individual respondents enter responses into the web-based questionnaire on their own time or using multiple web-linked computers in a workshop setting (each person's responses are confidential and seen only by the Scan facilitator)	*Each individual fills out their own paper form during a group workshop, and then discuss their responses in a facilitated discussion. There is no expectation of confidentiality. Researchers collect the forms at the end of the workshop.*
Stocks and sustainability requirements are suggestive of advanced technologies and diversified economies characteristic of Europe and Canada.	*Stocks and sustainability requirements for capitals' stocks are refined to relate to rural, indigenous, low-technology, and mainly subsistence economy*
Scan users are asked to express their opinions using a bipolar scale with values from -5 to 5	*Scan users are asked to express their opinion using a bipolar scale with values from -5 to 5, reinforced by verbal descriptions such as "worst possible impact" and "best possible impact"*

To identify communities interested in testing the Scan, we went to meetings of traditional indigenous authorities to introduce the project and invite participation. Although there was interest from more than five communities, in the end the selected test sites were the communities that were able to set and confirm workshop dates. This may construe a kind of bias in that it may be communities with higher leadership capacity or greater cohesion that are able to make use of this type of planning tool. However, to stay true to the principles of participatory research it was critical that communities organize themselves to participate in this project. In total, 166 people (45% of whom were female) participated from the five communities. Each Scan process involved 12 to 40 people who self-selected and included community leaders (who are chosen by community members and serve on a rotating basis) and other interested community members.

We then staged a two-part series of workshops in each community. The first workshop introduced people to the idea of community capitals and how they can be used to support sustainable community development. In these, local participants practiced identifying the six types of capitals in their communities and reflected on the health or current state of each capital according to the stocks. These workshops also served as a second test of the relevance of the stocks and the applicability of the framework.

In a second set of workshops, we invited participants to identify specific initiatives that they would like to implement to enhance their economic, social, cultural and /or environmental well-being. We then used the Community Capital Scan to probe participants' expectations about the potential impacts of the community-nominated initiative on each of the six capitals' stocks. Participants discussed their responses in a facilitated group discussion and expressed their opinions by selecting values (-5 to 5) on the forms we had generated.

Having collected this primary data, researchers then left the communities to input the data into the web-based tool, returning later for a third community workshop with the graphs generated by the Community Capital Scan. Community members were encouraged to consider whether the graphs had adequately captured their input. Discussions centred on what the graphs implied in terms of participant opinion about how the initiatives might impact their community capitals, and where there were divergences in opinion that needed further discussion. We invited participants to reflect on the usefulness of the Community-Capital-based planning process and the Scan as a tool, and recorded our own impressions gathered from interactions with community members during the discussions.

Table 3. Capitals and Stocks Modified For Bolivian Highlands

Capital Type	Original Associated Stocks	Modified Associated Stocks
Natural	Land Soil Groundwater Surfacewater Air Minerals & non-renewable resources	Land Soil Groundwater Surfacewater Air Minerals & non-renewable resources
Physical	Infrastructure Land Transportation Housing & living conditions Public facilities	Infrastructure Equipment for productive activities Transportation Housing supply & condition Public facilities
Economic	Labour Financial resources Economic structure	Employment / occupation Financial resources Types of economic activities
Human	Education Health & wellbeing	Education Health & wellbeing Capacities and knowledge
Social	Citizenship Safety	Community-based organizations Values and attitudes Relationships between organizations Relationships between local people Safety
Cultural	Cultural heritage Identity & diversity	Cultural artifacts Cultural expression

Results

Results are shared here in two parts. First, we discuss what the Scans revealed about the specific initiatives proposed by the community members, in terms potential impacts on sustainable community development. Second, we report our preliminary impressions, based on discussions with community members, on the Scan's utility as a tool and resonance in this context as well as on adjustments made to help ensure the Scan supported locally relevant objectives and priorities.

Proposed Initiatives through the Lens of the Scan

The participants had many ideas for initiatives they could implement to improve the quality of life in their communities.

Challajahuira proposed expanding quinoa production and raising guinea pigs for consumption and sale. The Scan showed that these initiatives would enhance human capital (specifically, health and wellbeing) by improving food security and nutrition, cultural capital by recovering and retaining ancestral foods, and economic capital by generating income. Discussions about the Scan also helped community members see that the initiatives would build on their existing social capital (existing community organizations and kinship networks), cultural capital (traditional crops and lifestyles), and human capital (existing knowledge and capacities). People saw the need to access more economic capital, such as financial contributions from an NGO or the local municipality, to implement these ideas. They also concluded that they might need some external human capital, such as a professional with knowledge of national and international markets, to access markets.

Jalsuri considered starting up a cooperative milk processing plant to access regional and national dairy markets. Participants identified many challenges to be able to achieve this objective. Currently, individuals sell raw milk from the few cows they own, meaning that they cannot produce or transport milk on a scale sufficient to interest national-level dairy companies. Scaling up milk production would also require improved fodder, higher-producing breeds, the capacity to market products collectively, a mechanized facility to process and store milk. But the Scan helped several participants see that their social capital (membership in an indigenous organization at the local, regional, and national scale) enabled them to collaborate with other communities in proposing a large-scale investment by municipal and national governments. Indeed, a national-level government representative who visited these leaders at a municipal-level meeting was so impressed by the community's organization and strategic thinking that his department is considering a project that pilots greenhouses for improved cattle fodder production in this area.

Poopó focused on regeneration of Uros culture and through a fishing cooperative (fishing is a traditional practice) and by attracting cultural tourism. The Scan facilitated

discussion on how the combination of these two activities could build from, and enhance, their cultural, social, and human capital. After identifying the need for financial resources (economic capital) to make these initiatives a reality, discussion turned to how to strengthen their linkages to external organizations and agencies (social capital) to support these goals.

Lorocota proposed the construction of greenhouses for local consumption and market gardening, both for income generation (economic capital) and food security (human capital) and to reduce migration to urban areas. This latter result could enhance cultural capital by strengthening use their indigenous language, ties to the land, and ways of organizing.

Cheka Chinchaya was interested in establishing a local health centre and becoming a cultural tourism destination. The Scan stimulated discussion on how these would enhance economic, human, and cultural capital while maintaining the natural environment. The participants appeared to be inspired by seeing the "big picture" of how a series of initiatives can combine to create a more sustainable way of life in the place they call home.

Applicability of the Scan

The straightforward framing of each form of capital in terms of a few stocks, with the health of each stock described by a few requirements, seemed to support the utility of this tool and the resonance of its underlying framework to these community members. Workshop participants were easily able to identify the types of capital that existed in their community, such as leadership skills and knowledge of the land (human capital). Many participants seemed happy to find a way to frame development that aligns more closely with traditional indigenous worldview of the fundamental interdependence of individuals (reflected in social capital), and between humans and nature (reflected in human capital and natural capital).

The application of the Scan provided these community members with panorama of their current situation and how this could improve in various aspects through the implementation of a proposed initiative. In all five communities, participants saw opportunities to adjust proposed initiatives plans before implementing them in order to better integrate the benefits and to avoid possibly negative outcomes. Some of the issues made visible by the Scan may seem obvious, such as the need for financial resources to start up an income-generating initiative. Indeed, one may wonder what is the value added by using the Scan as part of this kind of planning process. Our observations and interactions with workshop participants suggest that the added value of the Scan was fourfold.

First, it created a structure and space for discussion of an idea among community members. This process enabled people to collaboratively think through the larger implications of a proposal, and how it might be adjusted for better sustainability

outcomes. The Scan also helped participants identify areas of consensus and disagreement, as well as areas where people felt more information or expert outside opinion was needed to evaluate the impacts of an initiative or to build consensus about specific kinds of external and internal inputs would be necessary. In essence, it acted as a tool to facilitate dialogue.

Second, it helped participants see what they already have to build from. Sadly, many people in these communities have come to see themselves through the eyes of the external world—as impoverished, backward, and deficient. Many participants expressed excitement about identifying their capitals because, in the words of one local person: "We can see that we are not poor—we have land, we have human capital, and we have our culture." People seemed to leave the workshops with a sense of possibility based on seeing that they had capitals from which to construct positive change.

Third, in soliciting participants' reasoning for their expectations as well as their suggestions for improvement, the Scan process stimulated enthusiastic interest among community members in planning specific initiatives related to food security, income generation, improvements in nutrition, and start-ups of cooperatives.

Fourth, each group acquired a written report that showed how participants felt their proposed initiative could contribute to various dimensions of community wellbeing—such as cultural and economic capital. Several local leaders indicated that this could help them to successfully approach NGOs or their local municipality for support, because "we have something in writing" or "we can show them this".

Of course, the process of employing the Scan and the ensuing discussions also revealed challenges. Some of the smaller projects. such as raising guinea pigs for local consumption and sale, are more feasible to implement in the short term because they require minimal financial resources and use already existing local knowledge and markets. Such initiatives can contribute to sustainable livelihoods for those for whom staying in place is a top priority, but offer minimal income-earning potential and likely will not retain much of the population. Larger projects like the dairy cooperative and processing plant have much more potential to contribute to greater income and retention of youth in rural areas. But these require substantial external resources and time to achieve, bringing into question the degree of community commitment and the willingness of local or national government to support such longer-term initiatives.

Based on our experience with the five communities, we found that the Scan tool to be very applicable. It was clear that locals understood and related to the different types of capital. They were able cite examples of each capital in their own local space, and participants reported having found added value in using the Scan for strategic planning of sustainable community development.

The essence of the Community Capital framework on which it is based seemed to make intuitive sense to a range of community members—men and women, younger and older people, and leaders and other residents. As a tool for participatory community planning in this rural, indigenous, developing-world context, it worked.

That said, some modifications may be necessary to achieve a deeper resonance in these areas. The concept of "capital" itself was identified as problematic for some participants, who thought that it supported a Western, non-indigenous, and capitalist way of thinking. They felt an alternative concept was needed to better fit their worldview, which is more oriented to collective wellbeing—such as "resources" or "factors." As already noted above under Method, other adjustments to the content were required to make the stocks and requirements relevant to a rural, subsistence, indigenous context.

Conclusions

The Community Capital Scan performed well as a method for communication among stakeholders and community members in these five communities, creating a space for thoughtful analysis of the multiple and interlinked effects of their proposed initiatives and helping participants consider proposals in a holistic, organized way—especially the chain of cause and effect between and within the various capitals.

All of the above suggests that, even when used in contexts that are very different from its origins, the Scan could be a useful tool for mobilizing communities in support of sustainable community development. By graphically illustrating the "terrain" of stakeholder opinion, reasoning, and suggestions for improvement before important decisions are made, this process can help develop a shared vision for strategic plans in a particular place. It suggests that the Community Capital Scan can contribute toward more strategic and relevant municipal planning by supporting local citizens in developing proposals for self-designed and self-managed initiatives. This study supports evidence from other contexts (Lowry 2012, Lowery 2013) that thoughtful completion of Community Capital Scans is a useful step towards creation of a common agenda for change.

Using the Community Capital Scan to probe stakeholder expectations and knowledge on proposed community initiatives in these five communities highlighted the utility of thinking about each proposed initiative as an opportunity to address not just one problem but to promote several forms of community capital at once. It helped participants think creatively together in support of economic development, inclusiveness, health and culture. We believe this more integrative way of thinking is at the heart of sustainable community development.

The process of adjusting the Scan for use in rural, indigenous people of these subsistence agriculture-based communities was revealing. It made clear that while Natural Capital stocks and

requirements are as appropriate to the Bolivian context as to any other, at least some Scan stocks and requirements—particularly those under Economic, Social, and Human Capital—may need adjustment in order to resonate.

We believe it is possible and highly valuable for Scan users in the Bolivian highlands to take ownership of the Scan process by identifying the right words in their indigenous languages. Ardis (2014) has already suggested several ways that the Scan's data collection and display could be modified to improve its data display and accessibility and add new levels of functionality to the Scan. While those suggestions were primarily made for use of the Scan with participants of higher mathematical and computer literacy levels, we believe it would be equally worthwhile to explore means of adapting the Scan to lower-literacy, low-technology settings such as these. For example, participants could be engaged in nominating locally relevant symbols to stand in for abstractions like "economic capital". Scan calculations could be made more transparent to people with limited computer and mathematical literacy by using 3-D physical models and/or simple graphs that could constructed by Scan users themselves, instead of graphs that need to be generated on distant computers. Alternatively, these could be used in combination with Scan-generated graphs.

In closing, we would like to acknowledge that this article reports on the beginning of our research involving the Community Capital Scan. Future research will explore communities' subsequent use of the Scan after researchers depart: What are people using it for? How is their experience with it? How does the Community Capital Scan complement traditional practices of group decision-making? Can the Community Capital Scan play a significant role in helping communities alleviate poverty and become less vulnerable to the impacts of climate change or global economic fluctuations? We look forward to investigating the conditions that support (or impede) successful and ongoing use of the Scan for planning, discussion, and decision-making, and to integrating users' own recommendations to make this into a vital tool in Bolivia's rural indigenous communities.

Acknowledgements
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Notes
[1] Hernandez and Mollinedo further engaged in joint analysis of the data and research process from a more theoretical perspective. The preliminary results of this analysis were presented at the Western Division of the Canadian Association of Geographers conference in Victoria in March 2014.
[2] We use the term "initiative" rather than "project" to differentiate between the way development is widely carried out in developing countries—as projects implemented by development professionals from NGOs or the State.

By contrast, the connotation of the term 'initiative' implies mobilization of people from the grassroots to improve their local area according to their own priorities, engaging in a long-term, self-defined process.

[4] A complete list of capitals, stocks, and requirements for the Bolivian version of the Community Capital Scan

[3] A complete list of capitals, stocks, and suggested requirements for the English version Community Capital Scan can be viewed at http://www.ccscan-ca.cscd.sfu.ca/stocks/ can be viewed in Spanish at http://www.ccscan-an.cscd.sfu.ca/

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Place-based Curriculum: Revealing Student Connections with Community through Walking Tours

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Abstract: *This research note summarizes our experience with creating and evaluating walking tours as a means of revealing student learning and knowledge. These walking tours were designed in the context of research on place-based curricula currently being conducted across disciplines at Thompson Rivers University. Using examples from assignments in two geography courses and one tourism course, this paper illustrates how a place-based focus enhances field trips, providing an ideal medium for engagement, interpretation, and interaction, allowing personal connections, and the perception of complex place relationships which can be masked by theoretical abstractions.*

Introduction

Geography and Tourism Studies are intrinsically focused on "place", which is defined here as a unique location which manifests intersections of social and physical processes and is imbued with meaning. Places matter as unique locations and as laboratories for studying general processes (Krakowka, 2012). Recently, place-based education has emerged as a pedagogical approach which counters overly general, exclusive, and economistic views of place, and emphasizes engagement with local community and ecosystem concerns (eg. Gruenewald, 2003, Gruenewald and Smith, 2007; Greenwood[1], 2008; Godlewska, 2013). Israel (2012) argues that place-based studies would benefit from theoretical input, specifically from Geography, which we extend to Tourism Studies. Both theorize a broader range of place-making processes.

To this end, we incorporated field trips to illustrate the disciplinary concepts in our courses, with each field trip occurring in a local and potentially meaningful place. Field trips are a core teaching practice in Geography, with proven ability to engage students and reinforce concepts (Kent, Gilbertson, and Hunt, 1997; Krakowska, 2012). It is important that the field trips be either student-led, or highly participatory, so that students taught both themselves, and the instructors (Kent, Gilbertson, and Hunt 1997). Place-based studies, by incorporating the participant as a place-maker, allows participants to contribute original knowledge.

The three case studies in this paper, all based in Kamloops, BC, illustrate

how field trips with a place focus can change the dynamics of teaching and learning, and make complex ideas understandable.

Example#1: Creating Downtown Walking Tours

Using Carter's (2001) interpretive planning handbook, *A Sense of Place*, student groups in a third year tourism management class created walking tours to engage locals and travelers with place. Students had to make a presentation to their peers, and submit a project write-up, a tour postcard, and a personal reflection paper. Specifically, they reflected on whether they thought differently about place at the end of the course and whether this assignment influenced how they connected with the other course material.

A wide-ranging and impressive set of tours emerged, including cultural and historical tours of local nature-parks; a tour of painted murals in the downtown area; (Figure 1) a culinary and cultural tour of selected European food and beverage outlets; and one tour, by female students, highlighting the importance of women's roles during the war years.

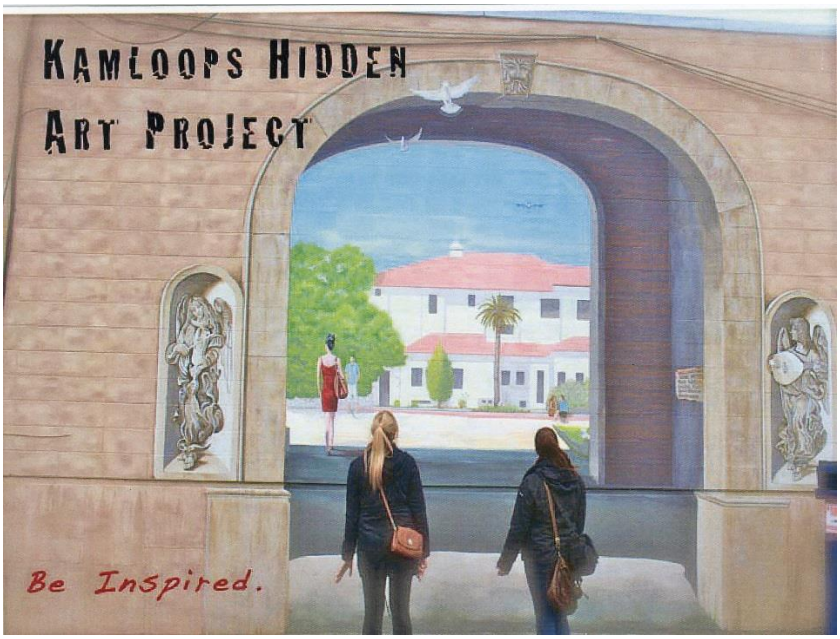

Figure 1: Student postcard, 2012. (Used with permission)

Perhaps the most unexpected place connections came from two tours created by students from China. One focused on the historical and cultural significance of the Chinese cemetery, the other on the history of the Chinese railway workers in the development of Canada's National Railway. Here, students discovered that some of the Chinese rail workers were from their home town in China.

Preliminary results from student reflections indicate that students learned most about Kamloops through their own research, from the local museum and archives, and from presentations by other students. Both

international and domestic students also indicated the importance of the assignment in connecting course material with personal engagement in the community where they live and study.

Example #2: Creating Neighbourhood Walking Routes

This assignment for a fourth year geography course on small cities was designed to develop 1) a walking tour of a Kamloops neighbourhood, 2) a sense of place for that neighbourhood, and 3) an understandable map with tour directions (Figures 2 & 3). The assignment structure required choosing neighbourhoods by randomly selecting neighbourhood names, and producing a postcard-sized map with instructions for the tour on the back. Students then assessed each other's maps, by again randomly selecting neighbourhoods, walking and describing their experiences of the route, and providing feedback in the form of another postcard.

Students became more engaged in the different neighbourhoods of Kamloops, and developed a better understanding of walkability (e.g., Wunderlich 2008) and its connection to sense of place. They also learned how places such as neighbourhoods are socially constructed with associated social, political and geographical meaning enacted in these urban spaces. By walking these routes, students were able to apply theoretical notions of place to lived-experiences outside of the classroom.

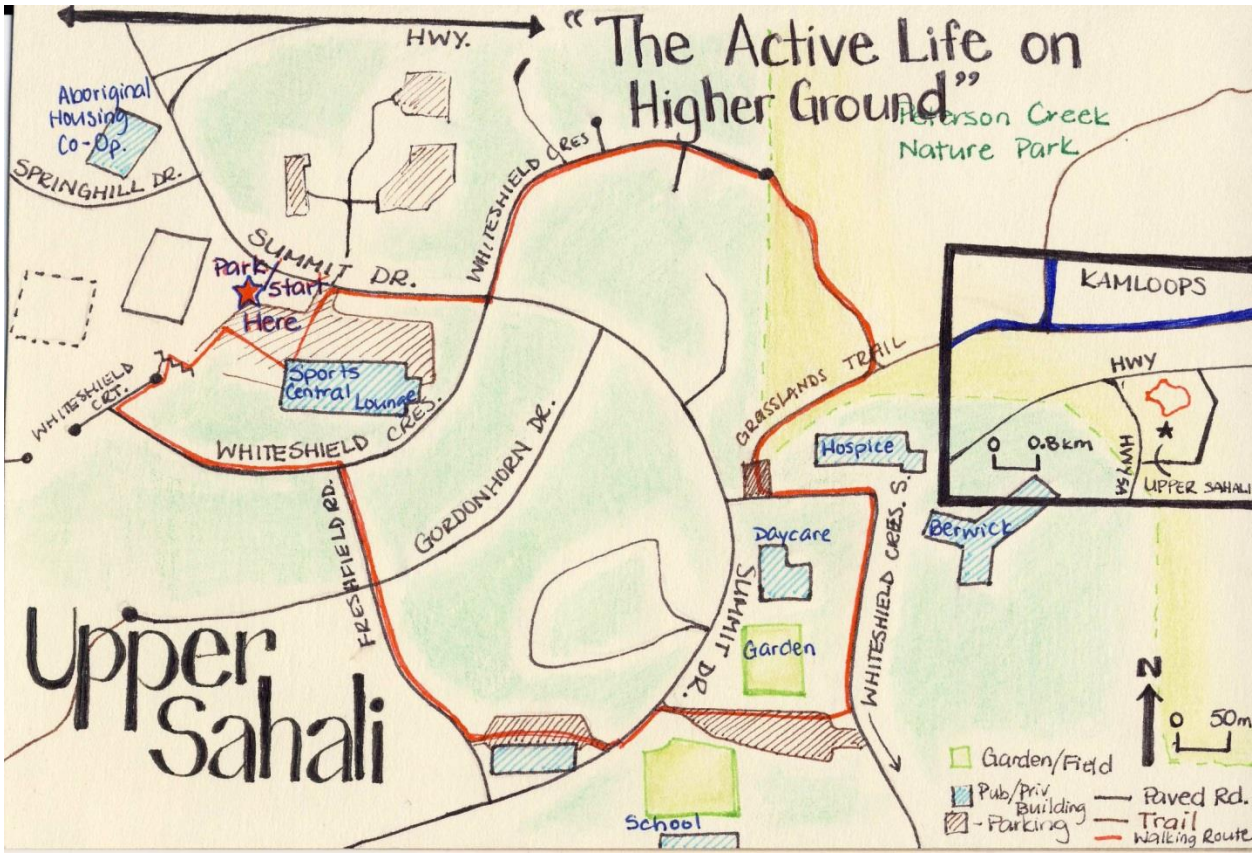

Figure 2. Student postcard (Source: Lee Giddens)

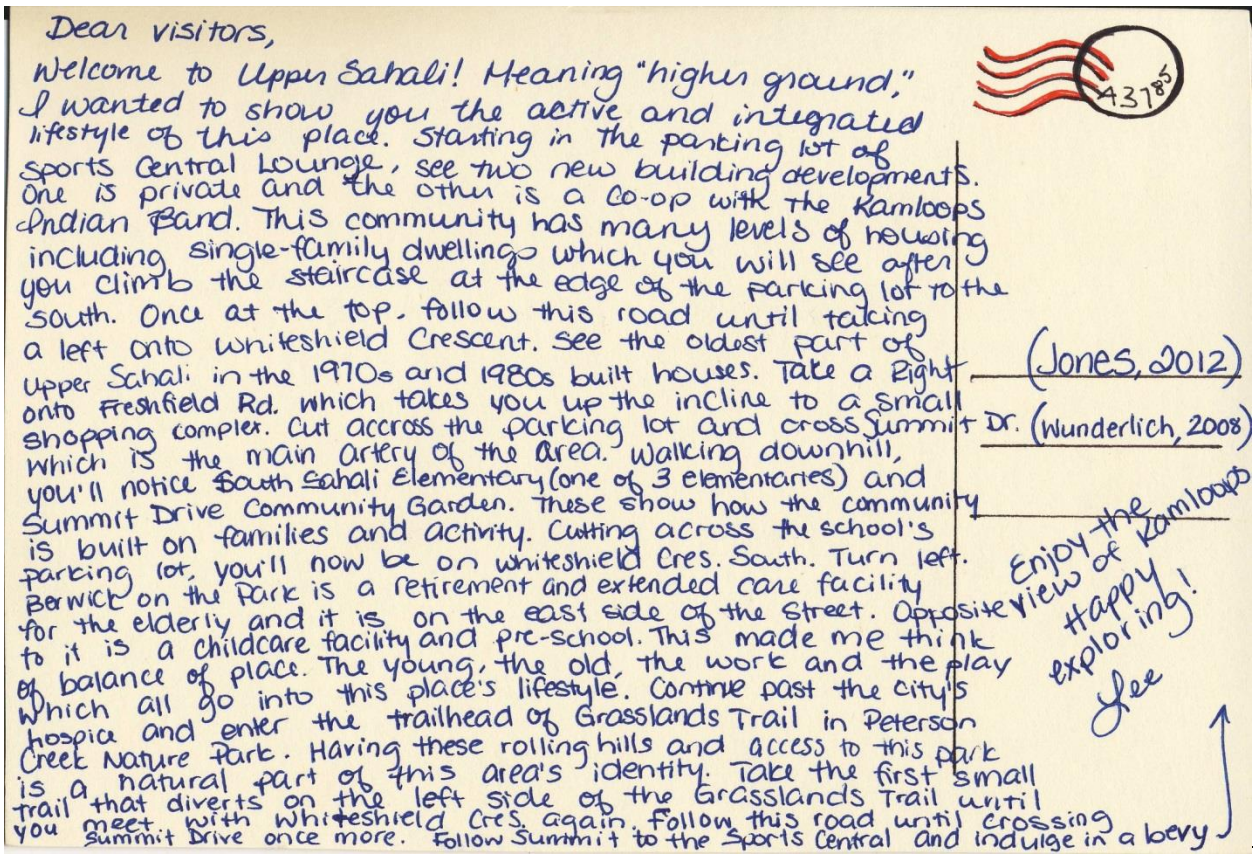

Figure 3. Student postcard write up (Source: Lee Giddens)

Example 3: Expanding Participation by Adding Instruction to a Self-directed Trip

Altering a self-directed field trip to a joint instructor-student exploration resulted in an unexpected increase in student input in a third year cultural geography course. Field trips of everyday landscapes are a cultural geography staple, and in this particular course the field trip explored downtown, incorporating transportation corridors, housing, commercial, industrial, and park space, and ending at the river (Figure-4). Students generally engaged well and enjoyed writing in narrative voice, but struggled with new geography concepts, such as reflexivity, social construction, and discourse. They also avoided less accessible spaces, and missed subtle human-nature relationships. Thus, in fall 2013, students had the option of accompanying the instructor, with surprising results.

Figure 4. Map of Walking Route. Students had to figure out how to get past the tracks to the river on their own. Source: Google Maps satellite image downloaded 27 Feb 2015, with added labels.

First, over one third turned up at 8:00 AM on a Sunday, and many spent extra time. Second, formal instruction expanded -- rather than replaced -- participation by pursuing observations. Third, instruction required pursuing topics and landscapes previously avoided, producing unexpected observations (Figure-5). Fourth, the group was more diverse, producing more observations, diverse observations, and comparisons. Last, student contributions illustrated their distinct experience, social construction of place, and situated knowledge. The typical scripted field trip introduces concepts and landscapes, but inevitably excludes the student's landscape. When describing their landscapes, students added information about graffiti and mural artists, trespass rules, and work practices, from their life experience. Combining place-based study and guided field trip rigour engaged students as place co-creators, while instruction provided general and specialised knowledge, vocabulary, and facilitated joint learning.

Figure 5. The field trip context encouraged students to move into this unattractive, usually avoided, industrial space, eliciting their own age and class-specific knowledge of local graffiti practices and trespassing practices (Source: K. Naqvi).

Concluding Comment:

Our experience with place-based field trips confirms the higher learning levels and retention shown in previous research. We also found that the place-based focus and student-driven structure of the field trips added depth and increased student engagement with course content. Students applied theoretical concepts, made original discoveries, and added knowledge from their previous experience, in the context of each course. The social construction of place and its multi-layered complexity was demonstrated not only in the landscape, but by the process of the field trips.

Notes:

1. David A. Gruenewald is published as David A. Greenwood after 2007.

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Temperature, Precipitation, and Snowfall Trends on the Coast of Vancouver Island

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Abstract: *Climate change has already had a significant impact on humans and the environment, and will continue to have both global and regional impacts. This study analyzed regional long-term climatological trends of temperature and precipitation from 10 coastal weather stations on Vancouver Island, British Columbia. All stations showed an increasing temperature trend, with the average regional trend increasing at a comparable rate to the global average, even with the Pacific Decadal Oscillation taken into account. Precipitation records are highly variable and show little significant change, while total snowfall trends are decreasing at all stations.*

Introduction

The Intergovernmental Panel on Climate Change (IPCC) predicted an increase in global average temperature from approximately 0.3 - 5.5 ^{0}C by 2100 (IPCC, 2013a). This study focused on local and regional scale climate trends on the coast of Vancouver Island, British Columbia. Understanding how local climate is changing will help enable policy makers to identify actions to protect important ecological, social, and economic environments on Vancouver Island. These include freshwater quantity and quality, agriculture productivity, forestry and forest habitats, the iconic salmon species, and our coastal communities (Allen and Scibek, 2004; Cohen, 2012; Gayton, 2008; Hutchinson and Rocke, 2008; Spittlehouse and Steward, 2003).

Specifically, this research focused on the long-term climatological trends of temperature, precipitation, and snowfall from the weather stations located on the coast of Vancouver Island. To better compare with similar studies, annual, winter (DJF), and summer (JJA) average trends for temperature, total precipitation, and total snowfall are examined. There are 10 main weather stations on Vancouver Island ranging from 2-130m in elevation, with recorded climate data from 1960 onward, used for this study: Victoria, Nanaimo, Shawnigan Lake, Tofino, Ucluelet, Port Hardy, Comox, Quinsam River, Quatsino, and Cape Scott (Figure 1). The stations are analysed individually to determine local trends and then the aggregated temperature data is compared to the global average temperature trend from the National Aeronautic and Space Administration (NASA) to examine the relationship between local climate change and global trends.

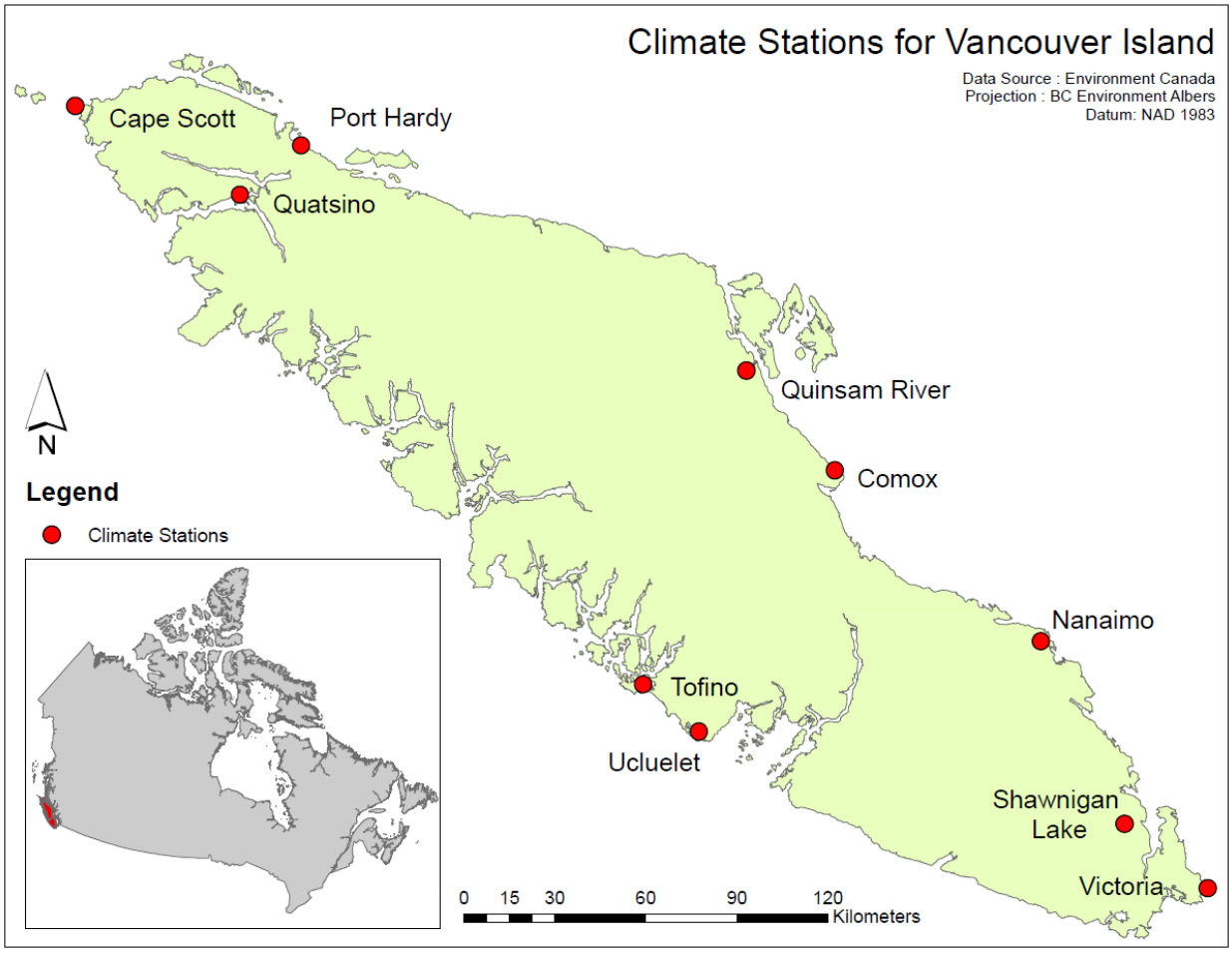

Figure 1: Environment Canada Climate Stations used in this study.

Data Collection and Methods

Where possible, the data used in this study is Environment Canada's (2011b) homogenized data, available for 7 of the 10 weather stations for temperature analysis and all 10 stations for precipitation, and snowfall analysis listed above. The temperature analysis does not contain homogenized data from Tofino, Ucluelet and Nanaimo. Moreover, the aggregated data for Vancouver Island does not contain Cape Scott and Quinsam River as they do not have data from 1950-2011 and Nanaimo as the station does not have homogenized data. Environment Canada (2011a) adjusted and homogenized the raw data from the weather stations in order to account for changes in instruments and observational procedures.

Results and Discussion

Temperature Analysis

The annual, winter, and summer homogenized mean temperature data for Victoria, Shawnigan Lake, Comox, Quatsino, Quinsam River, Port Hardy, and Cape Scott were analysed. Nanaimo, Tofino and Ucluelet are not present in the temperature data because the data is not homogenized. The annual mean temperature trends are positive for all stations over the last 50 years (Figure 2). The highest

rate of change is 0.23 ^{0}C/decade at Victoria, while the lowest rate of change is 0.18 ^{0}C/decade at Cape Scott.

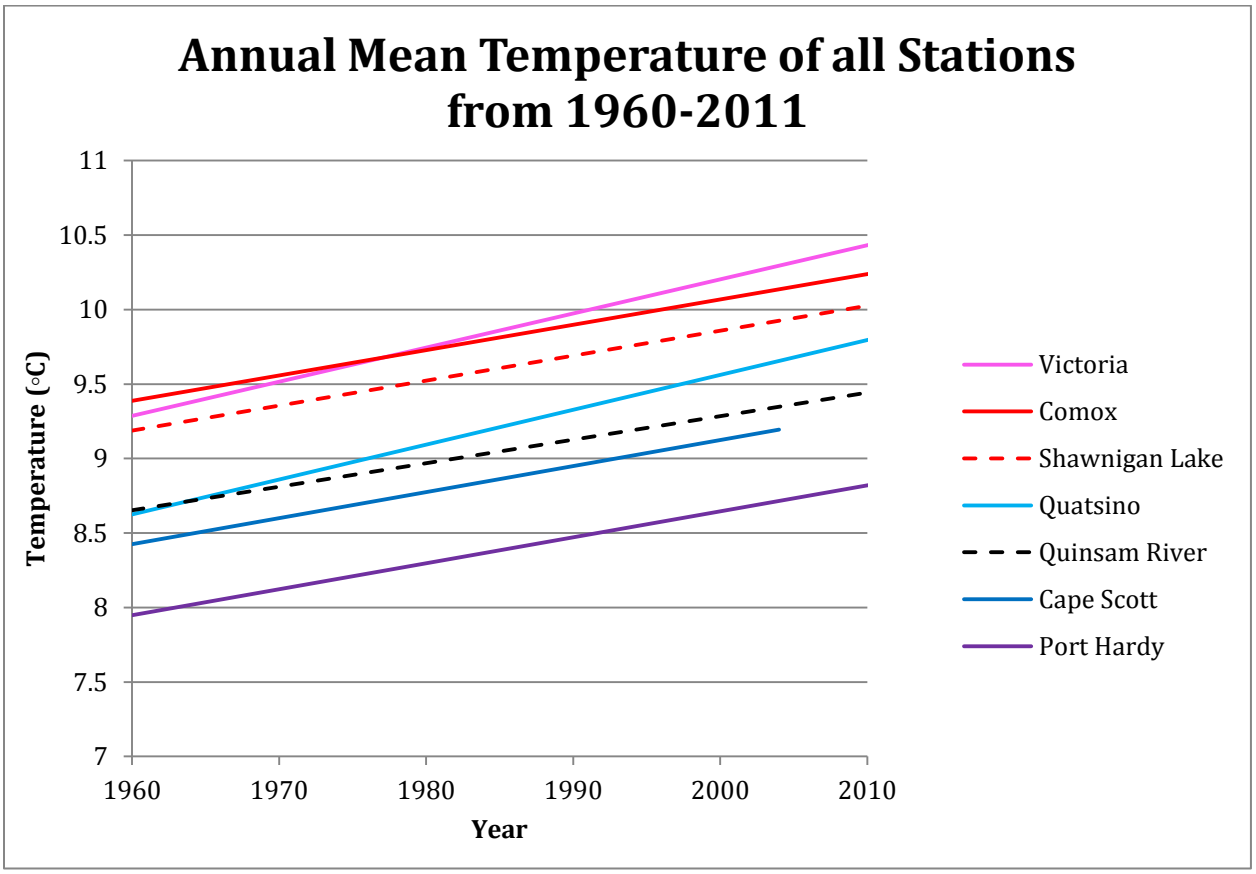

Figure 2: Annual mean temperature for all the stations from 1960-2011
Note: Cape Scott only has data from 1960-2004.

All stations were analysed for annual, winter, and summer trends but only Quinsam River trends are shown here (other station's data available on request). Quinsam River is representative of the average trends of all the stations (Figure 2). Annual, winters, and summer mean temperatures for Quinsam River, from 1960-2011, show positive trends (Figure 3), with greater variability in the winter than in the summer.

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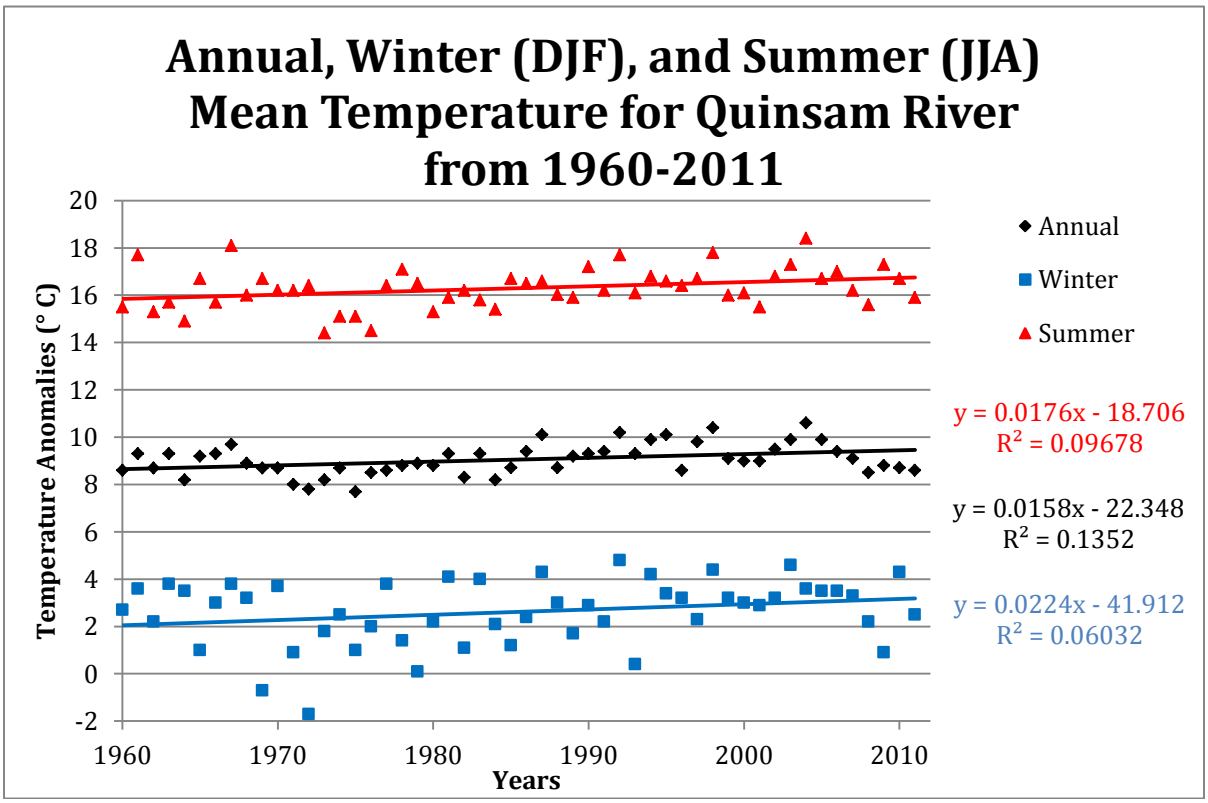

Figure 3: **Annual, winter, and summer mean temperature for Quinsam River from 1960-2011**

The rate of warming for winter temperature (0.22 ^{0}C/decade) is greater than the summer and annual temperatures (0.18^{0}C /decade and 0.16^{0}C/decade, respectively).

As seen in Figure 4, there are no obvious spatial differences in the annual mean temperature trends from the climate stations.

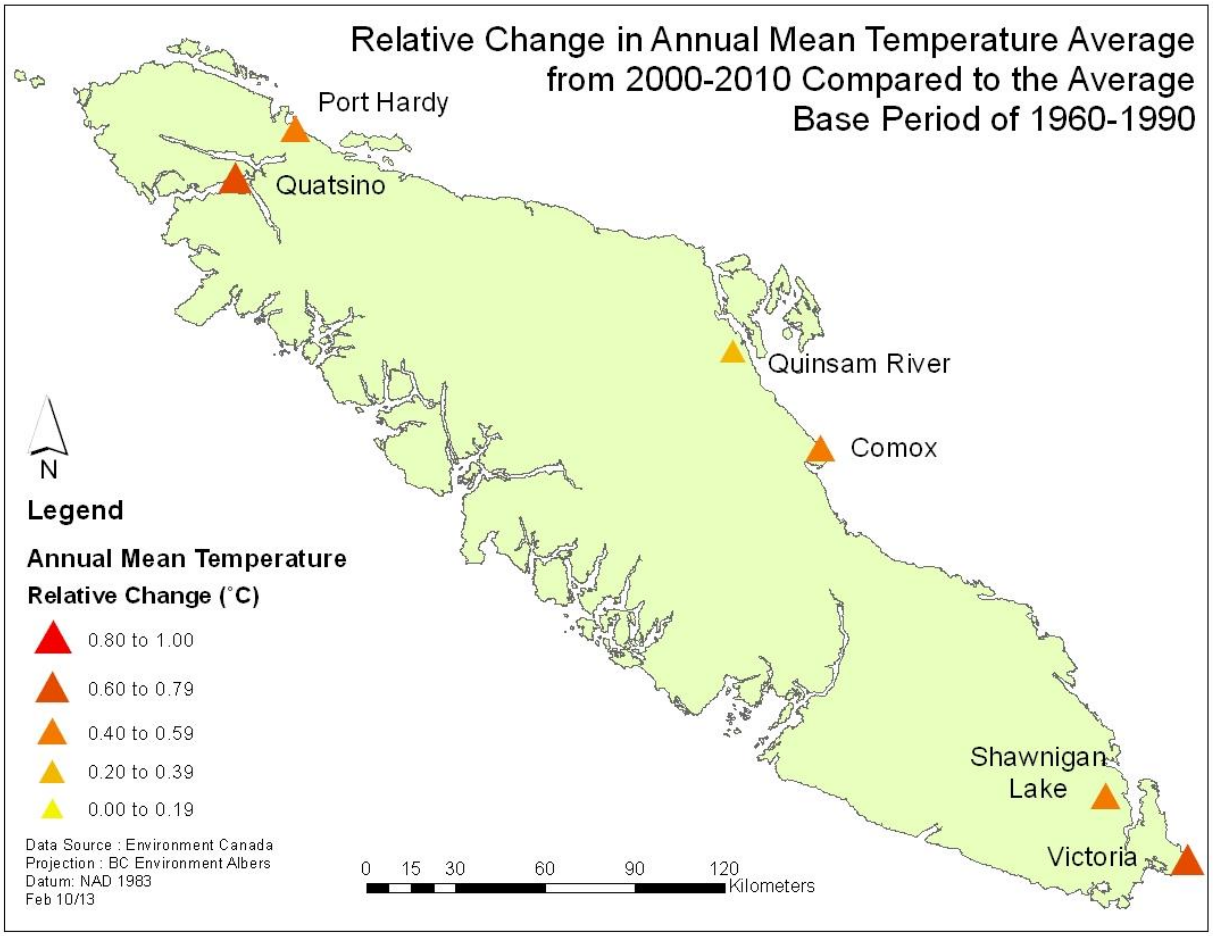

Figure 4: Relative change in annual mean temperature average from 2000-2010 compared to the average base period of 1960-1990
Note: Cape Scott is not present due to incomplete data from 1960-2004.

Global Comparison

Vancouver Island temperature trends are compared to the global trends from the NASA Goddard Institute of Space Studies (GISS) (Figure 5). The aggregated data from Vancouver Island's coast consists of the annual mean temperatures from Victoria, Shawnigan Lake, Quatsino, Comox, and Port Hardy.

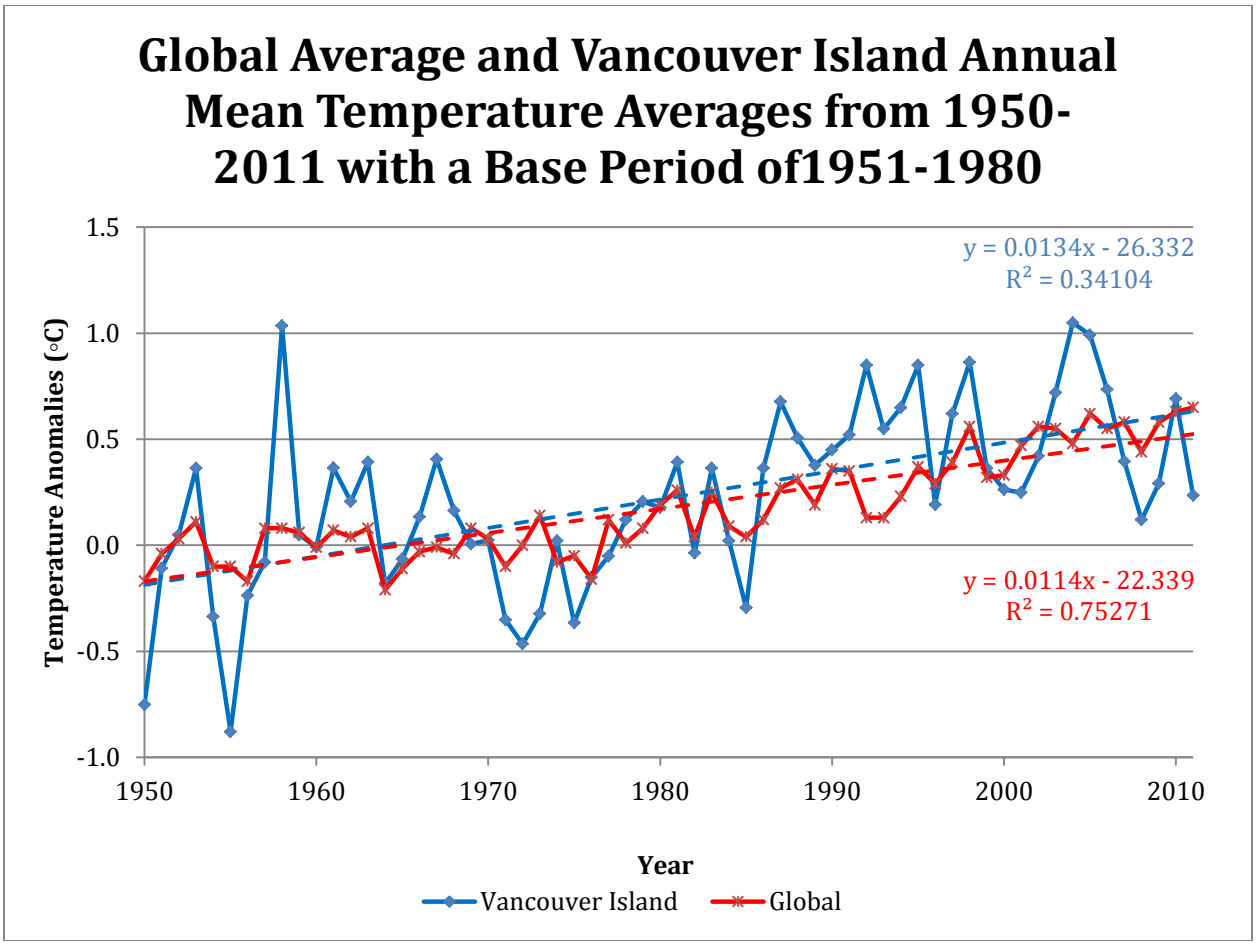

Figure 5: Global average and Vancouver Island annual mean temperature anomalies from 1950-2011 with a base period of 1951-1980

The average rate of warming for Coastal Vancouver Island (0.134 ^{0}C/decade) is increasing at a comparable rate to the global average temperature (0.114 ^{0}C/decade).

There are many factors that could contribute to the rising Vancouver Island average temperature trend. Since Vancouver Island is adjacent to the Pacific Ocean, one of the most important factors is the Pacific Decadal Oscillation (PDO). The PDO represents a pattern in which two primary nodes of sea surface temperature exists, one in the northern and western part of the Pacific basin containing the study area, and a smaller one in the eastern tropical Pacific (Figure 6). Over a time period of approximately 20 to 30 years, the sea surface temperature in the two zones undergoes abrupt shifts between positive phases and negative phases (Aguado, 2007)(Figure 7). This change in sea surface temperature over a 20-30 year period has shown to affect the long-term climatic trend on Vancouver Island.

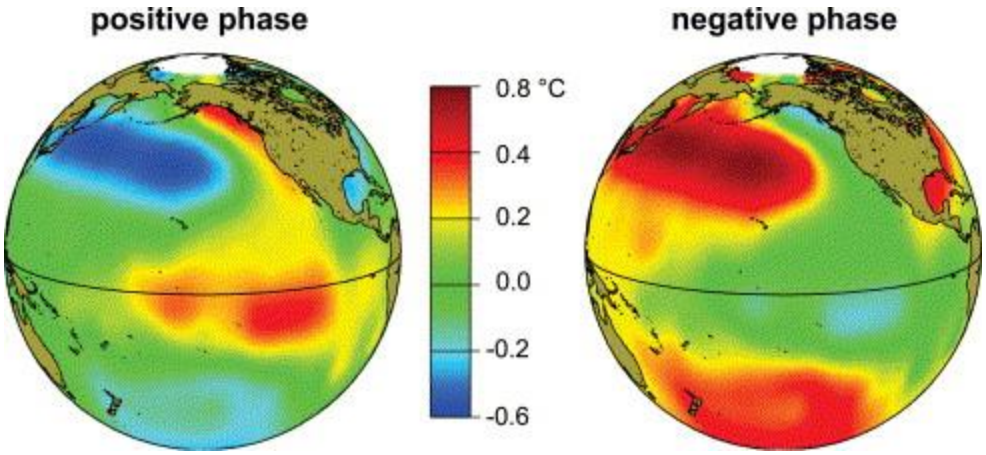

***Figure 6*: PDO water temperatures.**
Source: (Pavelsky & Smith, 2004)

The monthly values for the PDO Index indicate that the PDO has an increasing trend from 1950-2011, the time period over which the Vancouver Island temperature data was analysed (Figure 7). Therefore it is important to determine if the warming trend on Vancouver Island is solely due to the PDO or if other factors, such as global warming, could also be contributing.

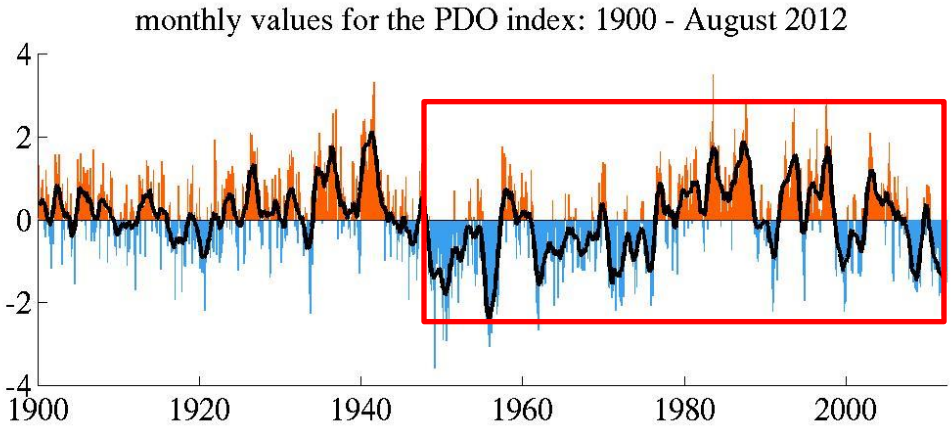

Figure 7: Monthly values for the PDO index from 1900 – 2012. The red box highlights the study period.
Source: (Hare, 2012)

The PDO index data from the Joint Institute for the Study of the Atmosphere and Ocean (JISAO) is compared against the Global, and Vancouver Island Costal Temperature Anomalies from 1970-2011 (Figure 8). This timeframe, changed from the original timeframe of 1950 to 1970, was chosen, as the PDO index has no trend over this time period. Any warming trend on Vancouver Island over this time period would be without the influence of the PDO.

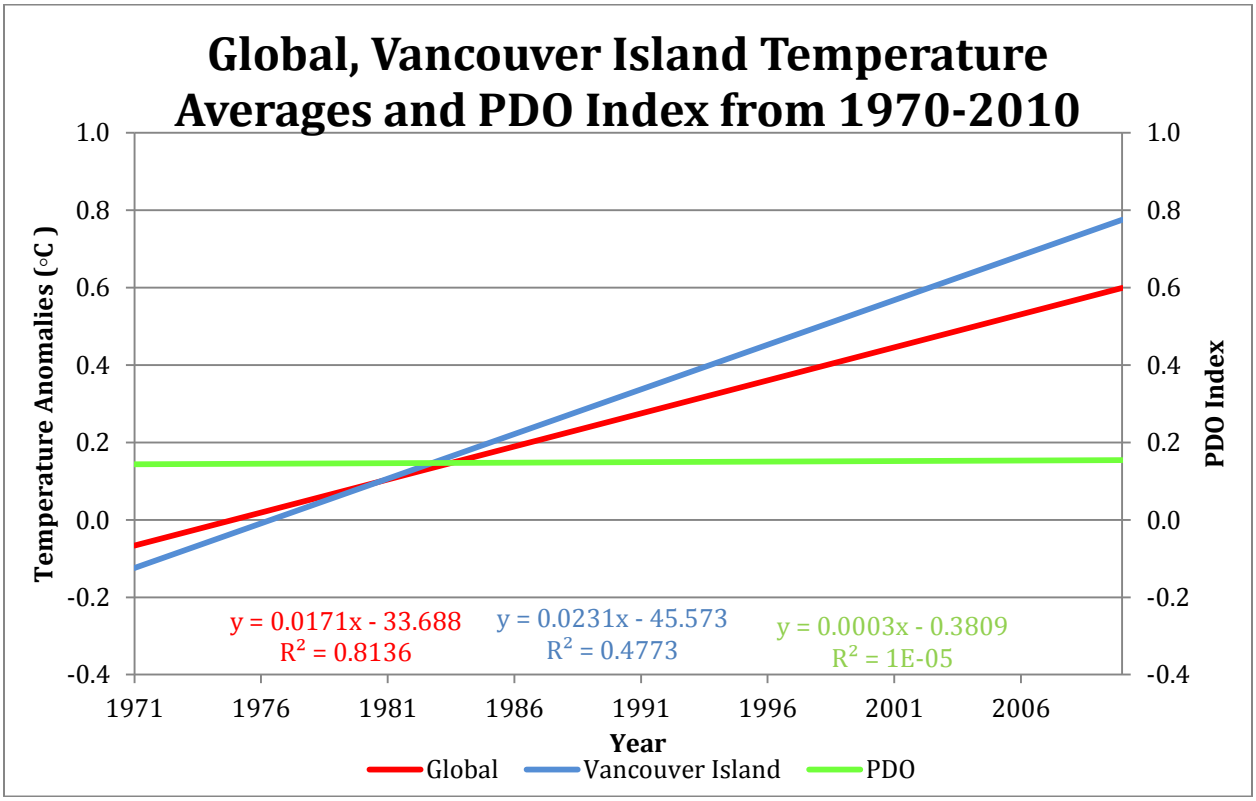

Figure 8: Global and Vancouver Island average temperature anomalies and PDO Index from 1970-2010
Source: (Mantua, 2013)

With negligible influence by the PDO, the global and Vancouver Island coastal temperature anomalies still show an increasing trend (0.17 and 0.23 ^{0}C/decade, respectively)(Figure 8). Moreover, the temperature for Vancouver Island are still rising at a comparable rate to the global average temperature, implying that the influence of the PDO is not the reason why Vancouver Island is warming at a similar rate to the global average temperature.

Precipitation Analysis

The annual, winter, and summer homogenized total precipitation data for Victoria, Shawnigan Lake, Nanaimo, Comox, Quatsino, Quinsam River, Port Hardy, Ucluelet, Tofino, and Cape Scott were analysed. The total precipitation trends for all the stations have a mixture of positive and negative trends over the last 50 years and none of the values are significant (Pearson's Coefficient; $P<0.254$ and $P<0.321$)(Figure 9). The highest rate of change is 17.3mm/decade at Tofino and the lowest rate of change is -84.5 mm/decade at Cape Scott. The results indicate that all the stations show little to no change in precipitation.

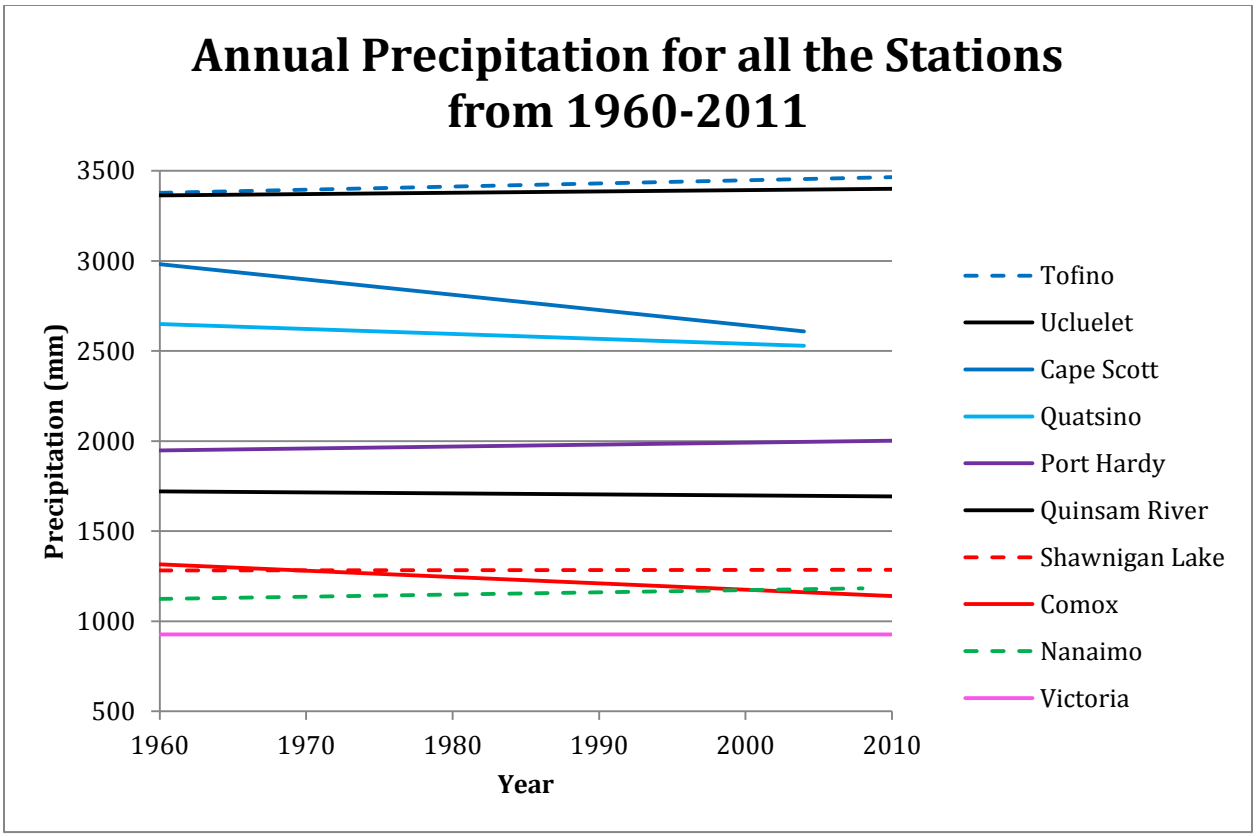

Figure 9: Annual Precipitation from 1960-2011
Note: Cape Scott and Quatsino only have data from 1960-2004 and Nanaimo has data from 1960-2008.

All stations were analysed for annual, winter and summer trends but only Quinsam River and Cape Scott trends are shown here (other stations data available on request). Quinsam River is representative of the average trends of all the stations (Figure 10). The annual, winter, and summer mean precipitation for Quinsam River, from 1960-2011, show a decreasing trend for the annual and summer trends (-5.6 mm/decade and -10.4 mm/decade, respectively) and increasing trend for the winter trend (3.5 mm/decade).

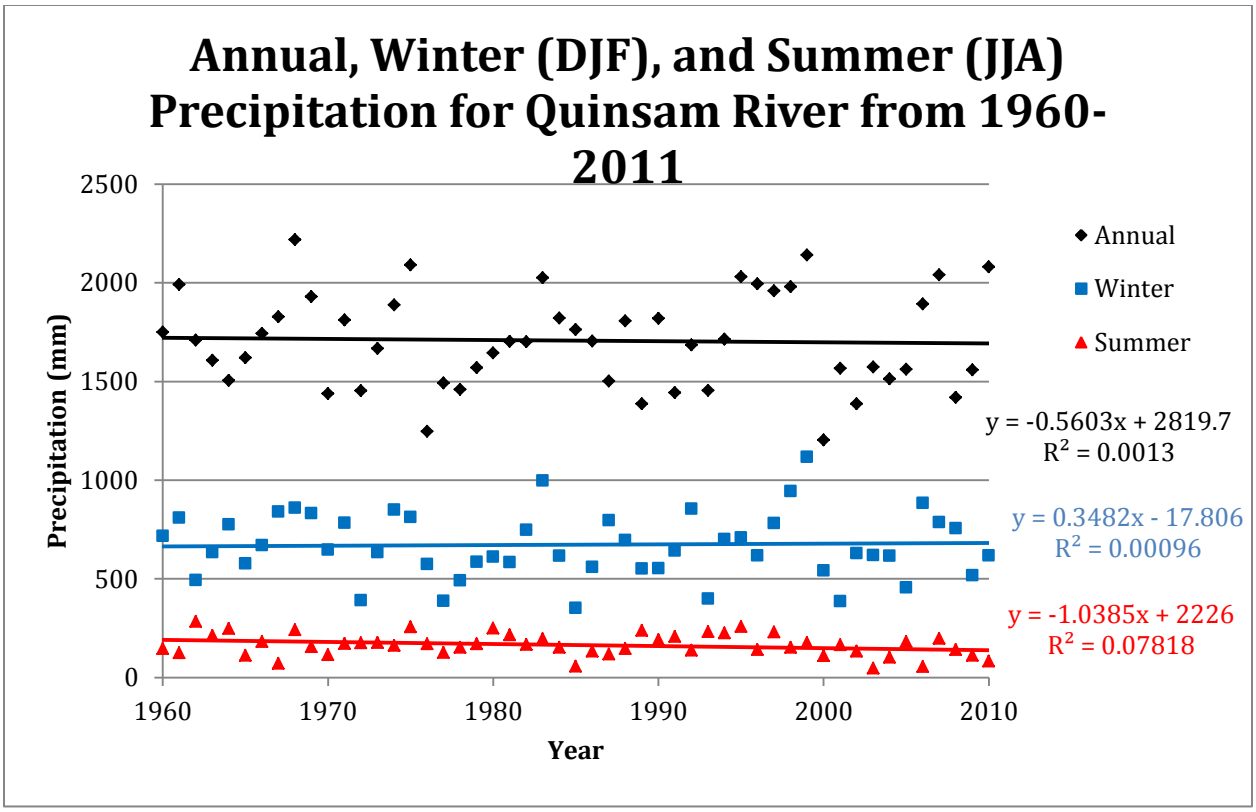

Figure 10: Annual, winter, and summer precipitation for Quinsam River from 1960-2011

The annual, winter and summer mean precipitation for Cape Scott River, from 1960-2011, show decreasing trends for the annual and winter (-84.5 mm/decade and -3.80 mm/decade, respectively) and increasing trend for the summer (2.73 mm/decade) (Figure 11).

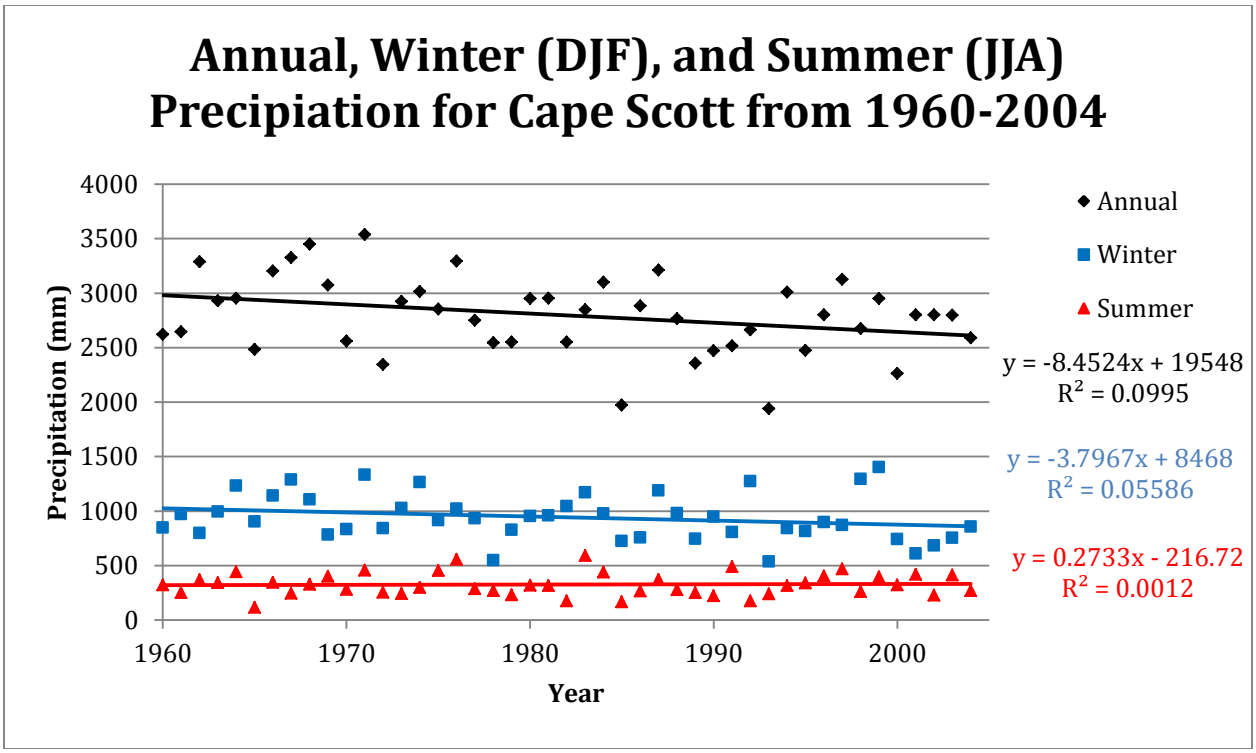

Figure 11: Annual, winter, and summer precipitation for Cape Scott from 1960-2004

As seen in Figures 12, there are no obvious spatial differences in the annual snowfall trends from the climate stations.

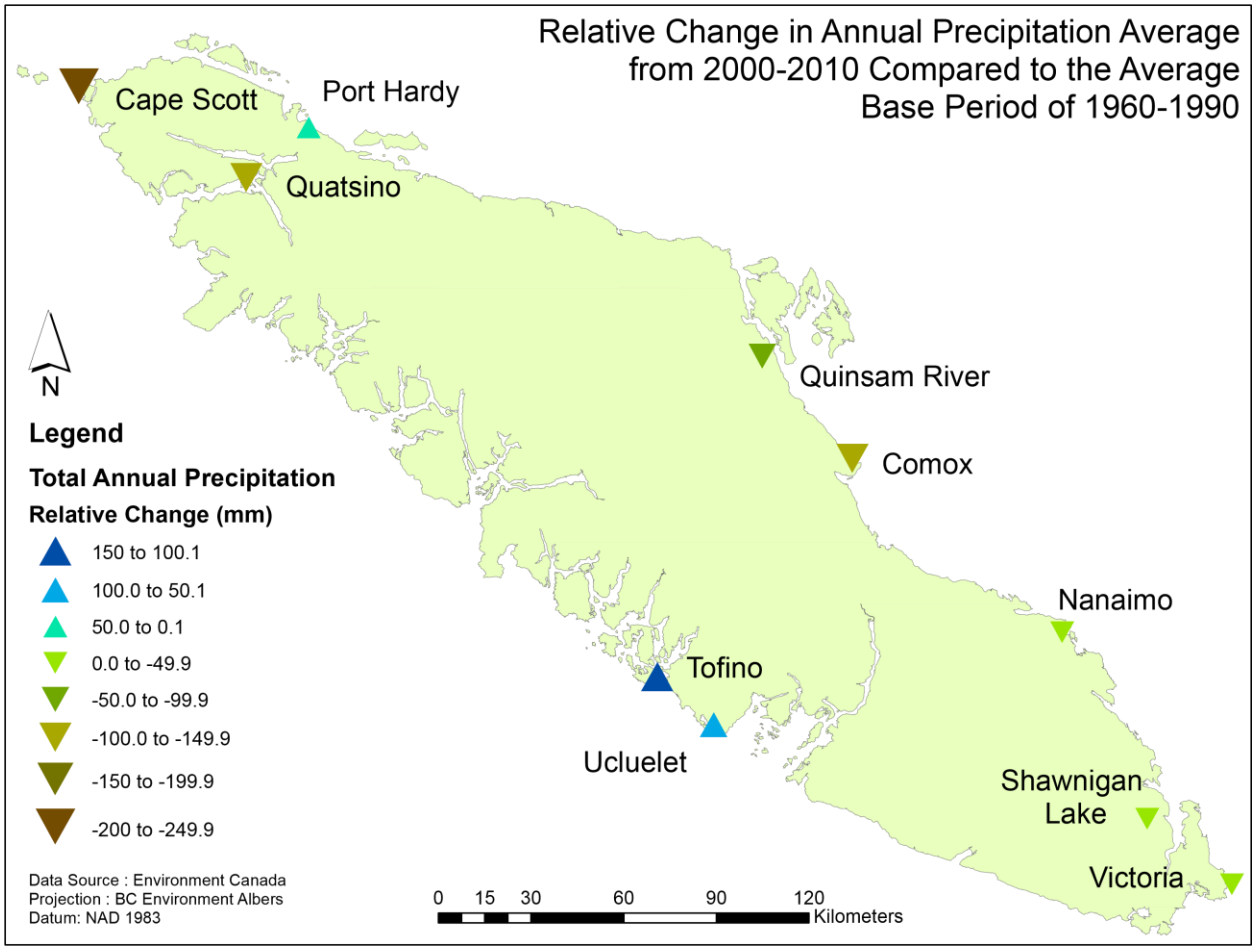

Figure 12: Relative Change in Annual Precipitation Average from 2000-2010 Compared to the Average Base Period of 1960-1990

Note: Cape Scott, Nanaimo, and Quatsino are not represented on this map because Cape Scott and Quatsino only have data from 1960- 2004 and Nanaimo has data from 1960- 2008.

Snowfall Analysis

The annual and winter homogenized snowfall data for Victoria, Shawnigan Lake, Nanaimo, Comox, Quatsino, Quinsam River, Port Hardy, Tofino, Ucluelet, and Cape Scott were analysed. The annual snowfall trends are negative for all stations over the last 50 years (Figure 13). The largest rate of change is -16.6 cm/decade at Quinsam River, while the smallest rate of change is -0.3 cm/decade at Shawnigan Lake.

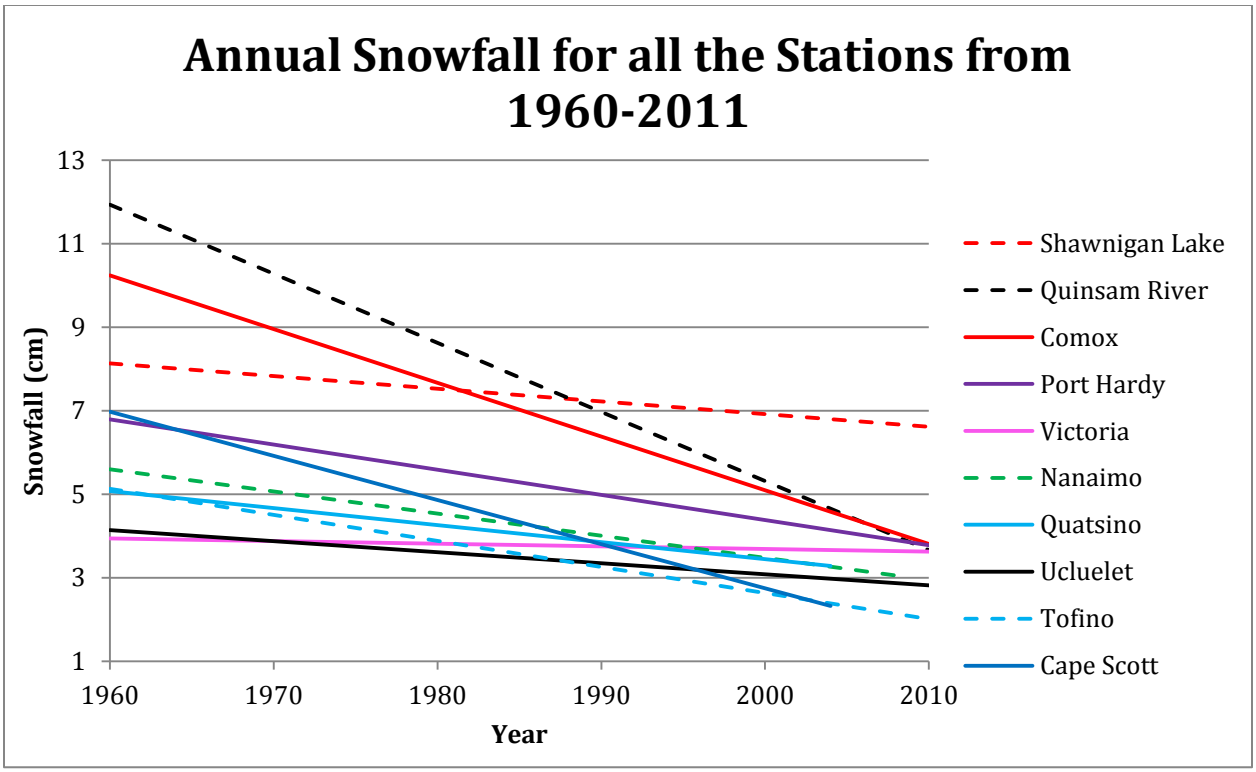

Figure 13: Annual snowfall for all the stations from 1960-2011.
Note: Cape Scott and Quatsino only have data from 1960-2004, while Nanaimo has data from 1960-2008.

All stations were analysed for annual, and winter (DJF) trends but only Cape Scott and Quinsam River trends are shown here (other stations data available on request). Annual, and winters snowfall for Cape Scott, from 1960-2011, show negative trends (Figure 14).

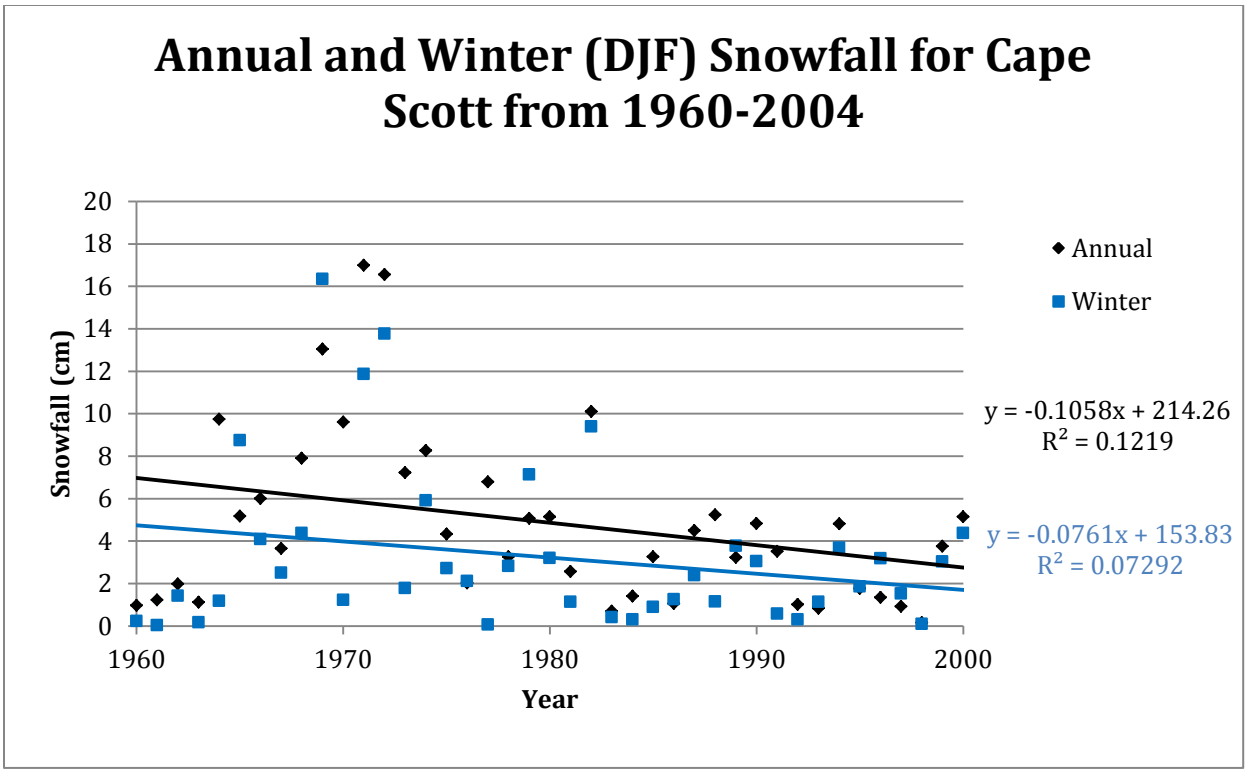

Figure 14: Annual and winter snowfall for Cape Scott from 1960-2004
The rate of change for snowfall is decreasing for the annual and winter trends (-1.1 cm/decade and -0.76 cm/ decade, respectively).

Similar to Cape Scott, the annual and winter snowfall for Quinsam River from 1960-2011 both show negative slopes and with the greatest amount of change (Figure 15).

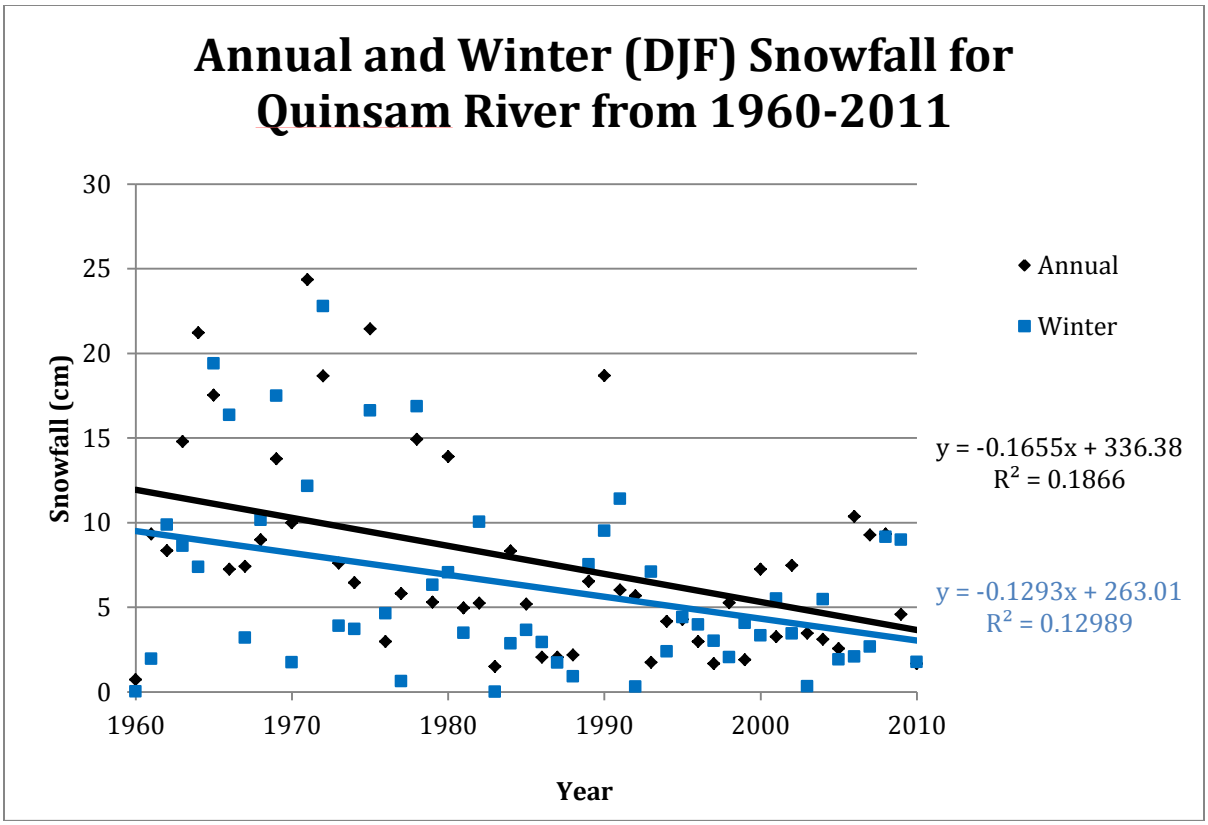

Figure 15: Annual and winter snowfall for Quinsam River from 1960-2011

The rate of change for snowfall is decreasing for the annual and winter trends (-16.6 cm/decade and -12.9 cm/ decade, respectively).

As seen in Figure 16, there are no obvious spatial differences in the annual snowfall trends from the climate stations.

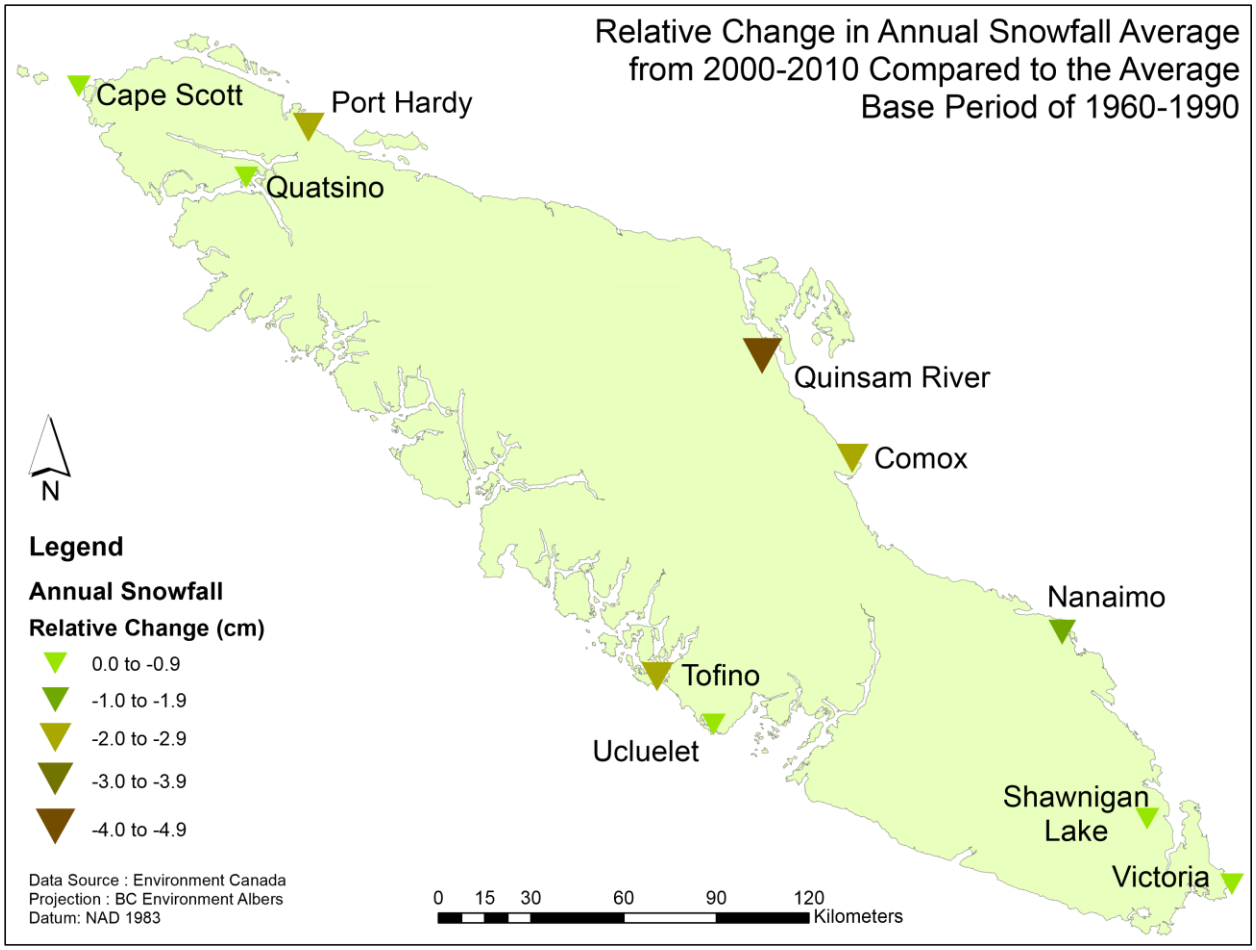

Figure 16: Relative change in annual snowfall average from 2000-2010 compared to the average base period of 1960-1990.

Note: Cape Scott, Nanaimo, and Quatsino are not represented on this map because Cape Scott and Quatsino only have data from 1960-2004 and Nanaimo has data from 1960-2008.

Conclusion

The results of the temperature, precipitation, and snowfall analysis have concluded that the climate is changing on the coast of Vancouver Island in concurrence with the global average temperatures. The annual mean temperature trends for all the stations has increased from 1960-2011 and the aggregated data for Vancouver Island has increased from 1970-2011 at a comparable rate to the global average temperature at 0.23^{0}C/decade, neglecting the effects of the PDO. The annual precipitation analysis illustrated that all the stations show little to no change in precipitation. The annual snowfall trends demonstrated a decrease in snowfall at every station. If temperature, and snowfall on Vancouver Island continue to follow the trends, the future environmental impacts on Vancouver Island, including freshwater quantity and quality, agriculture productivity, forest species, habitats and all species of salmon, will continue to diminish.

Areas of future study could try to correlate the decreasing water quality, loss of biodiversity in forest and salmon species, and increase agriculture water demand to the changing climate on Vancouver Island.

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Investigating Donor Patterns: *A Case Study of SOS Children's Village BC*

Amanda Younger, Kwantlen Polytechnic University

Abstract: *SOS Children's Village BC is a non-profit organization that works with many of British Columbia's 9000 foster children, its Surrey based village depends on attracting and retaining charitable donations to provide a range of services to five resident foster families and others in the community. Looking at several studies from 2000-2013 it can be noticed that relatively little has been written about the use of GIS with non-profit organizations and mapping their donor populations. The objective of this study was to find the organization's donor pattern to identify existing concentrations of donors, as well as new areas to target SOS Children's Village BC fundraising campaigns. ArcGIS 10 was used as the analytical tool to map the donor pattern. The study demonstrated the utility of GIS in tracking donors and lead to a series of recommendations to allow SOS BC to adopt GIS in their fundraising strategies. Work is continuing on replicating the study with other non-profit organizations.*

Introduction

While the use of Geographic Information Systems (GIS) by non-profit organizations to track service populations is not a new idea little has been documented regarding the application of GIS in the tracking of donor populations. The potential of looking at donor patterns and relationships on a spatially, rather than list or database system allows leaders at non-profit organizations to identify the donors on a regional basis. Once the GIS for the non-profit organization is set up, it only requires ongoing maintenance.

This use of GIS has been applied to SOS Children's Village BC for the purpose of finding donor patterns and developing fundraising strategies. The output for this project resulted in a hard copy paper map, and an electronic PDF map stored in the SOS BC computer system.

SOS Children's Village BC

SOS Children's Village BC (SOS BC) is a non-profit organization working with some of British Columbia's 9,000 foster children (July 2011 estimate). SOS BC provides a variety of support programs to five foster families living in the village, which is situated on a 2.5-acre property in Surrey, BC. They are part of the global SOS Children's Villages organization and are the only village currently located in Canada. SOS BC was founded in 1986 and the village site has been in operation since 1999. In addition, SOS BC provides outreach programs to foster families in the community through their Fostering Growth program. SOS BC relies mainly on donor support from across BC to run its programs. (SOS Children's Village British Columbia 2011)

GIS Applications for Non-profit Organizations.

When examining the literature it can be noted, that little has been published on the use of GIS with non-profit organizations. In a 2003 study, Jardine

used GIS to look at where Binghamton University alumni lived by state and county. The data was compared to the number of donations by state and revealed that the areas with the largest number of alumni also had the highest number of donors. This was beneficial because it allowed those at the university to see where the donors were located geographically .The evidence from Binghamton University shows that GIS can be used for observing the donor patterns of an organization (Jardine 2003).

There is also evidence for the use of GIS in non-profit organizations in tracking service populations, those who a non-profit serves. In 2003, Wallace reported on the use of GIS as a method of looking at service populations. In this case, the Boys and Girls Club organization in Providence, RI. was examined and it was found that they had been using GIS methods for several years to look at where their service population lived, by having the children place a pin in a map of the city to show their homes. The same report also looked at arts groups and their proximity to available sources of funding in the central business districts of New York and found a correlation between the distance and the amount of funding received. Other studies have looked at the effect of distance and demographics on service provision by using GIS techniques, which allow for population centers and locations to be, examined (Wallace 2003).

Another 2004 study by Bielefeld and Murdoch looks at the location of the non-profit organizations and their for profit counterparts, examining the benefit to non-profit organizations that comes from using GIS. In its opening, this study addresses the lack of research that studies the location of non-profit organizations, "location has been studied much less frequently for non-profit organizations. This is unfortunate, because non-profits also need to locate where they will have access to resources, labor and consumers. Several other factors may, in fact, make location more important for non-profits than for their for profit counterparts. Non-profit organizations often provide hard-to-evaluate products or services and are therefore, heavily reliant on factors, including location, which enhances their legitimacy in the eyes of consumers and funders" (Bielefeld & Murdoch, 2004). Location in terms of both donor and service populations for non-profit organizations is key to reaching those that they are trying to serve and those that they would like to receive donations from. The study goes on to discuss the necessity of locating in areas where the potential donors exhibit specific characteristics. The Bielefeld & Murdoch study focuses on non-profits working in education and human services, they found that similar services were clustered in similar geographic areas due to the need for similar services. However the organizations studied were not so clustered as to over saturate an area with a single service instead the services were spread out to provide service to a greater population.

Whereas these approaches have been used with non-profit organizations, they have not examined the donors for a non-profit in more detail. This case

study examines the donors for a non-profit by analyzing the locations of donors based on their on the postal code and individual address of each donor, which gives SOS BC greater certainty in knowing exactly where their donors are located which allows for much greater targeting of fundraising campaigns.

Impetus for the Study

The impetus to map the locations of the SOS Children's Village BC donors was the June 2011 direct mail campaign. While preparing envelopes, there was an observable pattern of where SOS BC donors were located that emerged. The donors appeared to be concentrated in Richmond BC, possibly because a Richmond couple founded SOS BC. However, both the village and SOS BC office are located in Surrey, which seemingly had fewer donors. There also appeared to be pockets of donors around specific locations, such as the offices, thrift stores and homes of founding or board members. In order to investigate further, the data was mapped to show the pattern.

Method

The first step in developing the GIS was data collection and preparation. All of the donor addresses needed for the GIS were stored in several locations in multiple spreadsheets as well as in a program called Income Manager. A master spreadsheet was created to collate the donor data.

At this point, it was also necessary to determine the scope of the map, or the area and amount of data it would cover. An initial evaluation of the data indicated that most of the donors were concentrated in the Lower Mainland region of BC. The cities considered in this analysis are Vancouver, Surrey, Richmond, Langley, Port Moody, New Westminster, Coquitlam, Port Coquitlam, Burnaby, Abbotsford, North Vancouver, Mission, Delta and Greater Vancouver A[25]. The data was sorted into smaller, easy to manage sections that would divide the large cities into smaller portions and yet be easy to obtain from the existing address data. Therefore, the Forward Sortation Areas (FSA)[26], layer for this area served as the base for donor matching, because every donor record included a complete postal code, so the FSA for each donor was easily extracted. The Census Metropolitan Area (CMA) data was used to aid in the selection of the geographic area for analysis because it clearly defined both Greater Vancouver and the Lower Fraser Valley, which together make up the Lower Mainland. The Local Distribution Units (LDU)[27] and Water layers were used to define the boundaries of the land mass as LDU's are only assigned to land areas and the water layer masked any boundaries that extended into the water. The method taken to create and analyze the maps is detailed in Figure 1 below.

[25] Greater Vancouver A is an unincorporated census tract located near Vancouver and encompasses the University of British Columbia.

[26] Forward Sortation Areas are the first three characters preceding the space of a six digit Canadian Postal Code

[27] Local Distribution Areas are the second set of three characters following the space of a six digit Canadian Postal Code

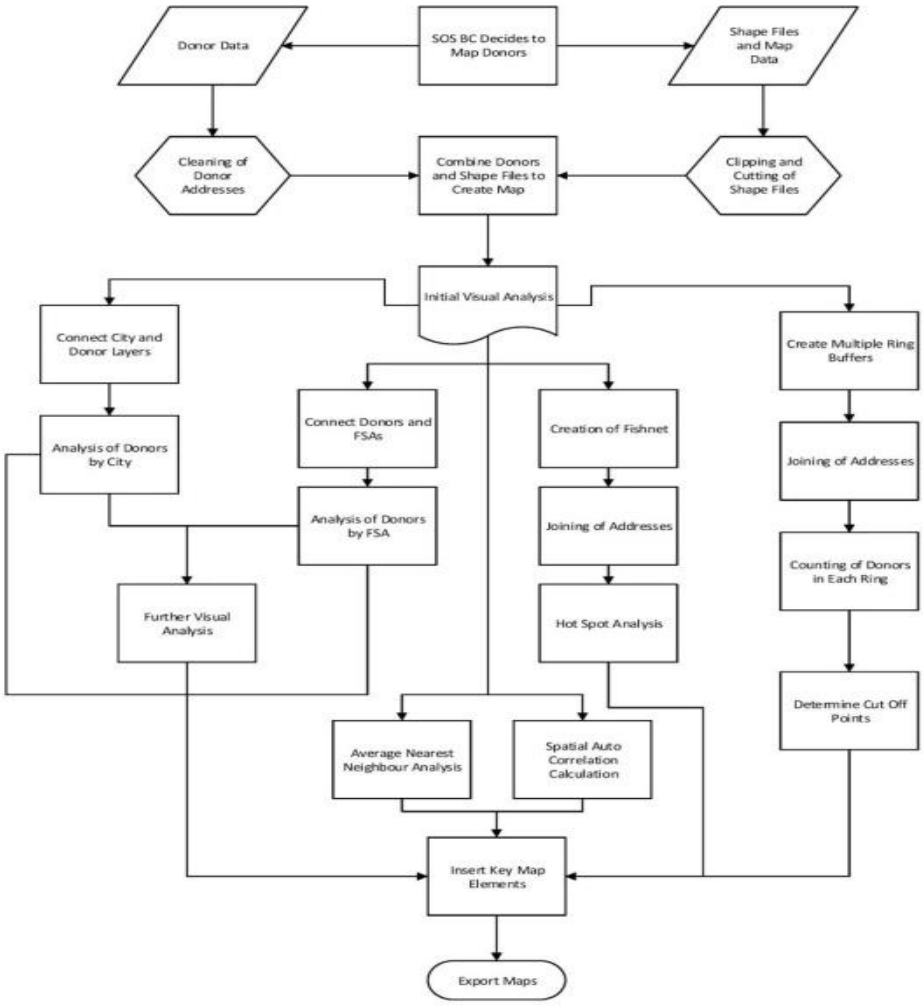

Figure 1 Flow chart of GIS functions and operations taken in the creation of SOS BC maps and analysis.

To present the data clearly it was necessary to determine how many donors live within each postal code. This was done using the count if function in Microsoft excel to count the number of donors in each FSA which was saved to its own excel sheet. The excel sheet showing the number of donors per FSA was joined with the FSA layer to allow for analysis. The number of donors was sorted into eleven categories in a Jenks arrangement. Jenks or natural breaks arrangements break the data into categories by finding the natural breaks in the data; it tries to minimize the variation of values within a category while maximizing the variation of values between categories. Jenks was the chosen because it proved to have the most logical separation of data in terms of how large the categories were and the distribution of the categories. Eleven

categories were necessary to show the varied amount of donors in each FSA, this number of categories relays more precise information to the user and allows for easy use of the map to determine where SOS BC has a strong donor base.

The geocoding of addresses within FSAs allows for identification of the pockets and patterns of donors by postal code. In this case, geocoding matched a street address in a table and the street layer to find the exact location of an address; these points were then created as a new layer. This increases the awareness of donor pockets donors are, and this makes the map more usable for SOS BC.

Further GIS analysis included the insertion of buffers around each of the key locations in one-kilometer increments ranging from 1 to 20 km away from the key locations. Buffers were chosen for this analysis as they create concentric rings around each key location, buffers function by drawing a circle with a specified radius around a chosen central point. In this case, buffers were used as a tool for a proximity analysis, allowing for the number of donors in each buffer zone to be counted. The donor layer was then clipped to these buffers to allow for the examination of the relationship between distance from a key location and the number of donors. Clipping is a GIS tool that allows the user to select only the data needed in relation to another layer in the same project, data is selected based on overlapping spatial characteristics; the resulting data is then generated as a new layer. For the SOS BC donors the clips were done in a way that allowed just the donors within each buffer to be counted. The donors that were within that layer were then counted to determine the number of donors in each distance increment from a key location.

Initial observations

There are 1314 SOS BC donors in the Lower Mainland region of BC in 103 Forward Sortation Areas (FSA). The mean number of donors is 12.25 donors per FSA with the lowest number of donors being zero in several FSAs and the highest being 123 in Richmond's V7E FSA. This FSA contains 9.84% of the donors in the Lower Mainland, while the next highest concentration of donors occurs in Richmond's V7C FSA, with 8% of the donor pool. The third highest number of donors is located in Richmond's V6Y FSA, with 5.84% of the SOS BC Donors in the Lower Mainland. Lower Mainland donors account for 82.40% of SOS BC's 1518 total donors. The cities with the highest number of donors in the Lower Mainland are Richmond with 379 donors followed by Vancouver with 312 and Surrey with 149. While this information is available in a spreadsheet, it is not effective for understanding donors' locations. These concentrations are illustrated in Figure 2.

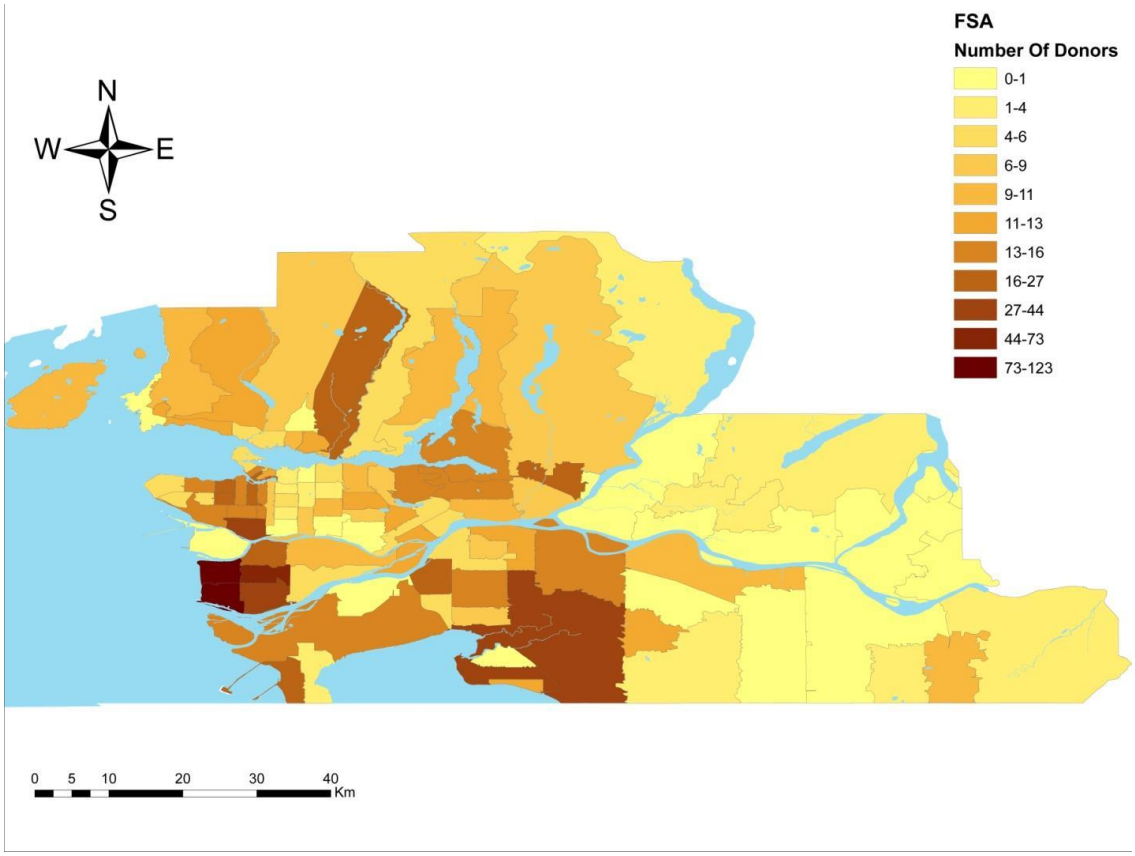

Figure 2 Choropleth maps of SOS BC donors, Dark Brown denotes the highest concentrations and the light yellow denotes no donors. This map illustrates the donor concentration by FSA.

Results

The results of the SOS BC mapping study produced several maps illustrating the donor patterns. Figure 3 shows the locations of the donors based on their street address; this type of map allows the user to examine the exact location of the donors and their proximity to other donors. While the map in figure 2 shows the concentration of donors in an FSA , the map in figure 3 shows the precise locations, which is more accurate than the FSA map for determining clusters and patterns of donors. The map in figure 2 shows a broad picture of where the donors are located but the one in figure 3 provided greater detail for in depth analysis.

Figure 3 SOS BC donor map. This map shows the locations of donors by street address. The green denotes a current donor and the red denotes a lapsed donor.

The SOS BC Donor Maps show the key locations for connecting with donors (Figure 4). These locations included the former head office near King George Highway in the Central City neighborhood of Surrey, the current head office in the Cloverdale area of Surrey, the home of G&BL (SOS BC's Founding Members), as well as the locations of past and present SOS BC Treasure cottage thrift stores. This pattern confirmed that the thrift stores are key locations for meeting potential donors. Over time, many of these customers have become SOS BC donors. The offices are also critical locations as a majority of the fundraising for SOS BC occurs there, as well as providing opportunities to have face time with potential donors. The location that does not fit the characteristics of the previous two is the home of G&BL, which is located in the densest pockets of donors. This pocket has formed because the couple is very passionate about SOS BC, and they have been actively engaging this community for many years.

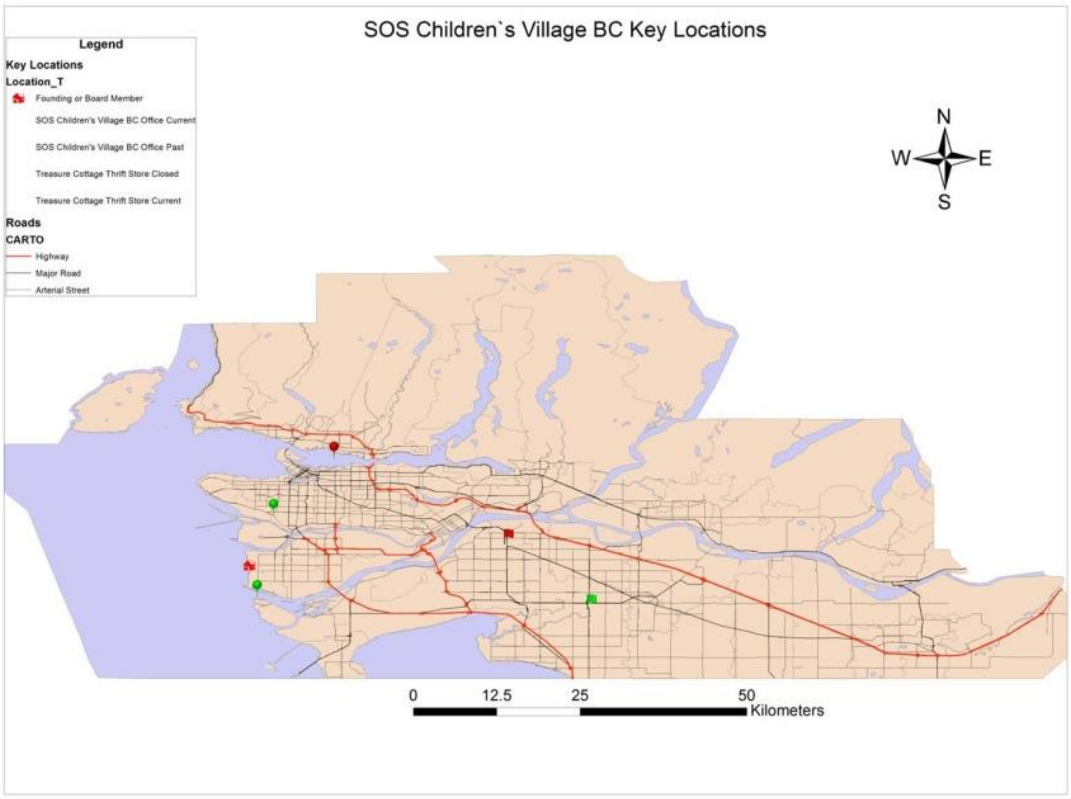

Figure 4 Stand-alone map showing key locations.

Overall, the maps show that pockets of donors have formed around areas where SOS BC has a strong and continued presence in the community. Being able to observe the exact location of donors allows for more effective fundraising.

Figure 5 examines the relationship between donors. After running several different analyses in ArcGIS, it is highly unlikely that they are randomly located. An average nearest neighbor evaluation revealed a p value of 0.00 and a z-score of -50.999170. This shows that the donors are highly clustered and that there is a less than 1% chance of them being randomly located. Using this method of analysis locations are deemed to be significantly clustered if the ratio of the observed mean distance, which in this case was 0.052724 Degrees divided, by the expected mean distance for the mean distribution, which was 0.199697 Degrees, the ratio in this case is less than 1 at 0.264021. While the average nearest neighbor measurement determines the mean distance between donors and how clustered they are, there are 2 other methods that were used to analyze the locations of the donors and their relation to each other. Next, a hot spot analysis, which calculates the relationship between data points to determine statistically significant clusters, was conducted. To obtain this information, a fish net[28] was applied

[28] Fishnets create adjacent polygons that are all of equal size, this breaks the area in to evenly spaced and distributed block

to the study area, with length and width of the squares being equal at .0125 decimal degrees this layer was created as a polygon[29]. This allowed for the donors in each area to be counted. To determine how many donors were in each area the donor layer was joined by location to the fishnet layer and the total number of the donors in each square was calculated. The Moran's I[30] calculation was done with the resulting data, it returned further evidence that the donors were highly clustered and unlikely to be random, with a z score of 354.567808 and a Moran's Index of 0.618158. Figure 5 illustrates the hot spot analysis; hotspots are used to determine where the clusters measured by the other analysis are located. The hot spot analysis works by comparing each section to the neighboring sections. To be considered a hotspot, an individual location must have a relatively high value as well as the neighboring locations. If several adjoining areas have, high z scores for this analysis they are considered be a hot spot. In the analysis of the SOS BC donor's hot spots appear around the Key Locations, and in South Surrey. There are other locations with smaller hot spots that do not have a significant impact on the donor patterns. The hot spot analysis confirms the suspected clusters by using statistical analysis. All of these analyses indicate a strong clustering and little chance of clusters being randomly located.

that do not take other data such as civic boundaries or water bodies.

[29] A polygon is a closed shape having defined edges and vertexes where all edges join at vertexes and the first and last vertex of the shape are identical.

[30] Moran's I calculates the significance of spatial autocorrelation between data points.

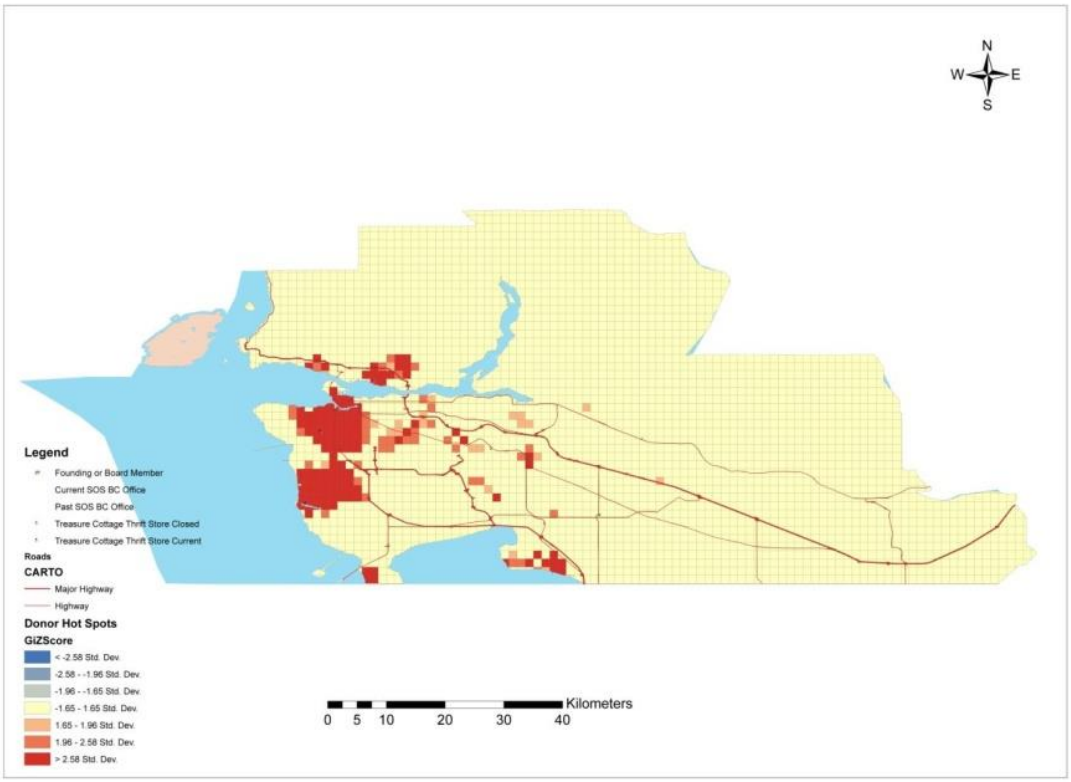

Figure 5 Hot-spot analysis, indicating high concentrations of donors around the key locations.

Table 2 summarizes the data collected from the six key locations. There is, however, a great deal of overlap between the range of influence of several key locations as is shown in Table 3, which illustrates the Euclidean or straight line distance between key locations. The exact distance between the key locations is important because it provides information about the optimal range between a key location and donors. Donor overlap is a particular concern in Richmond, which has both the home of G&BL and the Steveston thrift shop, 4 km apart. This overlap made it difficult to be certain, which key location, influenced which donors. This proximity of the 2 key locations also explains the very dense pocket of donors in Richmond. It further cements the idea that key locations are necessary for strong donor populations.

The number of donors by distance from key location is represented in figure 6 below. This does not factor in the overlaps but contains the total number of donors in that distance band. When observing the donors in 1 km increments, it has been found the SOS BC has the greatest influence within 6 km of the key locations where at this point there are more than 100 donors per square kilometer. Between 7 and 11 km there are between 60 and 80 donors , from 12-14 km there are 10-20 donors and beyond 15 km there are fewer than 10

donors. These cut off zones show where SOS BC is the most effective in reaching its donors by looking at different distances it can be determined exactly where the cut offs are.

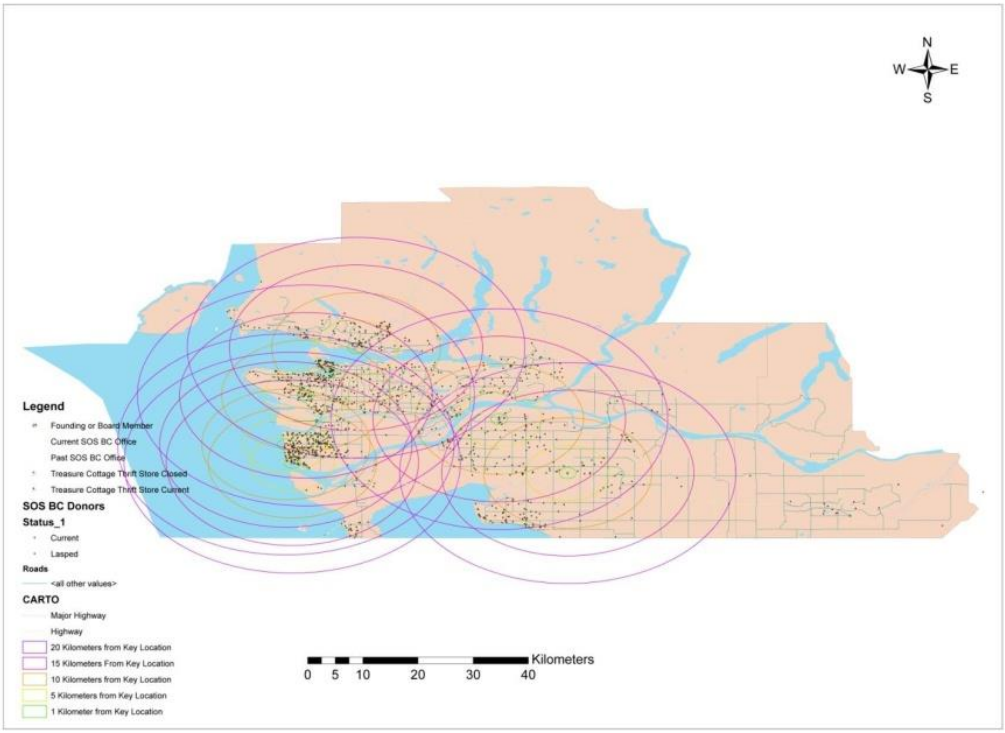

Figure 6 is a map showing donors relative to the key locations, with multiple ring buffers showing the total number of donors by distance from the key locations.

Discussion

With the increasing availability of GIS software and data, it is becoming easier for non-profits to use GIS to track their donors. Having one or more people associated with the charity trained to use and understand GIS and its outputs will allow charities to become more proactive and effective in their fundraising efforts. The ability to geocode addresses onto a street map layer allows for quick and accurate plotting of many addresses. This information can also be sorted in a variety of ways to track changing donor patterns. The data can be updated frequently, thus giving those making the decisions the ability to continuously adjust their strategies. Storing donor information in a single database also allows for more effective targeting of existing donors. This level of effectiveness in fundraising and advertising would also minimize waste by only sending the mail outs to those who are likely to participate. The maps can also be used to select locations for large SOS BC events, allowing for events to be held close to donors or, with additional data, close to specific amenities or population types.

The pocket of donors in the downtown core of Vancouver has several possible explanations. The major reason being, several of the board members live and

or work in that area and use their contacts to help bring donors to SOS BC. This cluster is represented in the hot spot analysis in figure 5. Thirdly, this pocket extends from the downtown core into Kerrisdale and the Point Grey areas of Vancouver, which are relatively wealthier compared to other parts of Vancouver and the Lower Mainland. Their average annual incomes are approximately $30,000 more than other Vancouver neighborhoods (Vancouver.com 2011).

There are very few donors in the Cloverdale and Langley areas. This is particularly the case in the area around the current SOS BC office. There are many homes in this area and SOS BC would benefit from making contact with potential donors in Surrey and Langley. This area is also critical for SOS BC because this is where it provides its services to the community. It would be expected that SOS BC would have more support in Surrey and Langley because it is an upper middle class neighborhood where many families have the financial resources to donate (City of Surrey 2008)

Table 1 shows the change in the number of donors as the distance from the key locations increase. The table shows both the overall summary calculated by a single multiple ring buffer and only counting each donor once as well as by the individual key location where donors may have been counted more than once depending on how far the individual donor is from a second key location. In looking at this it can be noted that Steveston, Kerrisdale, North Vancouver and GLBH have the most donors with in the first 5 kilometers, this is because these are the largest donor pockets. This contrasts with the Surrey and Cloverdale key locations that have most of their donor's further out. This can be explained for several reasons, mainly, both are located in commercial areas with relatively little housing in the first 3 km. These areas are also less densely populated than areas like Kerrisdale or Richmond area. The population density does affect the potential for donors, because where there are fewer people there are fewer opportunities to connect with a large donor population.

After observing the patterns of donor for SOS BC, it can be hypothesized that many non-profit organizations would have a similar pattern; in that where there are key locations there will be more donors. The use of GIS techniques and the maps that have been generated by this project can help non-profits to plan events that will help them connect better with potential donors. Another observation is that donors form concentrations around key locations, which require maps to reveal them. In addition, FSAs with high donor numbers are adjacent to each other, which is likely due to the presence of a key location nearby.

Conclusion

The information found is not going to be unique to SOS BC. Other non-profit organizations will also have patterns of where their donors are located. Mapping of the SOS BC donors has shown that there was a pattern of where the donors are located; this pattern is the one that was initially expected by the SOS BC staff. This

process could easily be repeated by other organizations, following the steps outlined in the method section. The map provides valuable information to SOS BC. Many organizations would find this information valuable because it provides a new view of their donor base. This information could be used to help to the organization become more effective in fundraising efforts as it allows for the targeting of donor campaigns for both retention and recruitment to the areas that an organization using this method feels needs attention.

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Appendix

Abbreviations used in Tables

Location / term	Abbreviation
GLB Home	GLBH
Steveston Treasure Cottage Thrift Store	STC
North Van Treasure cottage Thrift Store	NVTC
Kerrisdale Treasure Cottage Thrift Store	KTC
Cloverdale Office	CO
Surrey Office	SO
Increase	Incr.

Distance From Key Locations (km)	For All Key Locations, Combined (# of donors)	GLBH (# of donors)	Cloverdale Office (# of donors)	Steveston Thrift Shop (# of donors)	Kerrisdale Shop (# of donors)	North Vancouver Thrift Shop (# of donors)	Surrey Office (# of donors)
1	100	24	1	34	20	10	11
2	138	56	5	51	23	13	1
3	109	74	10	55	36	9	4
4	173	80	3	52	76	27	11
5	173	79	5	47	40	55	15
6	156	34	17	86	48	65	27
7	77	15	16	35	56	54	24
8	63	27	11	9	80	53	31
9	79	33	22	14	81	34	36
10	72	32	29	20	84	51	34
11	64	34	28	15	90	57	34
12	16	38	23	17	94	43	19
13	22	66	32	44	60	29	23
14	19	43	15	37	38	25	22
15	9	36	9	43	24	30	32
20	3	47	23	21	12	82	49

(Table 1) Table 1 shows the link between key locations and donors. The distances in 1 km increments and the number of donors within the specified distance are shown. The best measurement taken from this table is the increase in the donors.

Distance (KM)	Average number of donors	Max donors	Min donors	Area km^2 affected per location	Total donors
1	10.83	21.00	1.00	3.1415	65
2	30.83	68.00	5.00	12.566	185
3	55.50	119.00	6.00	28.2735	333
4	81.67	164.00	15.00	50.264	490
5	109.50	201.00	17.00	78.5375	657
6	141.33	253.00	23.00	113.094	848
7	176.17	289.00	31.00	153.9335	1057
8	220.00	340.00	39.00	201.056	1320
9	256.33	396.00	59.00	254.4615	1538
10	295.00	492.00	71.00	314.15	1770
11	331.67	569.00	87.00	380.1215	1990
12	369.50	644.00	114.00	452.376	2217
13	405.50	704.00	135.00	530.9135	2433
14	436.83	741.00	148.00	615.734	2621
15	459.50	762.00	162.00	706.8375	2757

20	609.33	869.00	249.00	1256.6	3656

(Table 2) Table 2 Summarizes the data in Table 1.it shows the average, maximum, and minimum amount of donors. It also shows the area affected by each key location in terms of kilometers squared and the average number of donors per square kilometer.

Distance Between Key Locations (km)	GLBH	STC	KTC	SO	CO	NVTC
GLBH	0.00	4.00	10.13	39.31	51.56	21.88
STC	4.00	0.00	13.00	38.69	50.01	24.69
KTC	10.13	13.00	0.00	35.51	49.40	36.11
SO	39.31	38.69	35.51	0.00	16.35	28.89
CO	51.56	50.01	49.40	16.35	0.00	45.03
NVTC	21.88	24.69	36.11	28.89	45.03	0.00

(Table 3) Table 3 shows the distance between key locations

The role of hydrologic fluxes in the monthly water balance and water chemistry of a small coastal headwater lake

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Abstract: *Small coastal lakes in the Pacific Northwest represent an important wildlife habitat as well as provide recreational and water resource opportunities for local communities. However, few water balance studies have been conducted in small lakes and this lack of data has implications for ecosystem, lake and fish management. The purpose of this study was to evaluate the monthly water balance of a small (~7.87 ha) shallow (max depth ~7 m) coastal headwater lake, and determine the influence of hydrologic fluxes on lake water quality. Hydrologic and water quality data were collected during ice-free periods in 2010. Hydrologic inputs and outputs were measured and net groundwater flow was determined as the residual of the water balance. Although the lake was situated in compact glacial till, net groundwater flow was negative for all months, indicating net groundwater outflow from the lake, accounting for at least 23-95% of the monthly outflow. Surface runoff was the dominant input to the lake but showed strong seasonal variation. The general water chemistry of Rice Lake may be described as acidic, reasonably well oxygenated and chemically dilute. This can be attributed to high annual precipitation and the hydrogeologic setting and landscape position of the lake. Smaller seasonal variations in water chemistry are controlled primarily by hydrologic and chemical differences in surface water inflow and seasonal variation of precipitation. Lake classification and management issues arising from the results are discussed.*

Introduction

Lakes in coastal regions of the Pacific Northwest represent an important habitat that supports various amphibians, birds and mammals (Stevens 1995) in addition to native and stocked fish (Bahls 1992). However, small lakes are also used for recreation (e.g. Eilers et al. 1996) or as reservoirs (e.g. Kahrer 1989) and hence are under increasing pressure from ecosystem and resource demands to remain in natural or pristine states (Eilers et al. 1996). There is renewed interest in the acidification of lakes and forest soil in the Georgia Basin, the land and water between and including southern Vancouver Island and the mainland coast (British Columbia and Washington state), as emissions of sulfur and nitrogen are predicted to increase (Mongeon et al. 2010; Strang et al. 2010). This is particularly important in the Pacific Northwest where both large and small lakes are naturally dilute (e.g. Efford 1967; Newell and Bernert 1996) and therefore susceptible to acidification (Eilers et al. 1996; Clow et al. 2003).

Despite extensive and/or long term studies of lake water quality in

southwestern BC (e.g. Phippen et al. 1996; Strang et al. 2010) and northwestern US (e.g. Gorham et al. 1983; Eilers et al. 1996; Clow et al. 2003), there have been few detailed water balance studies of small headwater lakes in the Pacific Northwest (see reviews in Born et al. 1979; Winter and Woo 1990; Newell and Bernert 1996). This is not surprising as access to and instrumentation of small, remote or high elevation lakes to measure hydrologic fluxes may be costly or difficult (Clow et al. 2003). However, this lack of information hinders ecological planning, management practices or remediation of lakes (Born et al. 1979). As well, hydrologic parameters such as residence time, which is important to understanding chemical or nutrient fluxes and trophic status (Dillon 1978), may range from days (Efford 1967) to years (Eilers et al. 1996) in small lakes. Determination of a water balance is an essential first step to better understanding the hydrology and chemistry of small coastal headwater lakes as well as predicting nutrient or chemical loadings and pathways.

One crucial component of the water balance of coastal headwater lakes that requires further study is the relative importance of groundwater. Roy and Hayashi (2008) suggested a continuum of groundwater-lake interaction from low (in impermeable bedrock) to high (in permeable sediments). While this framework is useful, the hydraulic conductivity of geologic units such as glacial till, common in Canada and northern US (Born et al. 1979), can range over six orders of magnitude (Freeze and Cherry 1979). This, combined with the general complexity of groundwater flow in glacial terrain (Winter 1999), makes predicting groundwater-lake interaction in glacial till difficult. For example, some studies of lakes in glacial till have shown groundwater to be an important component of the water balance (Winter 1999), while other studies have shown the opposite (Born et al. 1979).

Given the general lack of data, a greater understanding of hydrologic fluxes to and from small coastal headwater lakes is needed. Therefore the purpose of this study is to (a) evaluate the monthly water balance of Rice Lake and (b) determine how hydrologic fluxes influence basic lake water quality parameters (temperature, pH, electrical conductivity, dissolved oxygen). Results from this study will not only improve our knowledge of lake-groundwater interaction in coastal headwater lakes but may also be useful in the management of lakes or fish populations.

Methods

Study site

The study was conducted at Rice Lake (49° 21’ N, 123° 0’ W), located 4 km northeast of North Vancouver, BC in Seymour Valley (Figure 1). Rice Lake was originally much smaller but large earthen dams, likely constructed when the lake was used to store logs and later as a reservoir (Kahrer 1989), block outflow at the north and south ends of the lake. The lake has an average depth of 2.3 m (max depth of ~7 m), a surface area of ~7.87 ha and a volume of ~214 000 m^3. Surface

outflow occurs in winter and spring when lake stage exceeds ~201 m asl and ice typically covers the lake between December and March. Since 1990, Rice Lake has been stocked with catchable rainbow trout (*Oncorhynchus mykiss*) several times each year, typically in spring and autumn (BCMoE 2011). In recent years about 9000 fish have been added annually. The area is a popular location for hiking and fishing but boating and swimming are prohibited

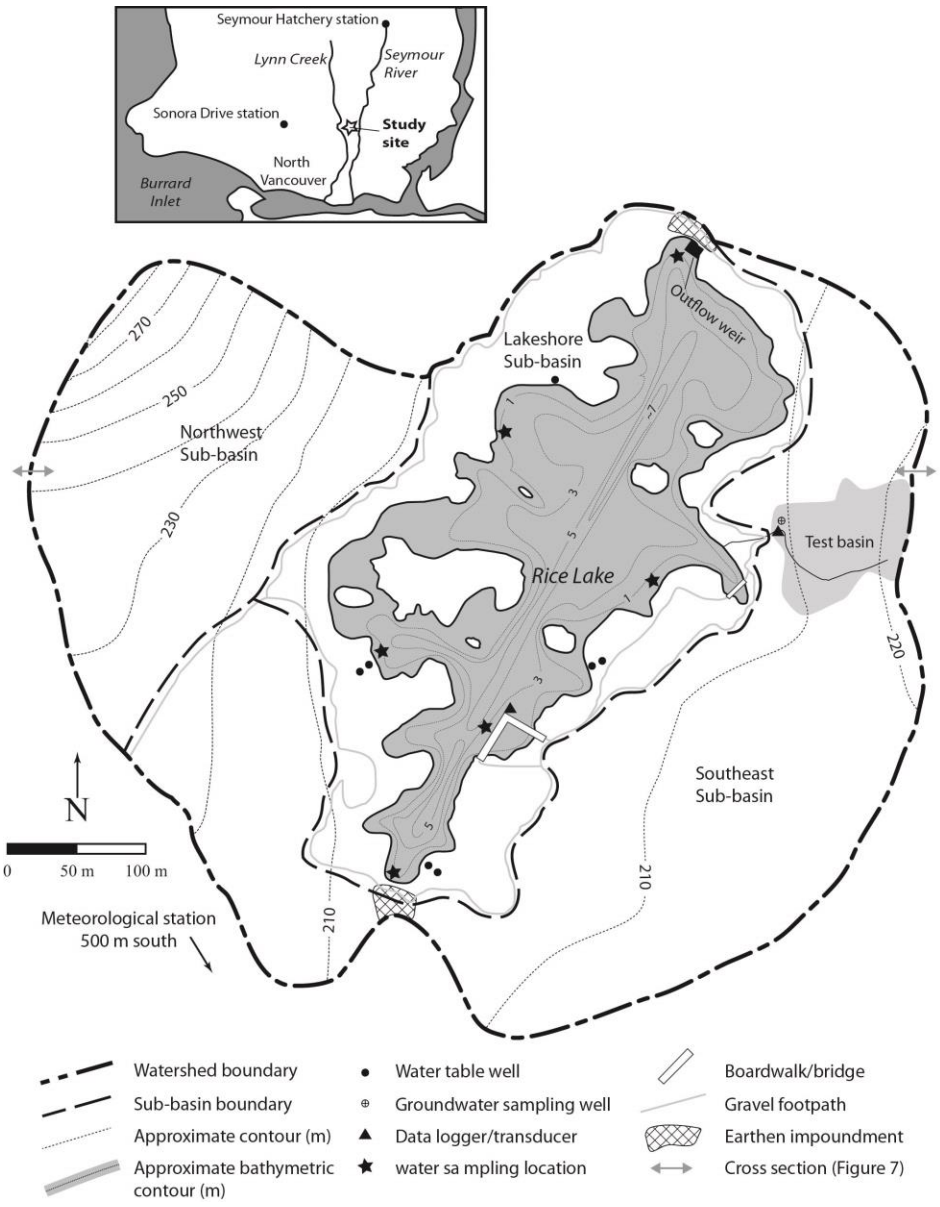

Figure 1. Map of Rice Lake watershed with inset showing site location.

The Rice Lake watershed is 25.8 ha (see Methods, Surface inflow) and is situated on a saddle-shaped ridge between Lynn Creek to the west and Seymour River to the east (Figure 7). With elevations ranging from 200 to 280 m above sea level, the

watershed is located in the Coastal Western Hemlock (CWH) biogeoclimatic zone (dry maritime subzone) based on the Biogeoclimatic Ecosystem Classification system (Green and Klinka 1994). This zone is characterized by western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*) and Douglas fir (*Pseudotsuga menziesii*). The forest is second growth and larger trees are up to 120 years old. Average annual precipitation and temperature measured at Seymour Hatchery (1981-2010), 9.5 km north of and at a similar elevation to the study site (210 m), is 3735 mm and 9.1 °C, respectively (Environment Canada 2014a).

The terrain of the watershed is hummocky with depressions between raised mounds which are up to 3 m high. Conifers and shrubs typically grow on the raised mounds while forested swamps, with abundant skunk cabbage (*Lysichiton americanus*), are common in larger depressions (MacKenzie and Moran 2004). Modifications to the watershed have included the addition of metal culverts under extensive gravel footpaths which allow small ephemeral creeks to flow through the depressions/swamps before entering Rice Lake. These modifications have resulted in surface runoff draining away from the lake north of the present watershed.

Soils are typically sandy podzols up to about 1.5 m deep. Surficial sediment consists of a thin mantle (< 2 m deep) of ablation till, alluvial fan or debris flow deposits (Lian and Hickin 1993; 1996). The hydraulic conductivity of the upper 80 cm of soil/sediment in the northeast corner of the watershed was determined to be 1.1 x 10^{-5} m s^{-1} (geometric mean; range: 6.2 x 10^{-6} to 2.9 x 10^{-5} m s^{-1}) (Martin 2011; unpublished data). Compact glacial (Vashon) till up to about 20 m thick, composed of a matrix of sand, silt and clay surrounding large boulders, underlies the soil and loose surficial sediment (Lian and Hickin 1993). Utting (1978) determined the hydraulic conductivity of compact Vashon till to be 4 x 10^{-7} m s^{-1} (geometric mean; range: 1 x 10^{-7} to 1 x 10^{-6} m s^{-1}). The till is underlain by glaciolacustrine sediment which overlies thick sequences of older Quaternary glacial deposits (Lian and Hickin 1993). Bedrock geology of the lower reaches of Seymour River and Lynn Creek is primarily medium to course-grained granite, diorite and granodiorite (Roddick 1984). Bedrock outcrops are common at higher elevations in the western portion of the Rice Lake watershed and depth to bedrock likely increases eastward across the watershed toward Seymour River (Lian and Hickin 1993).

Monthly water balance

The monthly (April - Nov 2010) water balance for a lake may be written as:

$$\Delta S = P + R_{in} + GW_{in} - R_{out} - E - GW_{out} \quad (1)$$

where ΔS is net lake storage, P is precipitation falling directly on the lake, R_{in} is surface runoff into the lake, GW_{in} is groundwater inflow, R_{out} is surface outflow from the lake, E is evaporation, and GW_{out} is groundwater outflow. Groundwater

fluxes were not measured directly in this study but net groundwater flow was calculated as the residual by combining terms ($\Delta GW = GW_{in} - GW_{out}$) and solving equation 1 as:

$$\Delta GW = \Delta S - P - R_{in} + R_{out} + E \quad (2)$$

where all terms are as defined above. A positive ΔGW value indicates net inflow to the lake and a negative value indicates net outflow from the lake. All terms are reported in millimeters to facilitate comparison with meteorological fluxes and other water balance studies. The percent error of each component on the right hand side of Eq. (2) was estimated to determine the accumulated error in ΔGW. Errors in measured components (e.g. precipitation) were based on values provided in the literature (e.g. Winter 1981) while errors in calculated components (e.g. storage) were based on the estimated uncertainty in derived equations (e.g. lake stage-volume). Errors in calculated components, including the absolute error in monthly ΔGW, were determined using the general method of error propagation outlined in Lee and Swancar (1997). Residence times were calculated as average lake volume for the month divided by the sum of monthly outflows which included evaporation, net groundwater flow (if negative) and surface outflow.

The rain gauge and data loggers (noted below) recorded data during ice-free conditions to avoid damage from ice buildup which typically occurs in the lake and nearby creeks between December and March. Therefore, the water balance is calculated from April through November.

Meteorological data

A meteorological station was installed in a clearing 500 m south of Rice Lake to measure precipitation and temperature (Figure 1). Precipitation (P, mm) was measured using an unshielded Novalynx recording tipping bucket rain gauge (0.25 mm per tip) placed one meter above the ground. An error of 10% was assumed for monthly precipitation (Winter 1981). Due to technical problems with the rain gauge, precipitation for April and May was estimated by averaging precipitation from two nearby Environment Canada stations at similar elevations to the study site (see inset Figure 1): Seymour Hatchery (elevation 210 m, 9.5 km north of Rice Lake) and Sonora Drive (elevation 183 m, 6 km west of Rice Lake). The mean percent difference in monthly precipitation between the Rice Lake meteorological station and the average of the two stations for June through November was 27.5%. Therefore, an error of 27.5% was assumed for April and May.

Given budgetary constraints of the study and open public access to the watershed it was not feasible to set up instruments to measure evaporation at Rice Lake. Therefore, the Hamon equation (Xu and Singh 2001), which requires only average daily air temperature and latitude (which is used to calculate daylight hours) was used to estimate evaporation from the lake. The Hamon equation has been shown to produce reasonable estimates of monthly evaporation from small lakes

compared to other, more accurate but data intensive, methods (Winter et al. 1995; Rosenberry et al. 2007). The Hamon equation may underestimate evaporation early in the year and overestimate evaporation later in the year (e.g. Rosenberry et al. 2007) likely because it does not account for energy stored and released from lakes. However, temperature data and estimates of energy storage at Rice Lake indicate this effect is likely minor and generally within the estimated percentage error noted below as evaporation from small lakes is controlled primarily by daily energy input (Schertzer 1997). Temperature was measured every 30 minutes using an Onset sensor and data logger (model U23-001 with shield) located one meter above ground at the meteorological station and daily rates of evaporation were calculated and summed to get monthly totals (E, mm). From a comparative study of 11 evaporation equations, including the Hamon equation, in a small mountain lake (Rosenberry et al. 2007), an error of 30% was assumed for monthly evaporation. Daylight hours were calculated assuming a flat surface so the shading of Rice Lake by local mountains likely causes less actual evaporation to occur resulting in slight overestimates of monthly evaporation.

Lake storage

Lake stage was measured using a Global Water 16L data logger, placed inside a 5 cm ID PVC stilling well. The logger recorded lake stage every 30 minutes. Stage-volume and stage-area relationships were derived using a bathymetric map of Rice Lake (scale 1:1000; contour interval 1 m) from Knighton (1989). Areas were measured using a Placom digital planimeter. Lake storage (ΔS, mm) was calculated as the difference in volume on the first and last day of the month divided by the average area of the lake for the month determined using the average monthly stage and stage-area relationship (Sacks et al. 1998). The root-mean-squared error (RMSE) normalized to the mean of the stage-volume and stage-area relationships was 2% and 3% respectively, resulting in an estimated error of 4%. However, an additional 5% was added to account for the interpolation of contours from the original bathymetric survey by Knighton (1989) yielding a total estimated error of 9% for ΔS.

Surface inflow

At least 18 ephemeral creeks flow into Rice Lake and field observations during rainstorms indicated that unchannelized flow did not occur over the forest soil but did occur over the compact gravel trails. Therefore, standard stream gauging techniques were inappropriate for assessing surface inflow. To address these issues, a monthly runoff coefficient was determined for a small inflowing creek and test basin and applied to the Rice Lake watershed (Figure 1). To account for differences in surface runoff characteristics around the lake, the watershed was divided into three smaller sub-basins (labeled lakeshore, northwest and southeast) and a modified runoff coefficient was calculated for each sub-basin. The test basin and the three sub-basins are briefly described below.

The test basin, located the northeast corner of the Rice Lake watershed, is 0.720 ha in area and the drainage divide was surveyed using a Trimble (Jumbo SC) GPS. A pressure transducer and data logger (Global Water WL16), programmed to record water level every 30 minutes, were installed in the creek upstream of a small metal culvert that channels flow under a gravel footpath. The outflow on the downstream side of the culvert was measured using a graduated pitcher and stopwatch and a stage-discharge rating curve was derived (n = 17) to convert water level to discharge. The monthly runoff coefficient (C_t) was determined as:

$$C_t = R_t / (P A_t) \quad (3)$$

where R_t is the total volume of water discharged in a given month, P is the monthly precipitation falling on the test basin as recorded at the meteorological station and A_t is the area of the test basin. The RMSE of the rating curve was 16.6% of average flow, the error in precipitation was 10 or 27.5% (as noted above) and the error in basin area was assumed to be 10%. For a more detailed description of the test basin see Martin (2011).

The three sub-basins were delineated using a 1:3750 map (contour interval 5 m) and checked against aerial photos and field reconnaissance. Areas were measured using a Placom digital planimeter and the error was assumed to be 10%. The southeast sub-basin is forested with an average slope of 2%. The total area of this basin is 12.3 ha (48% of the total Rice Lake watershed) which includes the test basin and 0.5 ha of islands. Due to similarities in slope, micro topography and geology based on field observations, the monthly runoff coefficient for the southeast sub-basin (C_{SE}) was assumed to be equal that of the test basin. The lakeshore sub-basin is 5.5 ha (21% of the total Rice Lake watershed) and has similar characteristics to the SE sub-basin but with an extensive network of compact gravel trails, ~2.5 m wide, that cover just over 10% of the lakeshore sub-basin. The monthly runoff coefficient for the lakeshore sub-basin (C_{LS}) was calculated using a weighted average assuming the trails (10% of the sub-basin) had a runoff coefficient of 0.75 (Obedkoff 1988) and the remainder of the sub-basin (90%) had a runoff coefficient similar to that of the test basin. If the monthly runoff coefficient of the test basin was greater than 0.75, this higher value was used as the runoff coefficient for the lakeshore basin. The northwest sub-basin is 8.1 ha (31% of the total Rice Lake watershed) with one large swamp, an average slope of ~24%, and exposed bedrock outcrops at higher elevations. The monthly runoff coefficient for the NW basin (C_{NW}) was assumed to be 30% higher than that of the test basin based on spot measurements of discharge and runoff coefficients provided by Obedkoff (1988).

Monthly runoff from each sub-basin (R_i) was then determined as:

$$R_i = C_i P A_i / A_L \quad (4)$$

Where C_i is the runoff coefficient for a given sub-basin (calculated using equation 3 and modified for each sub basin), P is the precipitation recorded

at the meteorological station, A_i is the area of the given sub-basin and A_L is the average area of the lake for the given month (see lake storage). Total monthly runoff into Rice Lake (R_{in}) was calculated as the sum of runoff from the three sub-basins. The error in P and A_L is noted above but an additional 10% error was assumed for extrapolating the runoff coefficient from the smaller test basin to the larger sub-basins. Combining equations 3 and 4 and using the method of error propagation outlined by Lee and Swancar (1997), the total error in R_{in} was estimated to be 28%.

Surface outflow

Surface outflow occurs when lake stage exceeds ~201 m asl through an artificial drain at the north end of Rice Lake which routes water to Seymour River through an underground pipe. Discharge into the drain is over a broad-crested rectangular concrete weir and was calculated using formulae outlined by Bos (1989). Lake stage was used to determine crest height and discharge over the outflow weir was calculated every 30 minutes and summed to get the total volume of outflow during a given month. This value was then divided by the average area of the lake for the given month (see lake storage) to determine the depth of runoff. Discharge over the weir calculated using the formulae was checked against a current meter measurement on one occasion and was within 8% of the calculated value and an error of 8% was assumed for discharge over the weir (Winter 1981). This, combined with the estimated error in lake area (3%), results in a total error of 8% for surface outflow.

Physical and chemical sampling

Installation of shallow water table wells began in mid-August to monitor hydraulic gradients around Rice Lake and the wells were placed to avoid popular public sites for fishing (Figure 1). The wells, designed to be small and unobtrusive, were made from 2.5 cm ID PVC pipe, slotted over the entire length and covered with nylon mesh. Wells were installed to depths up to one meter using a hand auger and water level was measured weekly using a dip meter. The hydraulic gradient was measured between two adjacent wells in a transect or between a well and lake stage where only one well was present. The wells were inundated when lake level increased late October. Therefore, hydraulic gradient measurements are limited to late August through October.

Basic water quality parameters (pH, electrical conductivity (EC), dissolved oxygen (DO) and water temperature) commonly used to assess lakes for fish habitat (e.g. Juteau and Lunn 2006), were measured to track chemical changes in hydrologic fluxes and lake water. Lake, creek and groundwater samples were collected for chemical analysis weekly, or when water was present in the creek or groundwater well, at about the same time each week, between 1100 and 1400. A larger water table well (5 cm ID) was used to collect shallow groundwater samples because the smaller wells (2.5 cm ID) typically did not provide enough water for chemical sampling. The larger well was purged before sampling to remove stagnant water and capped

when not in use. Surface lake water samples were collected at six sites around the lake. Creek water flowing from the test basin into Rice Lake was collected at the downstream end of the culvert. Precipitation was collected and analyzed, whenever a rain event of about 20 mm or more occurred, from a storage gauge located in a clearing 3 km south of the study site. All samples collected were measured in the field using a Symphony multimeter (model VWR SP90M5) which measured pH, EC, DO and water temperature. The meter was calibrated weekly or before going into the field and EC was automatically standardized to 25°C.

Results

Hydrologic fluxes and monthly water balance

Meteorological data and climate normals from Seymour Hatchery weather station indicated that, overall, 2010 was warmer (+0.47 °C) and drier (527 mm less precipitation) compared to the 1981-2010 normals (Environment Canada 2014a; 2014b) and this was most evident in summer months. For example, 1 mm of precipitation was recorded in July 2010 at Seymour Hatchery compared to the 1981-2010 average of 101 mm. Atmospheric and hydrologic data from Rice Lake in 2010 are shown in Figure 2 and monthly water balance totals are summarized in Table 1 and shown in Figure 3.

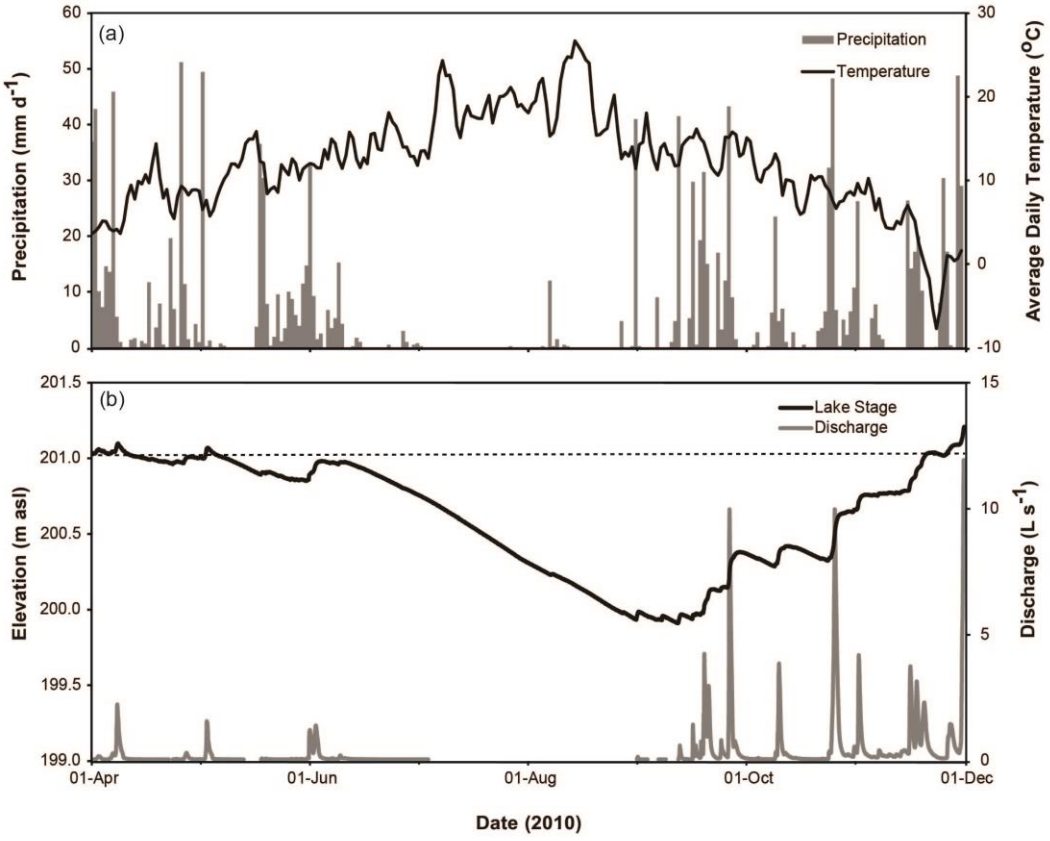

Figure 2. Atmospheric and hydrologic data: (a) Air temperature and precipitation and (b) lake stage and discharge from the test basin into Rice Lake. The horizontal dashed line indicates lake stage at which surface outflow from Rice Lake occurs.

Table 1: Rice Lake monthly water balance for ice-free periods in 2010. Average net groundwater flux (ΔGW) for the study period was -340 mm mon^{-1} (sd 160 mm mon^{-1}).

Month time	P[a]	R_{in}[b]	E[c]	R_{out}[d]	ΔS[e]	ΔGW[f]	Error ΔGW	Residence
					(all in mm)			(months)
Apr	284.6	179	43	326	-32	-126	97	6.0
May	202.3	134	68	95	-102	-275	71	6.5
Jun	89.5	176	88	0	-128	-305	57	7.2
Jul	1.5	6	115	0	-434	-327	39	6.1
Aug	60.8	6	102	0	-315	-280	34	6.7
Sep	243.8	748	53	0	383	-556	212	4.1

Oct	174.3	754	31	0	292	-605	212	4.2
Nov	264.8	1034	15	520	519	-245	294	3.6

[a] Precipitation - error 27.5% Apr and May; 10% Jun through Nov
[b] Runoff into Rice Lake - error 28%
[c] Evaporation - error 30%
[d] Runoff from Rice Lake - error 8%
[e] Lake storage - error 9%
[f] Net groundwater flow - calculated error shown in table

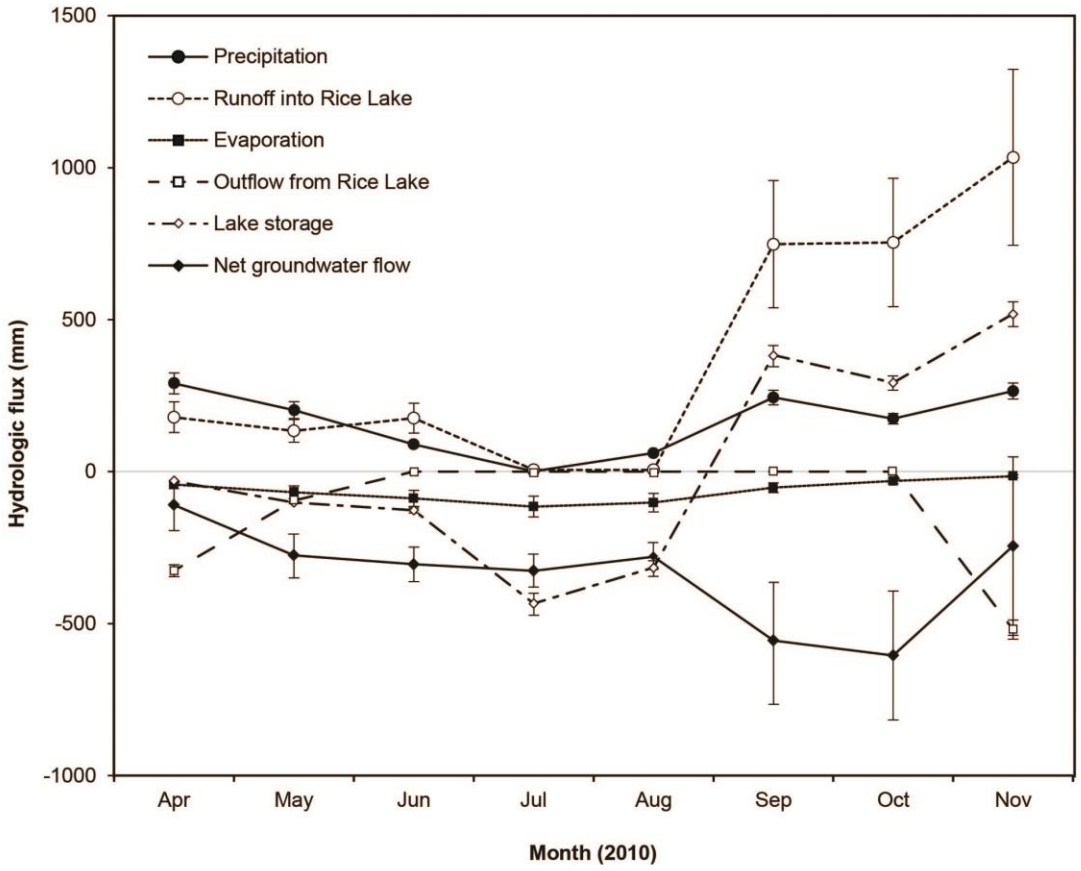

Figure 3. Monthly hydrologic fluxes with the calculated or estimated error in each term shown as error bars. Note that for some months error bars are smaller than the polygon symbol representing hydrologic flux.

Precipitation at Rice Lake was highest (> 200 mm mon^{-1}) in spring (April, May) and autumn (September, October, November) and lowest (< 90 mm mon^{-1}) during summer (June, July, August), with July recording only 1.5 mm of rain. Lake evaporation ranged from 15 mm mon^{-1} in autumn to over 100 mm mon^{-1} in summer. The gauged creek draining the test basin flowed

continuously into the lake for most of the year but dried up for extended periods (up to 28 days) in summer and responded only during intense rainstorms. Other creeks in the watershed showed a similar pattern when inspected throughout summer. Runoff into Rice Lake was highest in fall (> 700 mm mon^{-1}) and lowest in late summer (~6 mm mon^{-1}). Although lake stage generally declined throughout spring, it occasionally increased above the outlet weir during storms, resulting in surface outflow from Rice Lake in both April and May. The entire outflow of May occurred in the first eight days of the month and thereafter, lake stage remained below the outlet weir (i.e. surface outflow = 0) until November. Rice Lake reached its lowest level in early autumn and lake stage began to increase rapidly after prolonged and/or intense rainstorms. In some cases, lake stage increased by up to 300 mm d^{-1} following particularly large storms and runoff from the lake resumed in early November. Monthly lake storage changed from negative to positive in autumn and generally tracked precipitation and runoff.

Net groundwater flux and residence time

The residual net groundwater flux (ΔGW) was negative for all months of the study (average -340 mm mon^{-1}; Table 1 and Figure 3) indicating groundwater outflow was greater than groundwater inflow. Note that values for ΔGW represent minimum estimates of groundwater outflow because only net groundwater flow was determined from the water balance and groundwater outflow may be higher than net values reported but separate groundwater fluxes to and from the lake could not be determined from the monthly water balance data. Absolute errors in ΔGW were highest in autumn when surface runoff to the lake, which had a high relative error (28%) compared to other water balance terms, was also the dominant component of the water balance.

Groundwater outflow represents at least 22 to 95% of total monthly outflow (evaporation, surface runoff, groundwater outflow) from Rice Lake and can be divided into two hydrologic regimes (Figure 3). Groundwater outflow is the dominant flux of water from the lake (average 79% of total outflow) in late spring through early autumn (May to October) when surface outflow is minimal or zero (average 4%). Evaporation accounts for the remainder (average 17%). In April and November groundwater outflow (average 27% of total outflow) ranks second behind surface outflow (average 67%) in terms of water flux from the lake. Evaporation accounts for the remainder (average 6%).

The average residence time was 5.5 months and ranged from 3.6 to 7.2 months. In other words, the volume of Rice Lake will be flushed between one to three times per year. Note that residence times reported here are overestimates because, as noted above, only net groundwater flow was calculated from the water balance and this value was assumed to be equal to groundwater outflow from the lake. Residence times tended to be higher in summer when surface outflow, usually the dominate flux from the lake, was zero.

Hydraulic gradient

Horizontal hydraulic gradients around Rice Lake ranged from -0.142 to +0.262, where a negative number indicates groundwater outflow, and a positive number indicates groundwater inflow to the lake. Although the average hydraulic gradient was essentially zero, a majority of the measurements (80%), indicated groundwater outflow which is consistent with the negative groundwater flux calculated using the monthly water balance. However, during some rainstorms the water table would rise quickly relative to lake stage and hydraulic gradients would temporarily reverse resulting in groundwater inflow to Rice Lake (Figure 4). Overall, hydraulic gradients during periods of groundwater inflow were higher (average 0.127), but occurred less frequently compared to hydraulic gradients during periods of groundwater outflow which were lower (average -0.030) but occurred more frequently.

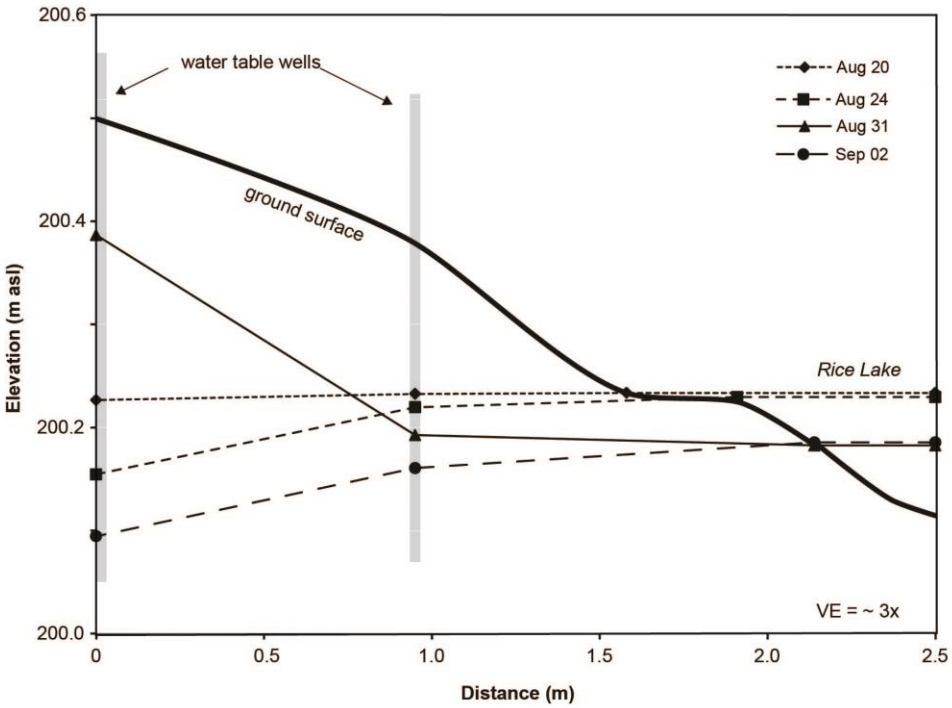

Figure 2. Example of water table elevation reversal from Aug 20 to Sep 2. The two wells (installed in the loose surficial sediment) are located on the eastern lakeshore (Figure 1). The amount of precipitation on Aug 31 was 41 mm.

With this data and hydraulic conductivity values from Martin (2011) and Uttig (1978), a crude estimate of horizontal groundwater flow into Rice Lake may be calculated using Darcy's Law. Assuming an average hydraulic gradient of 0.127 toward the lake, K_{sat} of 1.1 x 10^{-5} m s^{-1} for the upper 2 m of soil/sediment and 4 x 10^{-7} m s^{-1} for the lower 5 meters of till and that inflow occurs around the

entire perimeter of the lake (1950 m) to a depth of ~7 m, groundwater could contribute 228 mm mon^{-1} (over an area of 6.92 ha) to Rice Lake. However, hydraulic gradient measurements indicated groundwater inflow occurred only 20% of the time during September (when the bulk of these measurements were made) which corresponds to 46 mm mon^{-1} of groundwater inflow. As September had high precipitation (243 mm) and groundwater inflow tends to occur during rainstorms, months with rainfall > 200 mm may have a similar order of magnitude in groundwater inflow, while summer months with limited rainfall (e.g. July with only 1.5 mm) will likely have little if any groundwater inflow.

Using similar reasoning and parameters for Darcy's Law noted above, but with a hydraulic gradient of -0.030, horizontal groundwater outflow from Rice Lake in September was estimated to be -54 mm mon^{-1}. However, hydraulic gradients indicated outflow occurred 80% of the time which corresponds to -44 mm mon^{-1}. This is 13% of the average net groundwater flux (-340 mm mon^{-1}) determine as the monthly water balance residual (Table 1) likely because vertical fluxes from Rice Lake (which were not accounted for as the wells measured only horizontal gradients) are greater than horizontal fluxes from Rice Lake (see discussion).

Water balance accuracy

Uncertainty in water balance studies is an inherent problem particularly when calculating a component as the residual from the water balance equation (Winter 1981). Although errors were calculated or estimated for each component, a "short term" water balance over a smaller time interval was used to estimate groundwater outflow and assess the accuracy of the water balance. Three extended dry periods, greater than 7 days (Jul 5 to 26, Jul 28 to Aug 4 and Aug 13 to 26) occurred during 2010 where precipitation (P), runoff into (R_{in}) and out of Rice Lake (R_{out}) were zero based on field data. Hydraulic gradients indicated that groundwater inflow (GW_{in}) typically occurs during rainstorms and can also be assumed to equal zero during these dry periods. Therefore, Equation 1 reduces to $\Delta S = E + GW_{out}$ where GW_{out} can be determined as the residual (with fewer terms and errors relative to Equation 1) and compared to ΔS (Figure 5). There was no significant relationship between ΔS and GW_{out} (R^2 =0.0028; Spearman's rank correlation $r_s = 0.059$, $p > 0.10$), likely due to the relatively small range in lake stage (less than 0.8 m) and errors in daily evaporation (>30%).

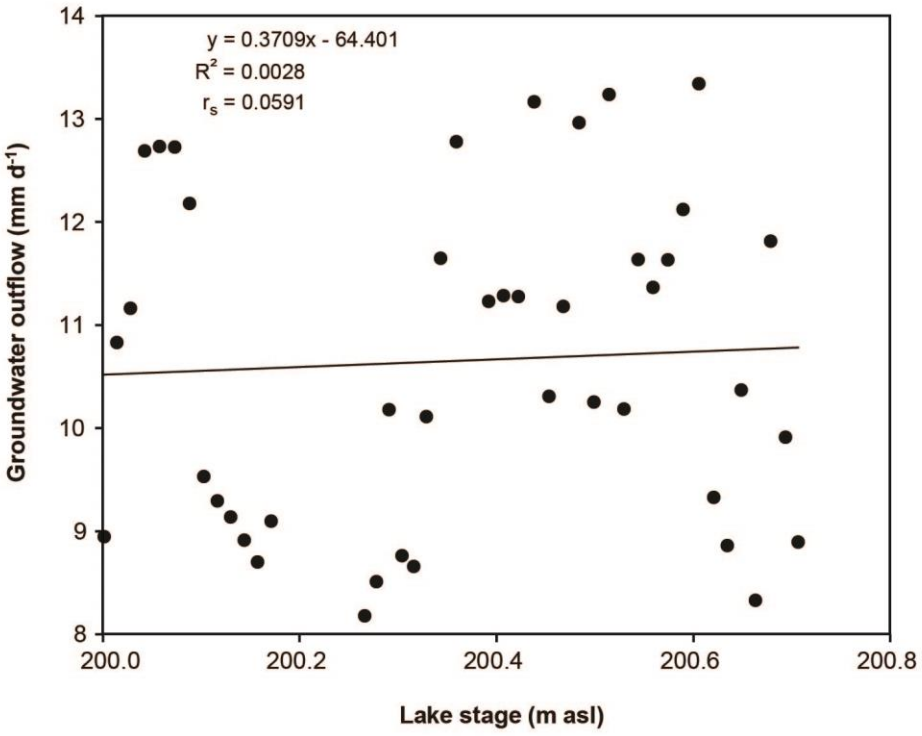

Figure 3. Lake stage vs. daily groundwater outflow calculated using a short term water balance during dry periods. Linear regression equation, coefficient of determination (R2) and Spearman's rank correlation coefficient (rs) shown.

The average daily groundwater outflow determined using the short term water balance was -10.7 mm d^{-1} (range -8.2 to -13.3 mm d^{-1}) which corresponds to an average outflow rate of -320 mm mon^{-1} (range -245 to -400 mm mon^{-1}) or a net groundwater flux of -320 mm mon^{-1} for months with no groundwater inflow. This value, combined with the estimated monthly groundwater inflow determined using hydraulic gradients (+46 mm), yields an average net groundwater flux of (-320 + 46 =) -274 mm mon^{-1} for months with groundwater inflow. These values (-320 and -274 mm mon^{-1}) are similar to the average net groundwater flux (-340 mm mon^{-1}) determine as the monthly water balance residual (Table 1), suggesting that these are reasonable estimates of groundwater flow.

Water chemistry

Water chemistry and temperature profiles from the present study (not shown) and from Juteau and Lunn (2006) indicate that Rice Lake is fairly well mixed (i.e. polymictic) during ice-free conditions with minimal differences between parameters at the surface and at depth (e.g. Temp < 1°C; pH < 0.5 pH units; EC < 1 µS cm^{-1}; DO < 2 mg l^{-1}). This is typical of small shallow lakes in the mid latitude (Lewis 1983). Therefore, the average values of surface water measurements from the six sample stations around

Rice Lake were used to quantify weekly and seasonal changes in lake chemistry (average standard deviation from the six sample stations: Temp = 0.86 °C; pH = 0.21 pH units; EC = 0.87 µS cm^{-1}; DO = 1.0 mg l^{-1}). Generally, the water chemistry of Rice Lake may be described as reasonably well oxygenated (DO 4.8 to 9.2 mg l^{-1}), dilute (EC 10.6 to 13.5 µS cm^{-1}) and acidic (pH 4.9 to 6.1). This is typical of lakes in forested basins overlying glacial till or granitic bedrock with high annual rainfall (Gorham et al. 1983; Eilers et al. 1990; Strang et al. 2010).

Temperatures showed a seasonal signature with creek and groundwater temperatures typically up to 10 °C lower than lake temperature during summer and only slightly lower in spring and autumn (Figure 6). Dissolved oxygen showed the opposite trend to that of temperature with the lowest values occurring in mid-summer for both the inflowing creek and lake. Although the lake was reasonably well oxygenated, values occasionally dropped below 5.0 mg l^{-1}, a critical value for salmonids (BCMoE 1997), in summer. Dissolved oxygen in the inflowing creek was similar to that of Rice Lake in range and magnitude.

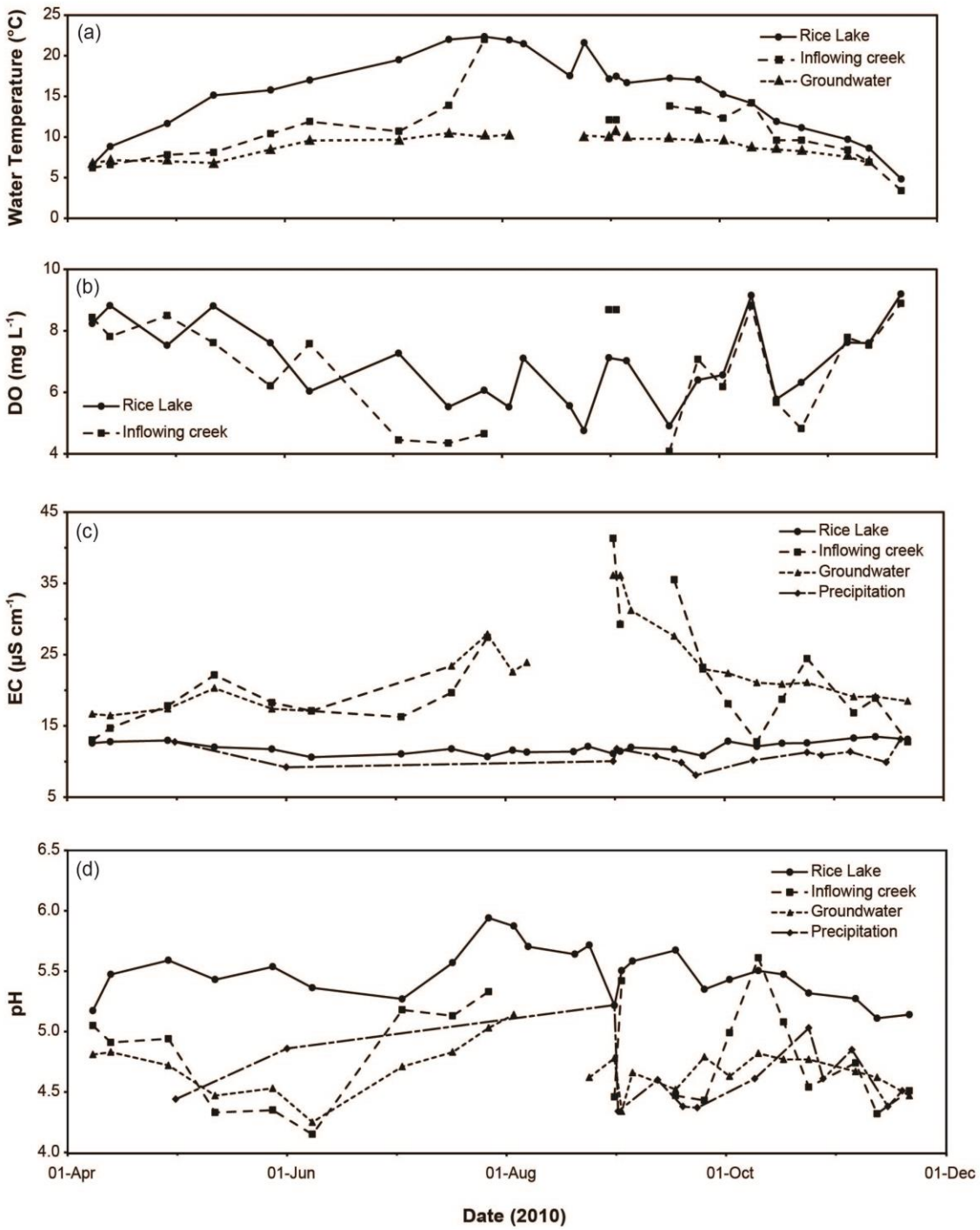

Figure 4. Water chemistry data: (a) Water temperature, (b) dissolved oxygen, (c) electrical conductivity and (d) pH.

The low DO values particularly in summer are surprising and the meter used in this study was checked against another DO meter on occasion with similar results. There are two possible reasons for the low DO in Rice Lake: low DO groundwater entering the lake and/or consumption of oxygen within the lake. Groundwater inflow to Rice Lake does

occur but seems limited (see below) and likely not sufficient to cause such low values. There is some visual evidence for the latter as algal blooms and fish kills have been observed in the lake. However, the low DO in Rice Lake requires further research beyond the scope of this study.

The EC of Rice Lake was slightly higher in spring and autumn and lower in summer although minor peaks in EC tended to occur after summer rainstorms. Assuming a TDS/EC ratio of 0.46 based on chemical data collected from Rice Lake by Juteau and Lunn (2006), TDS were estimated to range from 4.9 to 6.2 ppm. Given the relatively low concentration of dissolved solids, Rice Lake may be described as chemically dilute based on classifications provided in other lake studies (Hongve 1977; Gorham 1983; Eilers et al. 1996). The highest EC in creek water and groundwater generally occurred after extensive dry periods and little if any discharge from the creek.

The average pH of Rice Lake remained between 5 and 6 but individual measurements did occasionally drop below 5 which can effect development and reproduction in rainbow trout (McKean and Nagpal 1991). The pH gradually increases in summer and decreases in autumn and spring. The pH of the inflowing creek and groundwater were typically (up to one pH unit) less than that of Rice Lake and tended to track lake pH. The pH of precipitation ranged from 4.3 to 5.2.

Discussion

Hydrogeologic setting

Hydrologic data (negative monthly net groundwater flux, estimated groundwater fluxes) and chemical data (dilute, acidic lake water chemistry) are consistent with the climate and hydrogeologic setting of Rice Lake. Hydraulically mounded lakes high in the landscape typically receive relatively little groundwater inflow (generally high in dissolved solids) compared to other inputs such as precipitation (generally low in dissolved solids) (Webster et al. 1996). If the watersheds of these lakes are composed of conductive sediment rather than bedrock, then groundwater outflow from the lakes may constitute a greater proportion of total outputs. Under these conditions (limited groundwater input, high precipitation and groundwater output) lakes may be naturally acidic and dilute, particularly if sediments in the watershed are derived from, or the basin is dominated by, acidic weather-resistant bedrock (e.g. Strang et al. 2010). The bedrock geology of Seymour Valley consists of granitic rocks (Roddick 1984), resulting in acidic soils and sediments with low base cation weathering rates (Mongeon et al. 2010).

Although specific groundwater flow pathways were not determined in this study, it is possible that groundwater flows eastward from Rice Lake (elevation ~200 m) through thick quaternary sediments toward Seymour River (elevation ~ 115 m) (Figure 7). Groundwater flow to nearby Lynn Creek is unlikely given its relatively high position in the landscape and the impeding granodiorite bedrock. If this model is

realistic then groundwater must exit Rice Lake through the underlying Vashon till which dominates the lakebed. Substantial groundwater flow through Vashon till is in contrast to other studies that describe it as an impermeable layer below forest soil (e.g. Hutchinson and Moore 1998) or as a low conductivity confining unit above aquifers (e.g. Cox 2003). Field observations also confirm that locally, Vashon till is dense, compact and difficult to penetrate with a hand auger. Therefore, how does groundwater exit Rice Lake through the seemingly compact and low conductivity Vashon till?

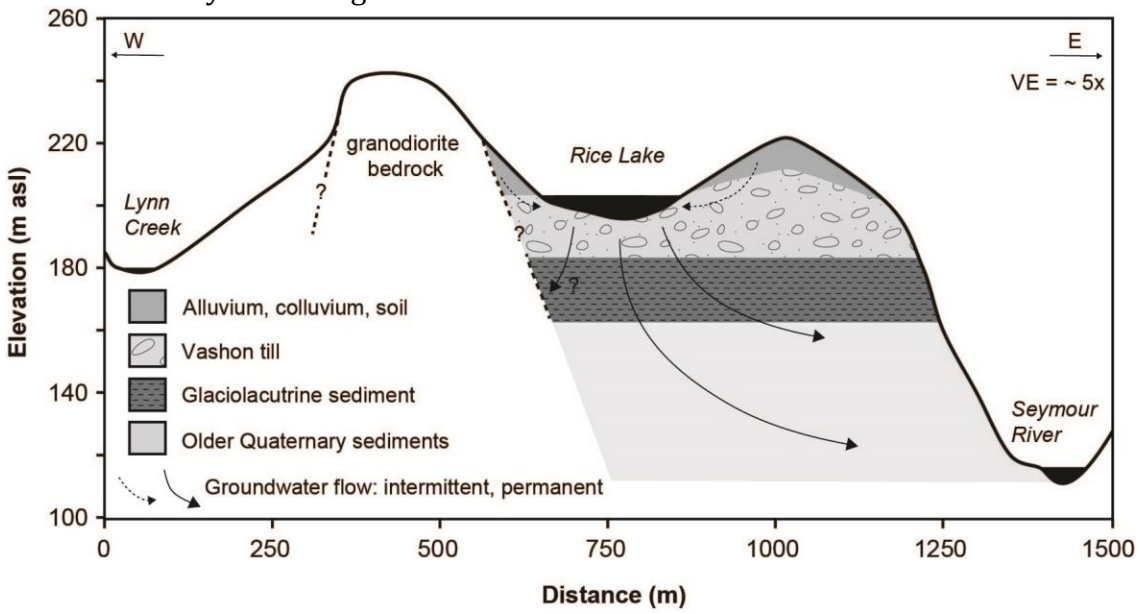

Figure 5. Conceptual hydrogeologic cross section through Rice Lake with inferred groundwater flow paths. The location of the cross section is shown in Figure 1. Quaternary stratigraphy is based on Lian and Hickin (1993).

Substantial groundwater outflow could occur horizontally through the earthen impoundments or higher conductivity surficial sediment overlying Vashon till. However, this seems unlikely as monthly horizontal groundwater outflow calculated from hydraulic gradients (-44 mm mon^{-1}) was less than the estimated total monthly groundwater outflow (-320 mm mon^{-1}), suggesting vertical groundwater outflow accounts for most of the groundwater lost from Rice Lake. In addition, net groundwater flow remained high throughout summer and autumn even though lake stage dropped ~1 m and likely remained at or below the base of the impoundments and surficial sediment. Lian and Hickin (1993) observed beds of medium to coarse sand in the compact till (which could promote groundwater flow) but noted their occurrence as rare which suggests limited geographic extent and likely only a minor pathway. Hicock and Lian (1999) observed two sets of extensive glaciotectonic factures, dipping in different directions, in upper Vashon till near Rice Lake and fractures have also been observed in till outcrops around Rice Lake. Fractures may have hydraulic

conductivities one to three orders of magnitude higher than the till matrix (Freeze and Cherry 1979). It seems possible that vertical groundwater flow through compact Vashon till is enhanced by the two sets of fractures. More research is needed to confirm the role of fractures and/or higher conductivity lenses but water balance data and calculated flux rates indicate that the presence of compact Vashon till does not necessarily imply limited groundwater-lake water interaction.

Transient flow and lake classification

Water balance data allows lakes to be classified based on hydrologic fluxes, which is useful for understanding hydrologic processes and management of lakes (Wentz 1981). Data from Rice Lake indicate that the hydrology of small coastal headwater lakes is highly variable and may not fit a single hydrologic classification. During dry months (e.g. June through August) Rice Lake primarily acts as a groundwater recharge lake, lacking surface outflow and dominated by groundwater outflow. During wet months when gradient reversals are more likely to occur and lake stage remains below the outflow weir (e.g. September and October), Rice Lake may be considered a flow though lake (Born et al. 1979) having horizontal groundwater inflow through the shallow surficial sediment, and vertical groundwater outflow, possibly through fractures in the deeper Vashon till. When lake stage overtops the outflow weir, surface outflow may exceed groundwater inflow and groundwater outflow and Rice Lake may be considered a drainage lake (e.g. April and November). These classifications are driven by seasonal and annual climate variability. For example, semi-permanent groundwater mounds may develop during wetter years, resulting in consistent groundwater flow to the lake over longer periods of time (e.g. Krabbenhoft and Webster 1995). However, given that 2010 was drier and warmer than the 1981-2010 normals, resulting in greater evaporation and reduced surface water and groundwater inflow, the hydrologic regimes noted above represent a more extreme case than would typically be observed at Rice Lake.

Hydrologic fluxes and lake water chemistry

Although precipitation, landscape position and hydrogeology are useful for predicting the general water chemistry of Rice Lake, small seasonal changes in water chemistry can be understood in the context of hydrologic fluxes to and from the lake. Seasonal variations in EC emphasize the relative importance of surface, subsurface and atmospheric fluxes. Martin (2011) noted that surface runoff from the test basin is divided into two distinct hydrologic regimes, with different chemical signatures, based on the mechanisms generating runoff. During summer, creeks flowing into Rice Lake are dominated by shallow subsurface flow with a relatively high EC due to prolonged contact with mineral soil. However, the volume of (high EC) runoff to the lake is low and inputs via (low EC) precipitation may be similar to or greater than surface runoff (Figure 3) as rainfall is stored in the watershed. As a result, the EC of Rice Lake

decreases slightly in summer as groundwater outflow continually removes ions from the lake. Because EC decreases, it appears that surface and atmospheric fluxes to the lake are generally more important than evapo-concentration. Occasionally small spikes in EC were observed, but these correspond to summer rainstorms and pulses of surface and groundwater inflow.

In autumn, runoff from the test basin is dominated by outflow from ponded water stored in swamp depressions (Martin 2011). This water has a relatively low EC, but higher than the EC of precipitation, presumably due to limited contact with mineral soil. As surface inflow dominates the water balance relative to precipitation in autumn, the EC of Rice Lake gradually increases. The water balance was not measured during winter months and there was little snow remaining on the ground when data collection began in spring. However, given the dilute acidic nature of snow (Eilers et al. 1990), it seems likely that melting of a deep snowpack would also cause dilute conditions in early spring.

The seasonal variation in pH emphasizes the role of surface and atmospheric inputs as well as processes within Rice Lake. Lake pH typically increased in summer and minor peaks generally tracked inflowing creek and shallow groundwater. This suggests that lake acidity is controlled, in part, by precipitation, runoff from forested swamps and shallow groundwater flow from uplands. The pH of surface runoff and groundwater rarely exceeded that of Rice Lake indicating that other factors influence lake pH. Although primary productivity is generally low in dilute lakes due to limited nutrient availability and high flushing rates (Efford 1967), Phippen et al. (1996) attributed higher summer pH in small dilute coastal lakes in southwestern BC to minor increases in primary productivity. Primary productivity was not measured in the present study but algal blooms have occasionally been observed in spring and summer suggesting that primary productivity likely plays a role in influencing the water chemistry of Rice Lake.

Lake management issues

Knowledge of hydrologic fluxes is not only crucial to understanding lake water chemistry but also provides important background information necessary to outline an effective lake management strategy (Born et al. 1979). However, assumptions of hydrologic fluxes or lake water quality in dilute headwater lakes based on limited geographic, geologic or chemical information or models derived from such data may mask substantial hydrologic inputs from surface runoff and/or shallow groundwater. For example, Eilers et al. (1996) noted that the water chemistry of Lake Notasha and other lakes in the Coast Mountains of Oregon were similar to that of precipitation indicating that precipitation was the dominant source of water to the lakes. Rice Lake and Lake Notasha have similar geology (till), landscape position (headwater lakes), depth (< 10 m) and high levels of precipitation. Although the chemical signature (i.e. pH and EC) of Rice Lake is also similar

to that of precipitation, hydrologic data indicate that surface runoff and groundwater both to and from the lake play a role in the water balance and water chemistry of Rice Lake. These differences are fully apparent in the residence times of the two lakes. The residence time of Lake Notasha is about 5 years (Eilers et al. 1996) while the average residence time for Rice Lake is an order of magnitude less. Surface and groundwater fluxes should be confirmed with field data when estimating hydrologic/chemical budgets or residence times of headwater lakes in compact glacial till.

If surface inflow is a dominant component of a coastal headwater lake, then management of runoff becomes important because dilute lakes are susceptible to acidification as they lack sufficient buffering capacity to neutralize acidic inputs (Strang et al. 2010). Results and field observations from the present study highlight the potential problems resulting from surface modification in watersheds with high runoff. Although compact gravel footpaths cover only ~2% of the entire Rice Lake watershed, they frequently show fresh scour marks and sediment deposition after intense rainstorms. Water converging on the gravel footpaths typically spills onto forest soils creating gullies that channel water directly into Rice Lake. Eilers et al. (1996) stressed the need to preserve the hydrologic setting of dilute seepage lakes by limiting the construction of trails. If trails are constructed around dilute coastal lakes, excess runoff should be channeled into existing swamps/depressions, common in CWH forests (MacKenzie and Moran 2004), or artificial basins to reduce chemical loadings and minimizing sedimentation. Shoreline and riparian vegetation may also control surface runoff in sensitive lake environments (Newell and Bernert 1996).

Knowledge of hydrologic fluxes and water chemistry is also important in assessing lakes and their potential to support fish populations. For example, a study of lake managers in 11 western states concluded that most regions manage stocked lakes using limited survey and research data (Bahls 1992). Results from the present study indicate there are two potential areas of concern for fish, specifically stocked or natural rainbow trout, in dilute headwater lakes: high temperature/low DO and low pH. Therefore, lake water quality should be tested in summer to monitor the highest temperatures and lowest DO, and again in spring and/or autumn to determine the lower limits of pH. Samples collected only in summer, to assess fish habitat or to classify acidic lakes (e.g. Juteau and Lunn 2006), would likely miss the lower pH values typically observed in spring and autumn. This is important because some local dilute lakes are stocked with fry or yearling rainbow trout in spring and autumn (e.g. Marion Lake in BCMoE 2011) and juveniles are more susceptible to lower pH than adults (McKean and Nagpal 1991).

Conclusion

The monthly water balance and water chemistry of a small coastal headwater lake were determined for ice-free periods during 2010. The general hydrology and water

chemistry of Rice Lake is controlled by high annual precipitation, hydrogeologic setting and landscape position. Monthly net groundwater flow was consistently negative indicating that groundwater outflow from the lake was greater than groundwater inflow to the lake. Overall, groundwater was the dominant output from the lake while surface inflow, which showed a strong seasonal pattern, was the dominant input to the lake. Rice Lake acts primarily as a recharge lake during summer when hydrologic inputs are low and likely acts as a groundwater flow through lake during the early wet season when groundwater inflow occurs following rainstorms. However, surface outflow increases during extremely high stages in the wet season, when Rice Lake acts as a drainage lake, which further complicates its classification. Small seasonal variations in lake water chemistry are controlled by hydrologic and chemical differences in surface water inflow, seasonal variation in precipitation and, to a lesser extent, primary productivity.

Classification of small headwater lakes and management of water quality and/or stocked fish populations should consider the hydrogeologic setting as well as seasonal variation of water fluxes to and from the lake. The presence of compact glacial (Vashon) till in these landscapes does not necessarily imply limited groundwater-lake water interaction and groundwater contributions should be confirmed with well or piezometer data. It is possible that vertical groundwater flow from lakes may be enhanced by fractures in Vashon till although more research is needed to provide confirmation.

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Copenhagenize Vancouver? Perspectives on bicycling after a semester abroad

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Abstract: *As the environmental externalities of car-dependency contribute to the growing impacts of climate change, major cities throughout the world are turning towards more ecologically friendly transportation modes such as bicycling. In the case of Copenhagen, its long-term dependence on the bicycle has created a city that extensively updates its infrastructure to maximize rider safety and comfort. Part of this success speaks to the utilitarian identity of Copenhagen cyclists, where the bicycle's primary appreciation stems from convenience and affordability. Not only have such realities produced 'people who happen to ride their bicycles' (City of Copenhagen, 2009, p. 3) Copenhagen reminds potential cycle capitals to embrace the benefits of cycling from a more holistic perspective. Following several months of fieldwork in Denmark's capital, this research summary explores the potential transferability of the ways in which Copenhagen plans for the bicycle to cities such as Vancouver. More specifically, the following paragraphs briefly highlight how the City of Copenhagen and existing bicycle literature broadens the foundations of bicycle-oriented planning, in the hopes of making utilitarian cycling more convenient, affordable, and accessible to a varied demographic.*

Everyday cyclists and the utilitarian identity in Copenhagen

With nearly 36 percent of all Copenhageners bicycling to work or education, Denmark's capital is one of the world's leaders in bicycle-oriented planning (City of Copenhagen, 2012, p. 8). Similar to Vancouver, the car-centric realities of the 1960s affected Denmark's larger cities (Larsson & Thomassen, 1991); however, what makes Copenhagen such an interesting case study is its ability to have drastically resisted the dependence on the automobile and instead plan, and legislate a city that embraces cycling as more than simply a mode of transportation (Ruby, 2013; Oldenziel & de la Bruhèze, 2011). As the following paragraphs suggest, the City of Copenhagen and additional academic literature provide critical insights into enhancing cycling ridership and infrastructure. Of equal importance is to question the transferability and potential applicability of these insights to cities such as Vancouver, in the hopes of making cycling a more mainstream rather than alternative mode of transport.

In a city where there are more bicycles than people, Copenhagen is leading a revolution of sorts, one pedal at a time. The importance of bicycling is most accurately described on the city's cycling webpage:

"Bicycles play a vital role in Copenhagener's everyday lives. The bicycle is used for all means: for getting to work or school, going out for a night on the town, transporting construction materials or appliances, bringing children to kindergarten,

going for a recreational ride, or just for gazing at other Copenhageners on their bikes. No matter what the purpose will be, the bike is the answer" (City of Copenhagen, 2013, p. 1)

This excerpt emphasizes how the normality of bicycling in Copenhagen is directly influenced by its utilitarian nature. A recent city-based survey found that Copenhagen cyclists reported 'It's fastest' and 'It's more convenient' as their most popular reasons for choosing the bicycle. The city's ongoing efforts to make cycling the most efficient option for traveling from point A to point B, while simultaneously making it more difficult to drive, have proven effective. The result is a utilitarian style of cycling, and a city without 'cyclists', rather 'people who happen to ride their bicycles' (City of Copenhagen, 2009, p. 3; Gössling, 2013). It is not surprising then, that the majority of Copenhageners cycle in their everyday clothes, including dresses, suits, high heels, and business pants, and often ride middle-of-the-road city-style bicycles. However, in cities such as Vancouver, the prevalence of bright, reflective jackets, cycling shorts or shoes, and even yellow construction-style vests are defining features of many bicycle users. While these cycle-specific materials are often used for safety, visibility, and comfort, there is a case to be made that the usage of these particular objects may reaffirm bicycling as an alternative rather than conventional mode of transport. American researchers such as Pelzer (2010) dive deeper into the socio-cultural aspects of cycling, suggesting that 'soft factors' often exist within bicycle mobility cultures, where riders may associate feelings of empowerment, resistance, and environmental consciousness within their bicycling behaviour (p. 6). Horton (2006) reaffirms such claims, stating, "Engaged in a marginalized, distinctive and distinguishing act, the cyclist unavoidably sends signals to the rest of society" (p. 49). It is these sorts of 'signals'-- the messages that cycle-specific materials send to non-riders -- that are worth questioning in North American cities, in hopes of gaining a deeper understanding of some of the barriers to utilitarian cycling.

Copenhagenize Vancouver?

One would hope that as cycling in North American cities becomes safer and more accessible, its appeal would extend to the mainstream. However, in order to achieve a cycling environment that encourages bicycle users rather than cyclists, the majority of academic research focuses on safety and infrastructure as the primary means to a more bike-friendly city. As numerous studies have identified, creating a separated and integrated bicycle track network, through the physical segregation of bicycle and vehicular traffic, greatly enhances the rider's actual and perceived sense of safety (City of Copenhagen 2011; Pelzer, 2010, Winters et al., 2012). Where appropriate, additional infrastructure may include the demarcation of bicycle paths through intersections, bus islands to separate pedestrians and bus traffic, and bicycle traffic lights (Pucher & Buehler, 2008; 2012).

Beyond infrastructure, Copenhagen has turned towards intergenerational encouragement when looking to expand the age demographics of its cycling ridership (Pucher & Buehler, 2008). In Copenhagen, close to 30 percent of all families with two children own a cargo bike, while almost 58 percent of parents state that their children bicycle to school (City of Copenhagen, 2012, p. 12, 22). Exposing young Copenhagener's to a lifestyle where bicycling is the norm, not only familiarizes them with basic cycling safety and etiquette, but also suggests a certain value and appreciation towards bicycle usage (McDonald, 2012; Pelzer, 2010). For example, a bicycle training ground in Fælledparken and the 'Safe Road to School' program are two of several initiatives to ensure a more diverse ridership profile. Furthermore, various bicycling campaigns in Copenhagen have been useful methods to both encourage future cyclists and remind existing riders of their contribution towards a more bikeable city. Approaches include the city-branding 'I Bike Copenhagen' icon and phone app, cycle counters in Frederiksberg and Nørrebro, and behavioural campaigns such as Cycle Karma in 2010 and 2012 (City of Copenhagen, 2013). However, one particularly crucial and perhaps under-researched aspect of cycle advocacy is how to target potentially underrepresented riders, such as elderly citizens and recent immigrants (Tragellis, Lopez, & Ilyashenko, 2010). In regards to the latter, research has suggested that cultural perceptions towards bicycling may vary between certain cultural groups (Steinbach et al., 2011; Silva, 2013). Therefore a more nuanced appreciation of such values is essential in broadening the cultural diversity of bicycle users, especially within cities such as Vancouver, where a significantly high percentage of recent urban immigrants exists.

Conclusion

The success of cycling in Copenhagen will continue to spur further research about the potential transferability and applicability of Danish bicycle-oriented planning to a North American context. Rather than suggest a literal interpretation of the 'Copenhagenize' bike-planning ethos, this research encourages future cycle capitals to 'Copenhagenize with caution.' In other words, cities like Vancouver should consider how the ways in which Copenhagen plans for the bicycle may provide applicable planning policy solutions, while at the same time, recognizing how Vancouver's existing challenges may complicate planning for a more mainstream utilitarian cycling environment. Further research in regards to the meanings and materiality of North American bicycle users will not only provide a more robust understanding of the qualitative intricacies of bicycle culture, but may also stimulate governments to expand their perceptions and attitudes about the benefits of city cycling. As such, a more bike-friendly city is best achieved through a multi-faceted policy and planning approach. For example, Copenhagen's ability to recognize the analogous relationship between cycling and liveability moves beyond the notion of bicycling as

simply a means for alternative mobility. Thus, choosing a more holistic approach values cycling as an affordable and efficient form of movement, with potential to benefit the cultural and even economic[31] dimensions of everyday transport.

[31] Research has proven that while cyclists may spend less than customers shopping by vehicle, they shop more frequently, thus spending more overall. Furthermore, studies have shown that investment in city cycling reduces individual and state-wide health expenditures (City of Copenhagen, 2012, p. 13, 18)

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Research Notes

Shorebirds, Wolves, Dogs and Beaches: Human-Wildlife Conflict in Pacific Rim National Park Reserve

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Research Brief

Inappropriate visitor behavior in parks and protected areas can lead to human-wildlife encounters that displace species, disturb sensitive habitat, and habituate animals. Parks and protected area mandates for ecological integrity and visitor experience can find themselves in conflict with actual visitor behavior. Protected area landscapes require people and their pets to 'learn how to live with wildlife' since links between people, wildlife, prey, foraging habitat, and landscape dynamics can contribute to human-wildlife conflict as human populations and their pets blend with, and place pressure and stress on local wildlife populations.

Dogs running free in the Long Beach Unit of Pacific Rim National Park Reserve on the west coast of Vancouver Island, British Columbia, Canada, are one of the largest sources of disturbance for migratory shorebirds. The park and its beaches are also home for a steadily increasing population of Vancouver Island wolves. Wolves in this region have a history of human-carnivore conflict. There exists evidence of a trend of wolves increasingly following and approaching people and attacking their dogs. Extensive efforts to persuade dog owners to keep their pets on-leash have been unsuccessful.

An understanding of pet owners' beliefs can help to inform strategies that persuade them to engage in the desired behaviour, or at least why these efforts may not be successful. The "Theory of Planned Behaviour" was used to uncover underlying visitor beliefs about walking their dogs on the beach among compliers (people who had dogs on-leash) and non-compliers (people who had dogs off-leash).

Findings demonstrated strong correlations between direct measures of attitude, subjective norms, perceived behavioural control and intention, with an overall robust predictive ability of intention. However, correlations were weak between the indirect measures of behavioural beliefs and attitude, and between intention and behaviour. The low correlations were attributed to habitual behaviour among dog walkers: frequency, repetition and routine actions seem to remove reason from the decision making process. Visitor behaviour appears to be driven by automatic response, initiated by cues that stimulate the behaviour. Without reason as the driver of their dog-walking behaviour,

attempts to influence compliance behaviour are not likely to be successful.

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Troubling the Conventional: Notes from a Café-Style Session on Feminist Geographies at WDCAG 2014

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Introduction

With a café-style forum, the *Engaging in Feminist Geographies* session at the 2014 Western Division of the Canadian Association of Geographers Conference attempted "to trouble the conventional ways to engage in the exchange of ideas and research in scholarly venues" (Excerpt taken from the WDCAG 2014 session Call For Papers).[32] Pamela Moss and myself (Blake Hawkins) reasoning for this session style was to provide the opportunity for a participant driven session in place of the traditional conference panel structure dominated primarily by scheduled panelists. In this case, five presenters offered short six-minute presentations that were followed by an open conversation about feminist geographical research, the challenges and questions about non-presenters' research, and more specifically marked an opportunity to offer participants constructive feedback.

My inspiration for this format came after I attended a similar session lead by Dr. Caitlin Cahill and Natalie Jones at the 2013 Annual Meeting for the Association of American Geographers. This session format incorporated a feminist epistemological approach that encourages self-reflection and does not emphasize a need for one specific answer (Cope, 2002). It is my belief that this format permits a safe space for reflection within the academy. This is due to the acceptance of not needing a reductionist approach to nuanced issues.

Below, are brief summaries of some presentations which covered a variety of topics. However, each paper exemplifies aspects related to feminist geography.

Summary of presentations

My presentation was entitled 'This is my little piece of heaven: using content analysis to understand concerns over a proposed women's recovery centre,' which discussed the ideas of rural landscape, space, and place involving a proposed Women's Recovery Center in the Haldi neighborhood of Prince George. For this project I used online sources from the *Prince George Citizen*. By using conventional and latent content analysis and cross-disciplinary literature analysis, I wanted to understand concerns about the Haldi rural landscapes produced through the *Prince George Citizen*. However, I intended this presentation as a space to discuss the issues related to

[32] This paper would not have been possible without the willingness of each participant (Evelyne Laurie, Jennifer Mateer, Shandell Houlden, and Neil Nunn) to join the session. Additionally, I must thank Shandell Houlden and Neil Nunn for their feedback from the session, and Dr. Pamela Moss for her willingness to help this session to become such a success.

positionality and methodologies. Does one who considers themselves a feminist need to make it clear in their writing? Am I taking for granted the ideas that were once 'radical' and revolutionary by not acknowledging them in my academic writings? I thought that this supportive space could hopefully provide some feedback as I continue this and future academic work.

Neil Nunn's presentation entitled 'On emotions and materiality: humanism and contemporary feminist thought' began to outline the context and character of humanism in feminist and emotional geography by highlighting some of the ways that these sub-disciplines tend towards a deeply embedded human privileging. He did so by briefly outlining how he considers humanism to operate through feminist and emotional geography, specifically drawing on a working paper of his entitled "On emotions and materiality". The presentation underscored two broad points: (1) Human exceptionalism operates as spectral system of oppression throughout academia and continues to be a significant blind spot in feminist and emotional geography. We are haunted by human supremacy in the feminist geography; however, we have yet to make concrete moves in the discipline to address this form of domination. (2) Human exceptionalism is related to other systems of oppression, namely racism, sexism, ableism, hetero-normativity and operates in the same way by privileging a particular normative human subject. Moreover, his presentation impressed on the discipline that human exceptionalism and feminism are not at odds and that the idealized human exceptional figure that finds privilege over the non-human is the same hegemonic figure that holds privilege over those who are not white, male, able-bodied and heterosexual. There are many cases of the social abject dehumanized or treated as less than human. Here he was thinking of slaves and indigenous people who are considered less than human and equated to "animals" or "savages"; and women referred to as cougars or bitches. His presentation also reminded us that the human privileging over everything else in the world is related to normative power configurations that feminist thought has been for so long committed to dismantling.

Shandell Houlden presented a piece entitled **'**Towards an Ecology of Posthuman, Feminist Methodologies' as excerpted from her Master's research. While not a geographer by trade, her work traffics in animal geographies to the extent that any research in Animal Studies is a consideration of relational ontologies of embodiment and environment. Through her paper she sought to trouble normative notions of what academic scholarship claims to be, grounded as it often is in ostensibly exclusive rationalistic forms of knowing. It is these forms, often associated with and used to legitimate the exceptional figure of the human, that she suggests limit our capacity to rethink non-human-human relations. Rather than simply make an argument to this effect and thus re-inscribe the exact thing she desired to critique, she included lyric writing charged with metaphor as an attempt to stake a

claim for the value of alternative forms of knowledge production that aim to destabilize the figure of the human.

Evelyne Laurin presented a piece entitled 'Conversations on empowerment: Investigating the social impacts of microfinance programs on Cambodian women,' which related to her upcoming Master's field work. She argued that over the past three decades microfinance has become one of the most important policy interventions used by international development practitioners, offering loan opportunities to those who lack access to basic financial services. Women have been the primary targets of this poverty alleviation strategy as it was presumed that they would be empowered through increased control over their incomes. Since microfinance was not designed effectively to address social inequalities, she argues that it does not challenge deeply embedded patriarchal power relations, and does little to change the status of women within the household. Her proposed research combines discourse analysis and feminist theory to analyze how gender empowerment initiatives in international microfinance policies is embodied in the domestic spaces and lived experiences of Cambodian women. A feminist ethnography will be employed in seeking to unearth participants' understandings of their circumstances, where her specific methodological tools will include semi-structured interviews with Cambodian women who have taken loans with microfinance institutions (MFIs). Her analysis will be guided by examining discourse in microfinance policy reports as well as interviews with employees of MFIs and non-governmental organizations (NGOs). By investigating the ways in which microfinance programs may perpetuate systems of oppression, this study will contribute to a better understanding of gender roles in Cambodia. The purpose of this research is to improve the suitability of the services and support mechanisms available to women who take microfinance loans by providing a thorough understanding of borrower needs.

Feedback

As a co-organizer of this session, I can say that it succeeded at providing a space where one could discuss their research and know that it was safe to discuss their challenges. This was mainly due to the reflective questions given to the presenters and the space set aside for discussion. Over 90 minutes of productive discussion occurred about a variety of issues facing everyone in the room. These included troubling rationalistic forms of knowing, ethics while completing research in ones home community, how to engage in feminist and Marxist theories while completing quantitative research in the academy, the question of whether feminist epistemologies need to be acknowledged since they are mainstream, and the challenges of beginning to engage in feminist geography.

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The Commodification of Rural Space for Recreation and Tourism in Central Japan

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Introduction

Rural space in Japan is currently characterized by the increased role of consumption rather than the traditional activity of production, such as growing rice or other crops (Tabayashi, 2013). This situation is often described as the "commodification of rural space" (Cloke, 1993). Although the commodification of rural space can occur in various forms, recreation and tourism are the most visually appealing to people (Perkins, 2006). The objective of this study is to examine how regional differences in central Japan affect the commodification of rural space for recreation and tourism.

The study area ranged from the Tokyo metropolitan area (which contains the prefecture of Tokyo and three immediate prefectures) to 11 additional prefectures located in the central part of Japan. We visited the one main governmental office in each of the 15 prefectures to interview the officials in charge of tourism and agriculture, and asked them to identify important types of the commodification of rural space for recreation and tourism in their prefectures. We also asked them to show us typical rural recreation or tourism activities, in an effort to better characterize and divide the prefectural areas based on their experiential and subjective images of rural recreation and tourism. In addition to the experiential decisions of the officials, we examined the regional differences of the commodification for recreation and tourism based on our landscape observations and the analysis of statistics, previous studies, and tourist brochures.

Common types of consumption of rural space for recreation and tourism

Various types of consumption of rural space for recreation and tourism were found in the study area, though walking, jogging and cycling spaces in the countryside are the most popular. Even in urbanized areas, people enjoy walking in parks and along riverbanks. In addition, allotment gardens are often established for urban residents to enjoy small-scale farming of produce and flowers for personal use. In the past, most farm products were supplied by agricultural cooperatives or wholesale markets to destinations of consumption; however, in recent years, consumers and producers often connect directly without these middlemen. The resulting farm produce shops or stands are distributed widely across the study

area, especially in the flat plains, which are ideal for agriculture.

There are many "you-pick" farms of various fruits and berries. The purpose is not only that visitors get to pick and eat fresh fruits or berries, but also to enjoy the rural atmosphere created through the combination of the natural environment and scenery, the landscape of cultivation and various farm products. In many former dairy-producing ranches, new activities have emerged for tourists such as horse riding, viewing and petting animals, and a shop to purchase dairy products, ham, and sausages.

Hiking in hills and low mountains near urban areas is also very popular, for both younger generations as well as an increasing senior population, because of the recent health boom. Urban residents wish to experience rural life and agricultural activities, particularly in remote basins between mountains, which offer many programs that provide rural experiences (e.g., school children staying at farm inns).

While second homes, built for people to get away from the fast pace or summer heat of urban areas and to temporarily spend time in the countryside, have existed for a long time, there has been an increasing number of people who choose to reside in rural areas and either work there or commute to cities. Mountainous areas in central and northern Japan are well known for their deep snow, resulting in the presence of many ski resorts. In high mountains, climbing and trekking are the main activities for recreation and tourism, while in coastal and island areas, various types of marine leisure activities are popular, such as swimming, diving, sailing, surfing and whale watching.

Regional differences in the commodification of rural space for recreation and tourism in central Japan

Based on the empirical decisions of administrators in prefectural offices, as well as our analysis of statistics, previous studies, and tourist brochures, we choose common types of rural recreation and tourism to characterize individual regions. For example, walking spaces were found in every prefecture but it was the most important and basic recreation activity in urban areas.

While this provision of walking is typical of urban areas, allotment gardens were found to be dominant in suburban areas, and farm produce stands or shops were typical on farms located on plains. In the same respect, "you-pick" farms were commonly found in fruit-growing basins, as was hiking in hills and low mountains, the availability of rural experiences in remote basins between mountains, and escaping the summer heat in highland resort areas. Mountainous areas offered downhill skiing in snowy areas and climbing in the higher mountains, while marine leisure activities were common in coastal and islands areas. These patterns formed concentric rings around the Tokyo metropolis.

The differences in natural conditions, characteristics of farming,

existence of current tourist sites, and proximity to metropolitan areas affect the use of rural space in central Japan.

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A Tale of Three Universities: Sustainability, from theory to practice

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Abstract: *From 2012 to 2014, we conducted an applied policy analysis of sustainability policy and practice at three universities in British Columbia: University of British Columbia, Royal Roads University, and Vancouver Island University (VIU). The purpose was to discover the gaps in performance between VIU and the other two institutions to use as potential leverage to advocate for further change at VIU.*

Keywords: applied policy analysis, sustainability policy and practice, British Columbia universities.

Introduction

What responsibility do geography students and professors have for ensuring that universities not only talk about sustainability, but take action on it? At Vancouver Island University (VIU), we have a program called Work Opportunity that enables faculty members to hire students as research assistants for ten hours a week.

Two and a half years ago, the first author conceived of the idea of conducting a systematic comparison of three universities, including VIU, to see how they performed in variety of sectors relating to campus sustainability. The second author, Pamela Jack, was hired to conduct the bulk of the research. In producing the report, we were inspired by two authors, in particular – Michael M'Gonigle (co-author of *Planet U: Sustaining the World, Reinventing the University*)[i] and David Orr (author of *Ecological Literacy*, and former director of Environmental Studies at Oberlin College).[ii] Together we agreed on the categories, which included Water, Energy, Transportation, Food, Waste, Governance, and Curriculum, borrowing with modifications from the *Sustainability Tracking, Assessment & Rating System* (STARS) of the Association for the Advancement of Sustainability in Higher Education (AASHE) and Sierra Club's *Campus Sustainability Assessment Framework* (CSAF).[iii]

While we considered looking at more institutions, in the end we decided it was only feasible to do three – VIU, Royal Roads University (RRU), and University of Northern British Columbia (UNBC). While we wanted to make the comparison as objective as possible, we did have an agenda. The agenda was to discover if our institution was lagging behind and, if so, what could be done to improve its performance. We wanted to use the principle of invidious comparison –the 'bandwagon effect' – to help engender more rigorous efforts on VIU's part.

While the report has proven to be a more complex and time-consuming effort than we had expected, it is

almost ready for release. While each institution has certain strengths, VIU is overall the least evolved. However, there have been some changes recently in the administrative ecology that lead us to believe that the report will get a better reception than it would have done a year ago.

The virtues of this project are that it has involved a faculty member and a student in applied research, and it has focused on something close to home – not on sustainability as an abstraction, but as involving the practice of one's own institution. It takes the lessons of what we know about the global ecological imperative as geographers and brings it down to what we as an institution can do to exercise greater ecological and social responsibility. It has been an exercise that can be replicated at other any institution. The next step at VIU will be to do a full STARS or CJAF audit,[iv] and to further publicize our findings. A copy of the report, for those interested, is available from the lead author.

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[ii] Orr, D. W. (1992). *Ecological Literacy: Education and the Transition to a Postmodern World*. Albany, NY: State University of New York Press.

[iii] See https://stars.aashe.org/ and http://www.syc-cjs.org/sc/tools.

[6] Ibid.