Are We Planning Effectively For Climate Change?

An evaluation of official community plans in British Columbia.

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ARE WE PLANNING EFFECTIVELY FOR CLIMATE CHANGE?
AN EVALUATION OF OFFICIAL COMMUNITY PLANS IN BRITISH COLUMBIA

by

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Executive Summary

Climate change is a global problem requiring significant action to reduce greenhouse gas emissions and prepare for impacts at the municipal level. British Columbia is in a unique position, with all municipalities required to integrate climate change goals, policies and actions into their official community plans. Using a content evaluation methodology, this research evaluates 25 official community plans in B.C. to better understand the level of literacy, policy and action on both climate change mitigation and adaptation. The findings suggest that local governments are doing a reasonable job with integrating goals and policy, but fail to provide adequate background information or frameworks for implementation. This paper also provides recommendations to enhance municipal climate change planning and identifies opportunities for future research.

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Introduction

It has become clear that climate change is one of today's most challenging global issues, impacting human and natural systems worldwide (IPCC, 2007). The need to act immediately to reduce greenhouse gas (GHG) emissions is increasingly evident, and failure to do so will lead to devastating and likely irreversible changes to the environment, having a profound effect on human society. Given current and projected emission scenarios, impacts from climate change can no longer be avoided (IPCC, 2007). Adaptation is therefore a necessary and urgent counterpart to climate change mitigation.

Local governments must be at the forefront of climate change efforts. With influence over land use, transportation, community energy systems and green building, waste management, and food production, local governments are responsible for 44% of direct and indirect emissions (Federation of Canadian Municipalities, 2009) and have a key role to play in the reduction of GHGs. Moreover, municipalities will be on the front lines when it comes to the impacts of climate change. Among other things, communities will need to contend with the challenges of extreme weather events, degraded infrastructure, water shortages, food insecurity, rising sea levels, and community health issues caused or exacerbated by climate change.

British Columbia has proven itself a leader in climate action with a provincial mandate to attain GHG reduction targets province-wide and achieve a carbon-neutral public sector. As part of this policy regime, all municipalities are required to include climate change targets, policies and actions within their official community plans (OCPs), the guiding land use and policy framework at the local level. As communities have begun to update their OCPs and undertake climate initiatives across all sectors, there arises an incredible opportunity to examine the production of climate change policy and plan-making early on. To take advantage of this unique circumstance, this research seeks to answer the following questions:

- What are the key elements that should be integrated into an OCP to effectively guide climate action at the local level?
- How many OCPs in the Metro Vancouver, Fraser Valley, and Capital Regional Districts have an explicit focus on climate change?

- How well is climate change currently being addressed through OCPs in B.C.'s most populous regions?
- What are the key areas that municipalities could improve to strengthen climate change planning within OCPs?

This paper begins by setting the context in terms of climate change drivers and impacts, the authority that municipalities have to affect change in these areas, and an overview of the political context in British Columbia. It then goes on to explain the methodology employed, and the major findings and discussion. The paper is concluded with recommendations for improving OCPs and for future research opportunities.

Planning for Climate Change

The Motivation for Mitigation

As we move deeper into the 21st century, our world is rapidly changing. In its 2007 Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) pronounced the warming of the world's climate as "unequivocal" (p.30) and point to mounting evidence, including rising average air and ocean temperatures, sea level rise and the pervasive melting of ice and snow worldwide. Post-industrial human activities and the release of greenhouse gas (GHG) emissions into the atmosphere are the primary drivers of these changes. Human-caused GHG emissions increased by an unprecedented 70% between 1970 and 2004 and are likely to continue their upward trend over the coming decades (IPCC, 2007). Due to the longevity of GHGs in the atmosphere, a certain amount of warming is "locked in" at this point; even if the concentration of GHGs were to be kept constant at year 2000 levels, a warming of 0.1°C per decade would be expected. With the continued rise in GHG emissions that is anticipated, however, average global warming is forecasted to be 0.2°C per decade over the next 20 years (IPCC, 2007).

> ***Defining Mitigation:***
> *The Intergovernmental Panel on Climate Change (2007) defines mitigation as technological change or substitution that reduces resource inputs and emissions per unit of output. It involves implementing policies to reduce GHG emissions and enhance carbon sinks.*

Worldwide, the sectors that most greatly contribute to GHG emissions as illustrated in Figure 1, are energy supply (25.9%) followed by industry (19.4%), forestry (17.4%), and agriculture (13.5%). Transport, residential and commercial buildings, and waste and wastewater are also factors, contributing to global emissions at 13.1%, 7.9% and 2.8% respectively (IPCC, 2007). All sectors are experiencing a growth in the release of GHGs, with the fastest growing emissions coming from energy supply, transport and industry. Canada and the US are among the most intensive users of energy, with annual emissions of over 25 tCO_2-eq (tons of carbon dioxide equivalent) per capita in North America. This contributes 19.4% of global emissions despite only having 0.05% of the world's population (IPCC, 2007).

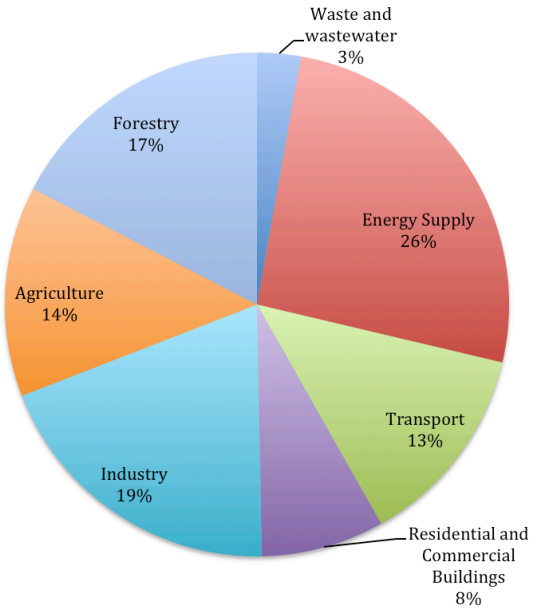

Figure 1: Global GHG Emissions by Sector (IPCC Synthesis Report, 2007, p.36)

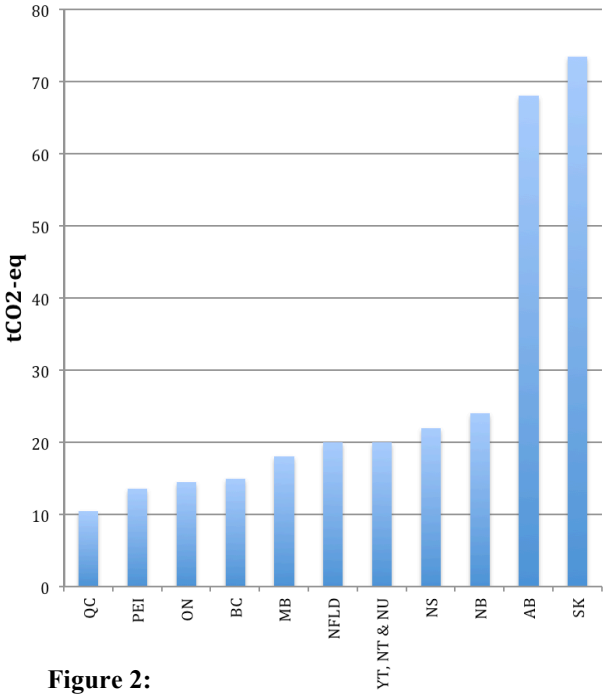

Figure 2:
Per Capita 2008 GHG Emissions by Province
(www.LiveSmartBC.ca/learn/emissions.html)

British Columbia is in a unique position relative to most of North America due to the use of hydroelectric power as a relatively clean primary energy source (LiveSmart B.C., 2011). B.C.'s emission intensity is 14.9 tCO_2-eq per capita and is the fourth lowest among provinces in Canada (see Figure 2). However, B.C. is also experiencing a rapid increase in emissions due to population growth and the expansion of the natural gas industry. Between 1990 and 2008 the province saw a 23% increase in emissions, which is the third largest growth rate after Saskatchewan and Alberta. These two provinces have dramatically higher emissions per capita as a result of the energy intensive oil and gas industry.

As illustrated in Figure 3, transportation is by far the largest contributor to emissions in British Columbia, at 36%. Fossil fuel production (19%), industry (18%), and residential and commercial buildings (11%) are also major sources, with waste, net deforestation, agriculture and electricity contributing 6%, 5%, 3% and 2% respectively (LiveSmart B.C., 2011). While certainly action is needed at the Federal and Provincial levels, many of the key emission sources such as transportation, energy use and buildings, waste, and agriculture can be heavily influenced by policy at the municipal level. Together, these sectors contribute over half of B.C.'s GHG emissions.

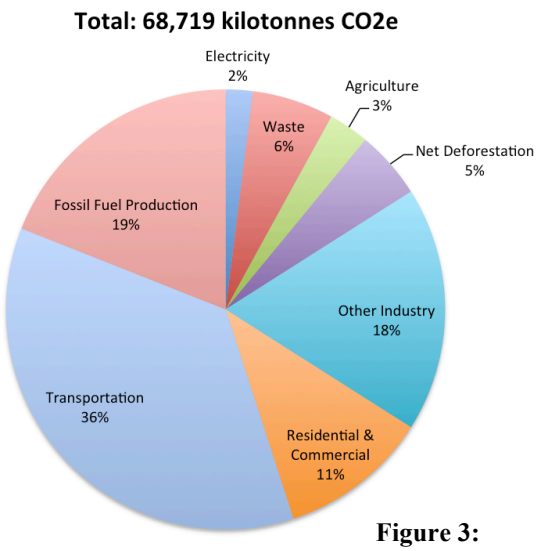

Figure 3: B.C. GHG Emissions by Sector, 2008
(www.LiveSmartBC.ca/learn/emissions.html)

The Impetus for Adaptation

Reducing GHG emissions should remain a priority, even as it becomes clear that rigorous climate change mitigation efforts will not safeguard us from serious impacts. Füssel (2007) articulates some of the benefits of mitigation as compared to adaptation efforts: first, mitigation, or GHG reduction has the ability to minimize impacts on all climate-affected systems, whereas adaptation is limited in many instances (particularly for ecosystems) and generally requires differentiated interventions for specific impacts. Secondly, because mitigation targets the root cause of climate change – GHGs – the outcome is more certain than adaptation, which relies on regional impact data and projections. A third consideration is that mitigation largely aligns with an equitable polluter-pays principle; developed nations are most responsible for the historic and present emissions associated with climate change, whereas adaptation will be most heavily borne by developing nations who have contributed the least.

> ***Defining Adaptation:***
> *The Intergovernmental Panel on Climate Change (2007) defines adaptation as the initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects.*

Lastly, it is far more difficult to measure the effectiveness of adaptation (or future impacts avoided) than it is to measure GHG emissions in a quantitative fashion.

Nevertheless, sticking solely to mitigation is no longer an option; the Intergovernmental Panel on Climate Change (IPCC) has stated that "no mitigation effort, no matter how rigorous and relentless" will be sufficient for us to avoid climate impacts from affecting the global community over the next several decades (Klein *et al*., p.748). In this context, implementing climate change adaptation measures as the counterpart to mitigation is both urgent and inevitable. And, while mitigation must be pursued simultaneously, addressing the impacts of climate change through adaptation will have a number of benefits at the local level (Füssel, 2007). First, adaptation is likely to yield direct regional benefits, regardless of what mitigative action is (or isn't) being taken on national or international scales. Moreover, the value of adaptation can be realized within a much shorter time frame than mitigation, where benefits may take decades to manifest. Finally, while there is considerable uncertainty with regards to the cost of adaptation and inaction, initial research has shown that it will be much less expensive to anticipate and adapt to climate change than to bear the costs of inaction (Stern, 2006).

> *In can be said that adaptation is about managing the unavoidable, whereas mitigation is avoiding the unmanageable.*

Globally, the impacts of climate change are wide ranging, with expected changes to the availability of freshwater resources, degraded ecosystem health and increased levels of extinction, greater food insecurity, risks to coastal systems and low-lying areas, and human health issues. The impacts specific to British Columbia include a limited water supply during peak periods due to smaller glaciers, declining snowpack, shifts in the amount and timing of precipitation, and prolonged drought (Walker & Sydneysmith, 2008). It is expected that hydroelectricity, which accounts for 90% of B.C.'s energy supply is also vulnerable from changes to stream flow, particularly during peak summer periods. Infrastructure will be affected by an increase in the frequency and intensity of severe weather and related natural hazards, such as windstorms, forest fires, storm surges, coastal erosion, landslides, snowstorms, hail, drought, and floods. Low lying and coastal areas, as well as certain infrastructure including transportation, port facilities, and electricity and communication distribution networks are particularly at risk.

Many of B.C.'s foremost industries are vulnerable; forestry is susceptible to forest fires and pest infestations such as the mountain pine beetle which has already wreaked havoc; rising ocean and freshwater temperatures, migration of exotic species, and changes to river flows pose challenges for B.C. fisheries; and, changes to precipitation and increased drought will impact agriculture, though there may also be some productivity benefits from increasing temperatures (Walker & Sydneysmith, 2008).

With such a diversity of climate change impacts and the unique socio-political, economic and geographic contexts of each community, there is no single response for adaptation planning. Füssel (2007), however, points to a number of common considerations regarding the drivers of adaptation. Firstly, extreme events as opposed to changes in average climatic conditions are often the stimulus that determines a need for adaptation planning. In the case of extreme weather events, risk arises from the combination of natural climate variability and human-caused climate change, and so must be considered together. There is often a distinction made between reactive adaptation, which takes place after some damage has already occurred, and proactive or anticipatory adaptation, which occurs before major impacts are experienced. Füssel (2007) points out that in reality, this difference is not so cut-and-dry; while adaptation may occur in reaction to an initial impact, it is often in anticipation of further or greater damage in the future. In this way, adaptation is an ongoing process, particularly as the effects will change and amplify over time.

It is also worth noting that there are two accepted approaches for adaptation planning, though they need not be mutually exclusive in practice (Füssel, 2007). The first is a hazards-based approach, which seeks to model climate change forecasts in an effort to anticipate risks and develop appropriate strategies. This approach is useful for identifying physical risks and responses, though it may be limited by the lack of available data at a fine enough scale to usefully inform decision-makers. A hazards-based approach does not generally consider social factors. The second approach is vulnerability-based, and has a strong focus on the socio-economic indicators of vulnerability and the capacity to cope. It often uses stakeholder knowledge and past experiences with managing climate risks to develop low-regret[1] strategies

[1] Low-regret adaptation options are those where moderate levels of investment increase the capacity to cope with future climate risks. For instance, installing larger diameter drains at the time of construction or refurbishment is

moving forward. It is implicit within this research framework that communities can and should be using both approaches to the extent possible in their efforts to plan for and manage climate change adaptation.

Governance Context

Since 2007, the Province of British Columbia has been a notable leader with regards to action on climate change. At that time, the GHG Reduction Targets Act (Bill 44) passed into law, requiring the province to reduce GHG emissions to 33% below 2007 levels by 2020 and 80% below 2007 levels by 2050. The same bill outlined requirements for a carbon neutral public sector by 2010, which includes government ministries and agencies, hospitals, schools, colleges, universities and crown corporations (B.C. Climate Action Plan, 2008). Public sector institutions are required to determine their GHG emissions each year, and apply carbon offsets, which are currently set at $25/tonne. The cost of offsets varies widely between municipalities, and in 2010 ranged from $250 in Belcarra to $441,314 in Vancouver (Ministry of Community and Rural Development, 2010). This liability has the potential to motivate local governments and other public institutions in reducing their carbon footprint.

In 2008, the Local Government (Green Communities) Statutes Amendment Act (Bill 27) also passed into law. Most notably, the Green Communities Act requires that OCPs and regional growth strategies include GHG reduction targets, policies and actions by 2010 and 2011 respectively. In addition to these new requirements, Bill 27 offers municipalities greater authority to require, reward and enforce different elements of sustainable development within their community (Rutherford, 2009). Other initiatives that the province is undertaking which will directly affect local government efforts include a process of "greening" the B.C. Building Code and the implementation of a revenue neutral carbon tax on fossil fuels (B.C. Climate Action Plan, 2008). It is worth emphasizing that while local governments are faced with significant requirements to plan for climate change mitigation, there is currently no mandate for them to develop goals or action around adaptation.

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likely to be a relatively low-cost option compared to having to increase specification at a later date due to increases in rainfall intensity (World Bank)

With the need to pay for offsets as part of North America's first carbon neutral public sector, and a requirement to set climate change targets and policies, municipalities have begun establishing plans to get themselves there. By and large, local governments have viewed mitigation and adaptation as distinct strategies, and have developed these plans independently of each other. Far more municipalities have developed GHG reduction or energy plans than adaptation plans, though it seems as though the established progression has been to start with mitigation, and move onto adaptation once that is completed or well underway. Of 74 B.C. local government websites that were reviewed at random in December 2010, 16 had either corporate or community climate change mitigation plans in place. Only 3 of the 74 municipalities had adaptation plans, and no community had integrated their efforts toward mitigation and adaptation. This research focuses on the integration of climate change into OCPs, a requirement of Bill 27. Despite having been a required element of OCPs since May of 2010, only 25 of 40 plans reviewed for this research (OCPs from municipalities in the Capital Regional District, Metro Vancouver, and the Fraser Valley Regional District) had integrated climate change sections, targets or policies a year later, in May of 2011.

Despite a considerable ways to go on the planning front, 179 of B.C.'s 188 communities have reaffirmed their commitment to become carbon neutral and report on progress by voluntarily signing on to the B.C. Climate Action Charter (LiveSmart BC) supported by the Union of B.C. Municipalities (UBCM). The motivation to sign the charter was substantially helped by the Climate Action Revenue Incentive Grant in 2010, which provided a 100% refund of that year's carbon tax payments to local governments that signed on to the charter (Ministry of Community and Rural Development, 2010).

In addition to accessing the resources available through the province and UBCM, a number of other key organizations provide critical support, research and capacity. *ICLEI: Local Governments for Sustainability* is an international organization that has been instrumental in providing climate change resources for municipalities. They deliver a 5-milestone mitigation planning process as part of their Cities for Climate Protection Program, as well as the more recently developed 5-milestone process for adaptation. Five municipalities and two regional districts from British Columbia joined the first cohort of local governments to undertake the

adaptation planning program in Canada and are currently about half way through. They include: the Capital Regional District, Delta, the City of North Vancouver, Surrey, Vancouver, Metro Vancouver, and Victoria (ICLEI, 2011). The Pacific Institute for Climate Solutions (PICS) is an organization endowed by the provincial government with $90M to undertake climate change studies at B.C.'s four research universities. The organization provides workshops, facilitates a network of scientists, researchers, policy-makers and stakeholders, and delivers B.C.-relevant research on both mitigation and adaptation. The Pacific Climate Impacts Consortium (PCIC) is also a research-based organization that undertakes quantitative studies on the impacts of climate change and climate variability. Their analysis tools and datasets help local governments get a more accurate understanding of projected impacts on a finer scale than would otherwise be available.

Opportunities to Act for Local Government

Local governments have a large part to play when it comes to climate change action; they have both a large influence over GHG reductions, and will bear many of the costs associated with climate change impacts. The following section is not exhaustive, but provides a brief overview of the primary avenues that local governments may use to guide climate change mitigation and adaptation. Constitutionally, local governments are limited by the powers delegated to them by the province and spelled out in the Local Government Act (1996).


Photo: ICLEI Adaptation Workbook

Mitigation: Transportation

In B.C., transportation is the largest source of GHG emissions, with 60% of the sector's emissions coming from road vehicles. Since 1990, transportation emissions have increased by 42%, making it one of the fastest growing sources of emissions in the province (B.C. Climate Action Toolkit). Influence over fuel efficiency and "right-sizing" of vehicles is largely limited to a municipality's own fleet. However, local governments can effect community transportation emissions through their investments in streetscape and transportation infrastructure, parking availability and rates, incentives for alternative transportation modes, and transit-oriented development. Of course, a key influence on transportation is the extent to which neighbourhoods are complete and

densely populated. These are such important factors in how people get around and their associated emissions, it is discussed in its own section, below.

Climate friendly policies and actions for transportation could include (Rutherford, 2009): setting a maximum (as opposed to a minimum) number of new off-street parking spaces in new developments; requiring a certain level of alternative transportation infrastructure in new developments; ensuring that all new development is accessible by transit or active transportation; amending bylaws to prohibit drive-through businesses; providing bicycle infrastructure and requiring end-of-trip facilities in multi-family and commercial buildings; and giving priority parking to bicycles, carpools and carshares. In addition, local governments can allow building owners to provide cash in lieu of providing off-street parking, and Bill 27 has amended their authority to now use those funds in the development of alternative transportation infrastructure.

Climate Change Policy in Practice

City of Surrey:

- Reduce the amount of parking required in co-ordination with efforts to discourage single-occupant cars, increase the frequency of transit services and introduce programs such as staggered work hours
- Review the minimum parking requirements and establish parking maximums

City of Port Coquitlam:

- Require bicycle parking and trip-end facilities in major developments

Mitigation: Energy

Approximately 12% of B.C.'s GHG emissions come from heating and hot water in residential, commercial and institutional buildings, with another 2% derived from B.C.'s electricity system (B.C. Climate Action Plan). This will be improved over time with the implementation of B.C.'s green building code, but local governments can greatly accelerate the process with tools they have available to them.

Photo: B.C. Climate Action Plan

The implementation of Bill 27 has resulted in increased authority over energy use, with municipalities now permitted to designate a Development Permit Area (DPA) for energy conservation or GHG reduction. Unlike many other DPA powers, this new authority may apply to single-family homes in addition to multi-family residential areas (Rutherford, 2009). DPA guidelines may be defined in a number of different ways, including: setting a specific GHG reduction target that must be met through the development; orientation of the building in relation to the sun or wind; landscaping considerations that will help maximize energy reduction; exterior design features such as colour, window heads or overhangs; or the implementation of district heating or geothermal energy systems (Rutherford, 2009). Furthermore, municipalities now have authority to enforce B.C.'s building code according to energy efficiency standards, in addition to the previous standards related to "health, safety or protection of persons or property" (Rutherford, p. 8).

Small housing units which generally consume far less energy per capita are encouraged in a number of ways through Bill 27; self-contained dwelling units of 29 m^2 or less are exempt from Development Cost Charges (DCCs), and municipalities have the option of waiving or reducing DCCs for subdivisions that are designed to reduce GHGs or have a low environmental impact (Rutherford, 2009). Energy efficient development can also be encouraged through density bonusing, by fast-tracking development applications for those that meet energy efficiency criteria (such as LEED), or by providing a sustainability checklist that includes energy efficiency or alternative energy installations (B.C. Climate Action Toolkit). It is also feasible for governments to develop bylaws or policy that mandate a proportion of on-site energy production, or the easy implementation of alternative technologies in the future, such as Esquimalt's "Solar Ready" bylaw, which requires new development to include plumbing and wiring for future installation of solar hot water (B.C. Climate Action Toolkit, SolarBC). Many governments have sought to increase the uptake of alternative energy systems in other ways, including education and/or funding incentives, or partnership with NGOs.

Climate Change Policy in Practice

City of Langford:

- Develop and implement a performance-based approvals process (e.g. expedited development/building permit application processing for developer/builder commitment to third party building labelling programs such as LEED™ or BuiltGreen™) if green and/or energy efficient measures are provided for private developments
- Promote 'future-proofing' of buildings and public works to allow for future adaptability and conversion of energy infrastructure systems

District of Sooke:

- Examine and promote the creation of solar energy zones in the Zoning Bylaw, which specify standards for roof pitches, solar access provisions and street orientations in order to preserve solar energy options
- Promote the creation of energy zones within the District of Sooke, which sets standards for density, rate of growth and infrastructure connections to provide for cost effective and sustainable energy choices
- Create a neighbourhood energy utility through partnerships with the private sector, using biomass or heat recovery from the sewer system

Mitigation: Efficient Land Use

Building complete, compact communities has a tremendous impact on transportation choice, the efficiency of civic infrastructure and energy systems, and is an area that municipalities have a high level of control over. A "tipping point" occurs at a density of approximately 35 people and jobs per hectare, below which automobile dependence is likely to be an intrinsic feature of the community (Newman & Kenworthy, 2006). Studies in the United States show that developing in accordance with Smart Growth Principles reduces emissions by 18-36% as compared to low-density, single-use development (B.C. Climate Action Toolkit). The vast majority of B.C. municipalities have committed to complete and compact development as signatories of the Climate Action Charter.

Zoning is one of the foremost tools for establishing compact, complete communities, and incentives such as a revitalization tax exemption program can encourage developments to pursue infill or the achievement of a target density in central areas (*Community Charter*, sec. 226; Rutherford, 2009). Local governments should consider policies around lot size and shape, lot coverage, siting, and allow sensitive forms of infill such as secondary suites, laneway housing, or freehold row housing (B.C. Climate Action Toolkit). Density bonusing can ensure high intensity land-use, while securing necessary amenities for the community. The establishment of urban containment and service boundaries is both cost effective and critical for focusing growth in desired areas (Rutherford, 2009). Finally, it is important to create attractive, well-connected streets that provide amenities for walking, cycling, and transit through street design standards and development control bylaws (B.C. Climate Action Toolkit).

Climate Change Policy in Practice

City of Coquitlam:

- Prioritize City investments in parks, leisure and other City facilities that reinforce efforts to direct future growth to existing centres and any areas appropriate for future residential intensification

City of Langford:

- Seek access easements or rights of way dedications at time of rezoning and/or subdivision for creating more finely grained street, pedestrian and/or cycle network connectivity

City of Surrey:

- Balance the number of local jobs with the resident work force to provide local employment opportunities for residents and to reduce regional commuting. A ratio of 1 job per resident in the work force is desirable
- Size urban neighbourhoods to support an elementary school, a, neighbourhood park and a small local commercial area (preferably combined with a residential use in the same building)

Mitigation: Waste


Photo: B.C. Climate Action Plan

Waste accounts for 6% of B.C.'s GHG emissions (LiveSmart B.C.), with much of the responsibility falling to regional governments with support from municipalities. Emissions from methane released in landfills is one of the primary concerns, though transportation of waste is also an issue and becoming more challenging as existing landfills fill up. Increased waste diversion is made possible by implementing yard and kitchen composting programs for all residents, which has the added benefit of retaining this valuable resource for agriculture or landscaping (B.C. Climate Action Toolkit). In addition, backyard or community-scale composting can be encouraged with bin subsidies available to residents. Recyclables and compostables may be banned from the landfill, so long as adequate programs and facilities exist to accept them. User-pay pricing schemes for waste pick-up and programs to encourage reuse of demolition materials may also be employed.

Municipalities can enable better recycling and composting practices through the provision of sufficient receptacles in public spaces, and can set standards for implementation through street furniture and design guidelines. Finally, there are interesting opportunities for municipalities to facilitate integrated resource recovery between public or commercial facilities, or the co-location of complementary facilities such as a wastewater treatment plant that can provide biosolids to a

Climate Change Policy in Practice

District of Sooke:

- Create a composting facility and implement curbside household organic waste pickup program

City of Langford:

- Work with other agencies or businesses to capture the value in waste streams as a means to generate local economic development opportunities
- Discourage construction and demolition waste from building demolition and encourage building disassembly and recycling through varied permit fees (e.g. $1,000 permit fee for building demolition, $1 permit fee for disassembly and recycling)

nearby composting facility ((Rutherford, 2009; Ministry of Community Development, 2009; B.C. Climate Action Toolkit).

Mitigation/Adaptation: Resource Management

Effective resource management fulfills benefits for both mitigation and adaptation. Vegetative growth sequesters carbon dioxide, acting as an effective carbon sink (Rutherford, 2009), and mature forests store tremendous amounts of carbon. The amount of carbon accumulated in B.C.'s forests is equal to 989 times B.C.'s annual GHG emissions (Wilson & Hebda, 2008). In an urban context, tree canopy and landscaping can be used to reduce energy consumption when placed strategically in relation to sun exposure or wind (Rutherford, 2009).

Stewarding natural systems in and around our communities is also critical for the ecosystem services they provide, such as the filtration of water and air, provision of habitat and fertile soils, water storage, climate regulation and nutrient cycling (Wilson & Hebda, 2008). Intact, diverse ecosystems are more resilient to change and far less expensive than the equivalent human-made infrastructure, and are therefore an important option for adaptation (*ibid*). Natural systems also offer increased resiliency in the face of extreme weather events and hazards, which are expected to increase in frequency and intensity as a result of climate change (Ministry of Environment, 2010). For instance, tree cover and streamside vegetation help manage rainwater and decrease the likelihood of flooding and erosion, while coastal wetlands dampen the effects of storms as well as flooding, and adequate tree canopy protects against the impacts of heat waves and urban heat island effect (Abramovitz *et al*., 2002; Solecki *et al*., 2004; Curren, 2007).

Municipalities have a number of regulatory tools at their discretion for managing and conserving natural areas as valuable resources (Curren, 2007). Through OCPs and zoning bylaws,

municipalities can establish urban containment boundaries, define land uses including parks and natural areas, and establish setbacks from sensitive ecosystems. Development permit areas (DPAs) are used extensively by municipalities to set guidelines that protect sensitive ecosystems from development. A number of more specific bylaws can also be set in place: for instance, a watercourse protection bylaw to prohibit polluting, obstructing or impeding stream flow; a rainwater management bylaw to regulate infiltration and impermeable surfaces; a landscaping bylaw with established standards; a tree protection bylaw to regulate tree-cutting; a soil removal and deposit bylaw to control sedimentation and erosion; a pesticide use bylaw to prohibit the use of pesticides on residential properties; an invasive species bylaw to regulate, prohibit, and impose requirements for their control and eradication; and a security bylaw to establish funds for the remediation of damage caused by development. Moreover, local governments can impose development cost charges to acquire parkland and natural corridors, or use a riparian tax exemption to place a conservation covenant on land title (Curren, 2007).

Climate Change Policy in Practice

District of Saanich:

- Require building and site design that reduce the amount of impervious surfaces and incorporate features that will encourage ground water recharge such as green roofs, vegetated swales and pervious paving material

City of Langford:

- Set targets for canopy coverage in built areas that result from street trees, urban forests and/or trees on private property
- Convert to universal use of plant species indigenous to the area and region.
    - When undertaking restoration of habitat areas, removal of invasive plant species will be undertaken
    - Species of plants indigenous to the area and region will be integrated into restoration practices

District of Highlands:

- Require all new developments or modifications of existing developments to cause no increase in peak surface water runoff compared to existing conditions of the site

Mitigation/Adaptation: Food & Agriculture

Food and agriculture is a second area that is connected to both mitigation and adaptation. Agriculture accounts for 3% of B.C.'s emissions, although worldwide this proportion is closer to 14% (LiveSmart B.C.; IPCC, 2007). Large quantities of GHGs are generated from livestock manure and chemical fertilizers, and emissions are also caused by deforestation, diesel fuel use, and energy for irrigation and drying processes (Branosky & Greenhalgh, 2007). Our current farming practices result in a net production of GHG emissions, even though agriculture has the potential to act as an enhanced sink, sequestering and storing carbon in plant material and soils (Branosky & Greenhalgh, 2007). For the most part, local governments' role in reducing GHG emissions from agriculture is limited to education regarding sustainable farming practices, though it is possible to regulate (not prohibit) the application of fertilizers (Curran, 2005).


Photo: Saanich OCP

> "Food has only recently become an important topic of consideration for community planning. Increasingly, food is becoming one of the most important issues to address due to its associations with human and environmental health and the economy, and its vulnerability in the face of rising energy costs and climate change."
>
> - Colwood OCP, page 97

Climate change is expected to impact all dimensions of global food security, including food availability, food accessibility, food utilization, and food system stability. Among the most vulnerable populations are low-income individuals and communities in coastal areas, floodplains and mountainous regions (Food and Agriculture Organization of the United Nations, 2008). While warmer temperatures are likely to increase the productivity and range of crops grown in British Columbia, agriculture will be adversely impacted by wetter winters and dryer summers, a decline in glaciers, resulting in an earlier spring run-off, new invasive plants and insects, and more frequent and severe weather events such as floods, fires, high winds and drought (Ostry, 2010). B.C. produces just over half the food that is consumed in the

province, with the balance being imported, primarily from the US, China, Mexico and Chile. Projected changes in the ability of these countries to grow and transport food will also have an effect on food security in B.C. (Ostry, 2010).

A primary strategy for increasing the resilience of food systems is to support a shorter supply chain and localized production to bolster local economies and increase control over food safety (Ostry, 2010). Municipalities can aid in this effort by enabling the preservation and active use of agricultural land, supporting direct sales of farm products such as farmer's markets, and facilitating access to urban land for food production.

B.C. is unique compared to other provinces and states, in that it has 4.7 million hectares, or about 5% of its total land area protected for farm-use only within the agricultural land reserve (ALR), 55% of which is actively farmed (Curran, 2005). Zoning is an important tool for supporting local farmers; regulating setbacks, buffering, building heights, signage and parking, and ensuring large lot minimums and contiguous areas of agricultural land can help reduce conflicts with non-farm neighbours. Municipalities can also limit the subdivision of ALR and adjacent land, and help ensure that suitable commercial land outside of the ALR is available for the agricultural service sector. Other tools available to local governments include development permit areas or covenants on the title of land adjacent to the ALR. These may specify the maintenance of buffers, siting of buildings, the water retention capacity of the development, and the disclosure of farm impacts (noise, dust, odours) to future buyers, among other things (Curran, 2005). In urban areas, land use or zoning policies may need to be adjusted to include farmer's markets as an allowed use. Municipalities can help support access and affordability of fresh, healthy food by facilitating gardening and agriculture in backyards, rooftops, vacant lots, parks, schools and boulevards.

Climate Change Policy in Practice

City of Langford:

- Specify plants for landscape design that produce food or herbs wherever possible in planters, hedges, shrub beds, or trellises. Utilize vertical and rooftop growing spaces for urban agriculture

District of Central Saanich:

- Allow and support the development of regular farmers' markets including small pocket markets in existing parking lots and public spaces
- Land abutting ALR land is to include a buffer strip. Any new development on lands adjacent to ALR lands may be required to provide berms, landscaped buffer areas, and/or fencing next to the property line between the farm and the non-agricultural use. The land use bylaw specifies setback requirements for residential development adjacent to lands in the ALR


Photo: White Rock OCP

Adaptation: Water

Many of the changes we are likely to see as a result of climate change will impact water availability in different ways. Smaller glaciers, declining snowpack, longer periods of drought, and shifting precipitation patterns are likely to lead to increasing water shortages in many regions of B.C. Changes to groundwater recharge rates will affect availability and temperature of aquifers, and sea level rise will also impact groundwater quality with the risk of saltwater intrusion (Walker & Sydneysmith, 2008). Demand management programs and enhanced water management strategies will be required at the local level.

As part of B.C.'s new green building code, stronger water efficiency standards have been set for new development and major renovations. Local governments are now authorized to realize these benefits by enforcing the code's provisions. This can be done in a straightforward manner through the building permit system. In addition, local governments now have the jurisdiction to apply development permit areas (DPAs) for the purpose of establishing water conservation measures (Rutherford, 2009). This tool could be used, for example, to require the use of rainwater collection systems for outdoor watering or irrigation, the installation of infrastructure to allow the reuse of treated water on a neighbourhood scale, or encourage grey water reuse strategies. A third power in the hands of local government is the ability to waive or reduce

development cost charges for "low impact developments", as defined by the municipality. This could include the installation of water-saving technologies that exceed the building code, or on-site rainwater management systems (Rutherford, 2009).

A number of demand management and regulatory strategies may also be employed at the individual or household level. For instance, many local governments have established a bylaw for time-of-day restrictions on certain types of watering and irrigation. User-pay systems are also effective strategies to shape consumer behaviour, and local governments may set up universal metering systems and consumption-based pricing to encourage the wise use of water (Rutherford, 2009).

Climate Change Policy in Practice

City of Coquitlam:

- Review existing water conservation initiatives and examine the feasibility of enhanced user pay programs to promote a fair and equitable citywide water supply

City of Langford:

- Adopt strategies that reduce water consumption and wastewater generation such as:
    - Outdoor technology (irrigation systems, xeriscaping, etc.)
    - Greywater reuse (toilet flushing, irrigation)
    - Rainwater Harvesting (irrigation, toilet flushing)
    - Dual piping systems for fire suppression and indoor residential usage.
- Implement incentives that promote the above strategies including:
    - FSR exclusions
    - Development Cost Charge restructuring
    - Density bonusing

District of Sooke:

- Require all new and re-development to implement on-site rainwater management, and surface treatment of rainwater, wherever possible
- Require municipal roads be designed to minimize impervious surfaces and manage rainwater within the right-of-way

Adaptation: Land Use

Extreme weather events and hazards are likely to increase as a result of climate change, including increased frequency and intensity of storms, forest fires, storm surges, coastal erosion, landslides, and floods (Walker & Sydneysmith, 2008). Together with projected sea level rise, these hazards present increased vulnerability for certain geographies, such as those in low lying or coastal areas, or those at the wildland-urban interface. Unfortunately, those areas that are most vulnerable are often most desirable for economic purposes, such as port or waterfront developments, or the use of fertile flood plains for agriculture (Burby, 1998). Communities generally prefer to use structural approaches such as dikes to keep risks at bay, as opposed to limiting development in hazardous areas. However, this becomes increasingly risky as climate change increases the variability of weather patterns and extremes become more difficult to predict. In the United States, two-thirds of national losses from flooding are a result of extreme events that exceed design limitations of engineered works (Burby, 1998). For this reason, Burby *et al*. (2000) assert that land-use planning is "the single most promising approach for bringing about sustainable hazard mitigation" (p.99).

Municipalities have many tools available for regulating development in hazardous areas, and secondary benefits may include the preservation of ecological services (as in the case of wetlands or floodplains) and the creation of public space and recreational facilities (Burby, 1998). Land use tools include: zoning ordinances to limit density or development in hazardous zones; aggressive setbacks from shorelines, streams or other risk areas; bylaws or regulations relevant to specific issues such as floodplains or wetland protection; boundaries for the provision of public works; the location of public facilities outside of hazard areas; urban containment boundaries' acquisition of development rights or easements; transfer of development rights away from the hazardous areas; preferential taxation for open space or reduced land-use intensity; impact taxes to fund added public costs for hazard area development; and the acquisition of land for recreational uses and hazard mitigation (Burby, 1998). While not related to hazards, land use practices should also be sensitive to available resources such as water. In rural areas reliant on

well water, densities and subdivision should be restricted to levels that can maintain water quality into the future (Parks, 2007).

Climate Change Policy in Practice

District of Highlands:

- Prohibit the construction of habitable buildings or septic tank fields within at least 30 metres horizontal distance from the high water mark of water features or within 15 metres of any flood hazard area

District of Mission:

- Prohibit development on lands subject to hazards where a report submitted by a qualified professional has not identified the land as being safe for the use intended

Adaptation: Built Environment

Over half of Canada's infrastructure is operated by local governments, and with infrastructure standards set by past experiences as opposed to future projections, there is much at stake with climate change (B.C. Climate Action Toolkit). Public assets such as parks, waterfronts, roads, bridges, dikes, sewers, water networks, and other facilities are at risk, as are private residences and commercial assets. Insurance companies have been requesting action on climate change for several years now, as climate variability has been increasing. One of the world's largest reinsurers, Munich Re estimates losses around several billion USD each year due to climate change, a figure that will continue to increase (Munich Re, 2009). A number of factors including increased population, concentration of wealth and climate change has caused global losses from natural disasters to increase 14 times between the 1950s and 1990s (B.C. Climate Action Toolkit).

While a land-use or locational approach is one way to minimize the impacts of climate change, a design approach to increase the resiliency of the built environment is appropriate in many cases. Low impact design, the minimization of impervious surfaces, green infrastructure, hazard-

resistant building characteristics and other similar design tactics can be integrated into both private development and public infrastructure. Municipalities may now encourage low impact developments through a waiver or reduction in development cost charges, and can enact development permit areas for water conservation, including the implementation of permeable surfaces or other green infrastructure features (Rutherford, 2009). Additionally, runoff control requirements, or a maximum allowable impermeable surface area per lot can be written into zoning bylaws. DPAs may also establish building characteristics such as freeboards or building heights for flood-prone areas, or roof materials for the wildfire interface.

Climate Change Policy in Practice

District of Sooke:

- Create minimum level, liveable area, building construction heights above the high water mark on waterfront properties in order to plan for increasing ocean levels as a result of global warming

City of Port Coquitlam:

- Require that all development in the floodplain comply with flood-proofing requirements, except where exempted

City of Langford:

- Plan and design green infrastructure systems in conjunction with "grey infrastructure" systems (roads, sidewalks, public gathering places, schools, etc.) as part of ongoing planning and development. This should occur through:
    - Integrated Watershed and Stormwater Planning and Management
    - Integration of greenways, city, regional and provincial parks
    - Stormwater, parks and environmental bylaw updates
    - Ongoing planning and development approvals processes

Financial Tools

Despite good intentions to implement climate action at the local level, financial constraints can impose limitations on the capacity of municipalities to act. Nevertheless, there are a number of financial tools that local governments can employ to finance their own initiatives as well as incentivize developers or community members to reduce their carbon footprints. For example, a

revolving green fund can finance projects that will lead to reduced operating costs, such as energy retrofits within government operations or the community at large. The cost savings are then paid back to the revolving green fund, where they are invested in further cost-saving sustainability projects (Sustainable Endowments Institute, 2011). User-pay strategies for goods and services such as water, waste collection, parking and road infrastructure can help generate funds and incentivize climate-friendly behaviour. DCCs can be used to incentivize energy efficiency, GHG reductions and water conservation (Rutherford, 2009).

Climate Change Policy in Practice

City of Langford:

- Use Local Improvement Charges (LIC) as a means to finance the capital costs of specific improvements to buildings on a cost-recovery basis. An LIC shows up as an additional line item on the property owner's municipal taxes. LIC's associate repayment of the cost of improvements over time with the property rather than with the building owner
- Implement revolving loan funds for promoting energy efficiency upgrades and renewable energy equipment as a means to improve energy-related performance and reduce related GHG emissions

Strengths and Limitations of OCPs

Integrating climate change targets and policies into OCPs (OCPs) is a powerful approach to ensuring all municipal decisions and development are aligned with climate change objectives. It is particularly relevant to embed climate action within OCPs for two primary reasons. First, they address the incredibly broad array of societal areas that can effect, or be affected by climate change. For instance, OCPs may include policy directions for land use and density, transportation, environmentally sensitive areas, parks and open space, public works, landscape and design guidelines, as well as social policies that affect vulnerability, such as housing, public amenities and services (B.C. Climate Action Toolkit). Using OCPs as a tool enables the level of comprehension and cross-cutting integration necessary for an issue as complex as climate change. Second, the OCP acts as the guiding vision for the municipality. It is adopted as a bylaw, and all further plans, policies and bylaws developed by the city must be consistent with it (Local Government Act, s. 884). As such, and because there is an arduous process to change an OCP

once adopted, using them as a vehicle for climate policy will help ensure its uptake and reach within the municipality over the longer term.

It is necessary to emphasize that establishing policy and plans for climate action is a critical first step, but will make little difference if implementation does not follow. There is, however, evidence to suggest that good planning is the first step toward meaningful climate action on the ground. Nelson and French (2002) undertook an insightful study that correlates plan quality with tangible outcomes; they showed that high quality hazard mitigation policies within comprehensive plans led to lower damage levels after the 1994 Northridge Earthquake in Los Angeles, California. It is hoped that similar outcomes will result from high quality adaptation planning, though it may prove difficult to isolate the climate impacts that are avoided through anticipatory planning. The outcome of effective mitigation planning may be easier to correlate though a longitudinal study of plan quality and GHG emission reductions over time.

British Columbian municipalities are in a unique position that is not easily replicated across other jurisdictions in Canada or the US; Bill 27, which mandates the inclusion of climate change targets and policies within OCPs is likely the key driver for the inclusion of climate change in community plans. It may also have had an incidental effect on the overall calibre of the plans, a phenomenon that was documented by Berke & French (1994), who found that state planning mandates have a significant positive effect on plan quality. In terms of relevance for this analysis, it is expected that the provincial mandate to include climate change mitigation targets and policies within OCPs will lead to stronger results in the goals and policy sections of the plans than in the fact base and implementation sections. It is also hypothesized that the mandate will have an effect on the range of climate policy included in plans. It is anticipated that the fact base, goals and policies related to climate change mitigation and GHG reduction will be considerably more represented in plans than those related to reducing foreseeable impacts, as adaptation is outside the scope of the mandate.

Research Rationale

Inevitably, climate change mitigation and adaptation will continue to grow as a central theme for planning across all of Canada. Through the government initiative that is being undertaken in British Columbia, there is an incredible opportunity to examine the production of climate change policy and plan-making early on. With a head start, B.C. can ensure that a high-quality

precedent is set, and that as governments across Canada and the US begin to integrate climate change into their local planning frameworks, they can look to B.C. as an exemplar of comprehensive, integrated climate planning. As a first step in this analysis, this research asks:

- What are the key elements that should be integrated into an OCP to effectively guide climate action at the local level?
- How many OCPs in the Metro Vancouver, Fraser Valley, and Capital Regional Districts have an explicit focus on climate change?
- How well is climate change currently being addressed through OCPs in B.C.'s most populous regions?
- What are the key areas that municipalities could improve to strengthen climate change planning within OCPs?

This research aims to contribute to the growing body of literature that looks at plan quality as well as provide accessible analysis and direction for practicing planners who are looking to embed climate action within land-use planning processes.

Research Methodology

Overview

Plan quality studies using content evaluation methodology has become a common research approach, particularly in the United States. Over the past decade, researchers such as Norton (2008) have used content evaluation to assess the quality of comprehensive plans in the United States. Many more have built upon this foundation to analyze the integration of substantive issues such as ecosystem management (Brody, 2003), sustainable development (Berke & Manta-Conroy, 2000), and natural disaster mitigation (Nelson & French, 2002) within these plans. The output of this type of research is highly relevant to planners and policy-makers, who are able to derive a framework or glean important plan elements when developing their own policy documents.

To date, no research has been published that considers general plan quality in Canada, though an evaluation of OCPs is currently underway in British Columbia (Stevens, under review).

Furthermore, there are no studies that have examined the integration of climate change into comprehensive or OCPs in the United States or Canada; however, Tang *et al.* (2010) and Basset & Shandas (2010) have both examined the quality of climate change action plans, which greatly influenced the evaluation protocol for this research.

The Evaluation Protocol

The plan quality literature has established a convention of using five general categories to define high quality plans:

- Fact basis
- Goals
- Policies
- Inter-governmental coordination and capabilities, and
- Implementation

Within each of these categories, appropriate indicators are developed against which to measure the plan. In the framework developed for this research, inter-governmental coordination and capabilities was deemed to be an important component of implementation and was grouped accordingly; as a result, a four-category framework was used.

The first of these categories, the fact basis for climate change, would be expected to include background or contextual information about the causes of climate change, its relevance as a global and local issue, and an explanation of the legislative context with reference to Bill 27's OCP requirement. The fact basis should also refer to an emissions inventory, which would provide data on the community's particular climate change drivers, an emission trend forecast for business as usual or alternate scenarios, and identify the key impacts and community vulnerabilities. The goals category of the protocol expects short and long term GHG reduction targets, objectives related to both government and community emissions, and goals specific to climate change adaptation. The policy component of the plan should set forth binding policy and programs in each of the areas discussed in the *Opportunities to Act for Local Government* section above (pp. 12-26), and relate these areas to climate change emissions or projected impacts. The derivation of these policy areas and the different dimensions of policy quality are described in more detail below. Finally, the implementation category includes indicators for incorporating

measurable objectives, a strategy for monitoring, the delegation of roles and responsibilities, priority setting, inter-organizational coordination, and establishing cost estimates or a budget commitment. Plans should also refer to current or future mitigation or adaptation plans for more detailed implementation. An outline of the specific indicators for each category can be found in Appendix 1.

The protocol framework described above is largely derived from the research on climate change action plans undertaken by Tang *et al.* in 2010. This recent work deviates from the conventional categorization used by plan quality studies, and uses a framework that groups indicators into "awareness", "analysis", and "action" classifications. The sub-categories within their framework (communication, financial tools, land use, transportation, energy, waste, resource management, and implementation) and many specific indicators were selectively chosen and re-categorized to fit within the framework for this research, defined by fact basis, goals, policies and implementation. The indicator set informed by Tang *et al.* (2010) was supplemented through a broader literature review that addressed considerations for mitigation and adaptation planning and implementation (Parry *et al*, 2005; Smit *et al*, 2000; Burton et al, 2004; Kane & Shogren, 2000).

Several revisions were made from the policy areas addressed in the climate-focused protocols developed by Tang *et al.* (2010) and Basset & Shandas (2010). First, "land use" was divided into two categories: efficient land use (mitigation) and land-use strategies for hazard reduction (adaptation). Three adaptation-oriented policy areas were also added: built environment for hazard reduction, food/agriculture and water. Moreover, whereas Tang *et al.* (2010) set a number of specific indicators under each policy area, (for example, each plan was evaluated based on the inclusion of three policies related to resource management: a) the creation of conservation zones, b) watershed-based and ecosystem-based land management, and c) vegetation protection), the framework used in this research was more sensitive to variation in risks and strategies available to local governments. Given the example above, a score would be awarded for resource management if they had any one of these policies. This was particularly important given the evaluation was of OCPs, which, given the broad array of issues they must address, aren't expected to be as detailed as climate action plans.

To ensure that plans were acknowledged for making modest steps toward climate planning, while further rewarding those that were more comprehensive or ambitious, indicators in each category were awarded points in the following manner:

- Fact basis: 0 = not mentioned; 1 = mentioned generally; 2 = specific/detailed
- Goals: 0 = not mentioned; 1 = mentioned
- Policies: 0 = not mentioned; 1 = suggested in plan; 2 = mandatory in plan
- Implementation: 0 = not mentioned; 1 = mentioned

Furthermore, an additional indicator within the policy category awarded a point when climate change was acknowledged in connection with that policy area. For instance, a plan was able to get points for transportation if it mentioned transit or active transportation strategies or infrastructure, if it supported transit-oriented development, or if it included parking standards adjustments. If any of these policies were mandatory it would receive a second point. If transportation was mentioned in relation to climate change or energy use, an additional point could be awarded. This measurement was useful as an indicator of climate literacy, and assessing which policy areas were understood to be causing or impacted by climate change.

Plan Selection

OCPs from 25 different municipalities were evaluated using the protocol described above. All plans were available online as public documents. The initial sampling frame included all 40 plans from the Fraser Valley Regional District, Metro Vancouver, and the Capital Regional District. These three regional districts were chosen because they are the most populous regions in British Columbia, and overall are likely to have larger planning departments with greater capacity for examining contemporary issues such as climate change. In addition, the plan quality research on B.C. municipalities that is currently being undertaken by Dr. Stevens evaluates plans from these 3 regional districts, providing an opportunity to build upon existing research now and in the future.

From the initial sampling frame, plans were chosen that either had a section or subsection on climate change, and/or had emission reduction targets within the plan. The City of Vancouver was excluded because it does not have an OCP. Of the remaining 39 plans from the 3 regional districts, 25 had an explicit focus on climate change, either through a dedicated section or

specified GHG reduction targets. The degree of integration varied widely between plans; dedicated sections on climate change ranged from a paragraph to numerous pages. Some plans integrated climate change framing and policy within all or most of their policy sections, whereas others referenced climate change strictly within its own subsection. The 14 plans that were excluded from evaluation were likely to have scored particularly low in many sections of the protocol, namely fact base, goals and the "climate change acknowledged" indicators within the policy category.

Plan Evaluation

The content evaluation process involved two researchers who coded each plan independently to reduce personal bias and increase reliability. Prior to evaluating the 25 plans, three test plans outside of the sampling frame were coded to ensure familiarity with the protocol and consistency between the researchers. Over 80% agreement was achieved on each of these plans. Throughout the coding process, the researchers met regularly to resolve disagreements and ultimately came to consensus on each code, which made up the final score for each plan. Each of the 25 plans achieved over 80% agreement on the indicator scores assigned by the two researchers. In the analysis stages, three individual indicators were removed because they had less than 80% consistency, leaving a total of 55 indicators within the protocol.

While an overall plan score was assigned, the emphasis within the analysis was on the comparison of the independent categories (fact base, goals, policies, implementation) to minimize the subjective weighting of inter-category indicators. It was deemed more accurate and a best practice within the literature to compare plans by category as opposed to assigning a final score and ranking plans in that manner.

Findings and Discussion

Analysis by Plan and Category

To contextualize the results, the "perfect plan" as it relates to climate change integration would include relevant background information including an overview of the science and the municipal emissions and vulnerability context, goals and targets related to adaptation and mitigation, policies across the full scope of GHG emission areas and community vulnerability, and key

measures for implementation such as monitoring, prioritization, and assigned roles and responsibilities. In addition, a plan that achieved 100% would use strong language and would clearly delineate the relationship between policy areas and climate change.

As summarized in Table 1, the mean score for plan quality was quite low at 44%. This score is derived from weighting each of the four category areas equally, which of course assumes they contribute equivalently to overall quality. The non-weighted average (in which policy accounted for nearly half the indicators) was 49%, or 26.8 out of a total possible score of 55. The lowest overall score received by any plan was just 12 out of 55 indicators, or a weighted score of 9.7%. The highest overall score was 38 of 55 indicators, or a weighted score of 59.5%. Clearly, there is considerable variation in the extent to which climate change is being included within OCPs, as well as the areas of strength and weakness, which is explored through the results in each category below. For a full account of plan scores, see Appendix 2.

Table 1: Summary of total quality and plan performance

Category	Number of Variables	Lowest Score	Highest Score	Mean	Minimum Frequency (/25 plans)*	Maximum Frequency (/25 plans)*
Fact Base	10	0%	60.0%	29.0%	0	15
Goals	6	0%	83.3%	55.0%	4	22
Policy	31	29.0%	87.0%	58.0%	1	25
Implementation	8	0%	62.5%	34.0%	2	21
Overall Score (Weighted)	**55**	**9.7%** (Lions Bay)	**59.5%** (Sooke)	**44.0%**		

**Frequency refers to how many of the 25 OCPs achieved indicators within each category. The minimum frequency refers to the indicator within that category that was fulfilled by the fewest plans (for instance, a minimum frequency of 4 means at least 1 indicator was achieved by only 4 of 25 plans). Maximum frequency refers to the indicator within that category that was fulfilled by the most number of plans (for instance, a maximum frequency of 15 means that the most highly integrated indicator was achieved by 15 out of 25 plans).*

Of the four category areas, fact base received the lowest assessment, with plans achieving a mean score of 29%, or 2.9 out of 10 fact base indicators. The lowest scoring indicator was the inclusion of details on the community's vulnerability to climate change, and this was not achieved by any plan (minimum frequency). The highest scoring indicator in this section was the foundational framing of climate change as an issue facing the local or global community, and was achieved by 60% of the plans (maximum frequency). This suggests that the rationale for including climate change within OCPs is not well communicated or perhaps not well understood

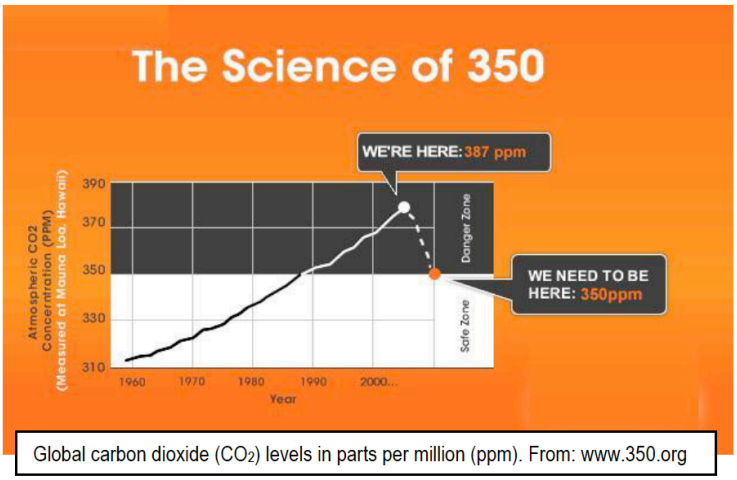
by the communities themselves. The fact base category had a 60% range, with some plans including no relevant background information on climate change, and others achieving up to 60% of the assigned indicators.

Colwood, Saanich and Maple Ridge received the highest scores for the fact base category, each including 6 out of the 10 indicators. Each showed that providing the context and background information on climate change does not need to be onerous, but can be integrated in a succinct and powerful way so that all readers are provided with a common understanding of the issues.

"Climate change is a global, national, regional, and local challenge. The local impacts of climate change have so far been relatively modest. However, significant large-scale impacts are expected in the form of increased precipitation, higher temperatures, rising sea levels, increased extreme weather events, and more weather variability. The release of GHGs, such as carbon dioxide from fossil fuel consumption and methane, along with deforestation are regarded as the primary causes of human induced global warming. Local governments need to be prepared for and adapt to these changes, and work to mitigate and eliminate local and regional emissions that contribute to climate change."

– Saanich OCP, page 18

Right: The Science of 350 parts per million as included in Colwood's OCP.



Global carbon dioxide (CO_2) levels in parts per million (ppm). From: www.350.org

"For the District of Maple Ridge, predicted weather trends due to climate change include warmer, wetter winters and drier summers. Wetter winters increase the risk of flooding in low lying areas, and landslides on hilly terrain as the average duration of precipitation events increases, and as soils become saturated and more unstable. Warmer winters lead to lessened snowpack cover which reduces the quantity of available water during drier months, thus exacerbating the problems associated with drier summers. Drier summers in the Lower Mainland are associated with a reduction in air quality, as particulates become trapped in an inversion layer and accumulate over successive days during a heat spell. The risk of forest fires also increases as vegetation and soils lose moisture."

- Maple Ridge OCP, Chapter 5, page 18

The goals category received the second highest score and had the widest range, with some plans including no goals or targets related to climate change, and others including 5 out of 6 goal indicators. Communities received an average of 55%, or 3.3 out of the 6 goal areas. The higher level of inclusion relative to fact base and implementation may be a result of the mandate to include targets and policies within OCPs. The lowest scoring indicator was the inclusion of specific goals related to adaptation, which was only achieved by 4 of the 25 plans. Surprisingly, not all plans included targets for GHG reduction, a requirement of Bill 27. 68%, or 17 of the plans included short-term (2025 or earlier) emission reduction goals, and 40% included long-term goals (2026 or later). Most plans had goals related to both government and community emission reductions, at 88% and 84% of plans respectively.

Central Saanich and Sooke received the highest scores for the goals category, each incorporating 5 out of the 6 goal indicators. Their shared strength was using climate change and sustainable development as an important framing issue for the plan in its entirety. For Central Saanich, climate change was embedded in their OCP's long-term vision, fundamental philosophy statement, and was identified as a core principle guiding the planning framework. Sooke tended toward sustainability as an organizing principle, which was well integrated through all sections of the plan.

"This plan explicitly acknowledges and addresses the causes and impacts of climate change by committing to the reduction of green house gas emissions in the community, and by adapting to the impacts of climate warming."

- Central Saanich OCP, page 1

"By 2012, the District of Sooke shall cut GHG (GHG) emissions significantly from municipal/community operations and community-wide initiatives with investments in environmental infrastructure, sustainable transportation infrastructure, food security infrastructure, and reductions in GHG emissions through sustainable land use planning and promoting leadership in conservation initiatives. [Sooke will] reduce GHG emissions to 20% below 2006 levels by 2012, 33% below 2006 levels by 2020. The District of Sooke municipal operations shall be reduced to a carbon neutral status by 2012."

- Sooke OCP, page 29

The policy category received the highest score, with plans achieving an average of 17.9 out of 31 policy indicators, or 58%. The relatively high assessment may be influenced by the mandate to

include climate change policies within OCPs, but is likely also higher due to the existence of "climate-friendly" policies that communities have in place for other reasons (for example, support for alternative transportation to reduce congestion). Policy was also the only category in which all plans achieved at least some indicators. The weakest plan attained 9 out of 31 or 29% of the policy indicators, and the strongest plan had 27, or 87%. The lowest scoring policy indicators were both related to the explicit acknowledgement of climate change in relation to the risk from hazards, and the use of built environment and land use policy levers to minimize associated risks. The highest scoring indicators were transportation and energy policies, which were included in all 25 plans. Variation in the frequency with which climate-related policies were included in OCPs may be due to a lack of understanding with regard to climate change drivers and associated policies, limited municipal jurisdiction, or the perception that certain policies are outside the scope of the mandate (in the case of adaptation).

Sooke scored the highest of the municipalities on the policy category, and included 27 out of 31 indicators. Not only did the OCP address climate change across the full spectrum of policy areas, it tended to use mandatory language and policy areas were generally identified in relation to climate change drivers or impacts.

"Develop administrative procedures for a Sooke sustainable purchasing policy/guide (green procurement). Extend procurement policy beyond purchasing to other aspects of District business, such as no bottled water, paperless agendas, 100% post consumer recycled paper and toilet paper, green cleaning supplies and cleaning services, local purchasing of supplies and organic food where possible, and green District events and community events;

Create a neighbourhood energy utility through partnerships with the private sector, using biomass or heat recovery from the sewer system."

- Sooke OCP, page 31

The implementation category received a relatively low score, with 34% or 2.7 out of 8 indicators being included on average. Some plans did not include any considerations for implementation, and the most any plan received was 5 out of 8 indicators, or 62.5%. Implementation is an important consideration in any plan, and this analysis indicates that there is considerable room for improvement across municipalities. The lowest scoring indicator was the provision of cost

estimates for climate change actions and/or a budget or financial commitment to implement certain programs. The highest scoring indicator was related to inter-organizational coordination on 3 or more policies or actions.

Mission and White Rock demonstrated relative strength in the implementation category and each incorporated 5 out of 8 indicators. Both plans were among the few OCPs that developed a framework for implementation that included, as a minimum, key action items, a timeframe or priority rating, and the lead role for each policy. Mission's OCP also included the deliverable or key reference document for each action item.

Policy	Key Action Item	Time Frame				Lead Role
		Short (1-2 yrs)	Medium (3-4 yrs)	Long (5+ years)	Ongoing	
4.2.10	Provide and protect riparian buffers adjacent to watercourses.				X	DS, MO
4.2.13, 7.2.5	Continue working with Metro Vancouver to develop a regional integrated stormwater management plan.				X	MO
4.2.17	Develop a Green Building Strategy (GBS).	X			X	DS
4.2.17	Develop a sustainability checklist.	X				DS

Above: An excerpt of White Rock's action plan for implementation (pages 51-56)

Inclusion of Mitigation vs. Adaptation

Unsurprisingly, mitigation was addressed more than adaptation across all categories. The most strongly represented category was within policy, where indicators related to adaptation were, on average, included within plans 50% of the time. This compares to mitigation-related policies being included 67% of the time. In many cases, policy areas that relate to adaptation, such as resource management or land use policies to reduce the risk of hazard are likely to be included in plans to some extent, regardless of adaptation being identified as a key concern for the community. The relatively low representation of adaptation indicators in the fact base category (16%) and the goals category (26%) suggests that communities are generally not at the point of

addressing climate change adaptation as a major issue within their community, or ready to streamline it within policy. The sole indicators specific to mitigation and adaptation within the implementation category were the existence or intention to develop mitigation and adaptation plans. This is further reinforced by findings for the implementation category; 56% of plans either had developed or were planning to develop a mitigation plan, whereas this was true of only 12% of communities for adaptation.

Table 2: Inclusion of Mitigation vs. Adaptation Indicators

		Number of Indicators	**Minimum Frequency**[**]	**Maximum Frequency**[**]	**Mean Frequency in Plans**[**]
Fact Base	Mitigation	4	4%	44%	29%
	Adaptation	4	0	24%	16%
Goals	Mitigation	4	40%	88%	70%
	Adaptation	2	16%	36%	26%
Policy[*]	Mitigation	18	12%	100%	67%
	Adaptation	15	8%	96%	50%
Implementation	Mitigation	1	-	-	56%
	Adaptation	1	-	-	12%

[*]*Two policy areas (resource management and agriculture) are relevant for both mitigation and adaptation and are included in tallies for both policy orientations*

[**]*Frequency refers to how many of the 25 OCPs achieved indicators related to mitigation or adaptation within each category. The minimum frequency refers to the indicator within that category that was fulfilled by the fewest plans (for instance, a minimum frequency of 4% means at least 1 indicator was achieved by only 1 of 25 plans). Maximum frequency refers to the indicator within that category that was fulfilled by the most number of plans (for instance, a maximum frequency of 44% means that the most highly integrated indicator was achieved by 11 out of 25 plans). The mean frequency is the average number of plans that integrated indicators from each category. See Appendix 1 for indicators included in mitigation/adaptation categories.*

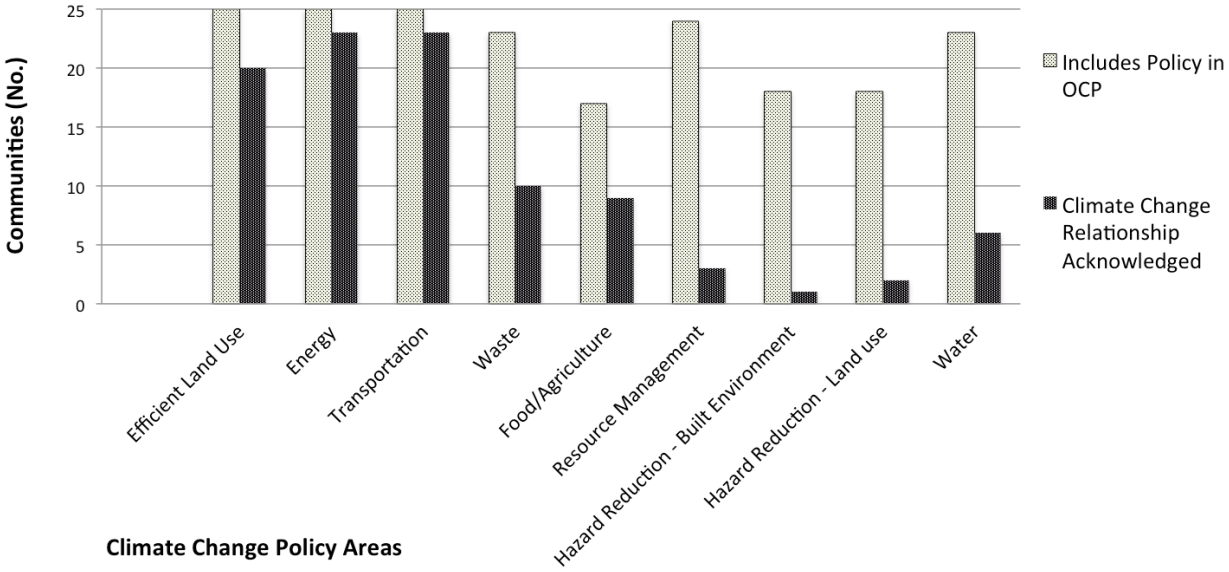
The high level of inclusion of mitigation-related indicators relative to adaptation is likely in part a direct response to Bill 27's mandate to include GHG reduction targets and policy within OCPs. There is no similar requirement for adaptation at this time. However, it may also be related to the established progression in which municipalities first address mitigation and then move on to addressing adaptation. Adaptation is still a relatively new field, with quickly evolving science, and risks and appropriate strategies not fully understood or developed. It is possible that streamlining adaptation within OCPs may become a norm, even without the help of a mandate as this field advances.

Policy Connections to Climate Change

Within the evaluation protocol, municipalities were awarded points if they had climate-supportive policy, regardless of whether they made an explicit connection to climate change. An additional point could be attained in each policy area if its relationship to climate change was acknowledged. Identifying policies within their relationship to climate change strengthens the rationale for action and is a reasonable indicator of a municipality's understanding and literacy around climate change drivers and impacts. For adaptation policies, an explicit consideration of climate change may mean a greater likelihood that the projected impacts are taken into consideration. For instance, municipalities are setting policy for land use to reduce the risk of hazard; however, outdated standards based on past hazard experiences are generally being used, as opposed to future projections that take climate change into account. For instance, Langley Township identifies the following policy: "In the unprotected areas of the Fraser River flood plain, namely Derby and East Langley, usage shall be limited to recreation and agriculture unless the said lands are filled to at least two feet freeboard above the highest 1894 flood level" (p. 27). While it makes sense to reserve flood-prone lands for recreational use, flood plain zones should not only consider past flood experiences, but incorporate sea level rise, increased frequency and intensity of storm events, changes to river flow as a result of warming and decreased snow pack, and non-climatic shifts such as sedimentation and land elevation due to tectonic movements.

As illustrated in Figure 4, 92% of plans made the connection between both energy and transportation issues and climate change, suggesting that the relationship is well understood and widely accepted. Efficient land use was also acknowledged as related to climate change mitigation in most plans. Recognition of waste and agriculture's contribution to climate change was less common and found in fewer than half the plans. The use of resource management as an important carbon sink was cited the least in relation to climate change mitigation and was included in only 12% of plans, despite resource management being one of the most common policy areas and included in 96% of OCPs.

Figure 4: Acknowledged Connection of Climate Change to Policy Areas in 25 OCPs



Adaptation-related policies, particularly resource management, land use, and built environment were cited considerably less in relation to climate change than mitigation policies. This is a concern, particularly for hazard reduction policies as it implies that science-based climate change forecasts and increased uncertainty may not be accounted for in current design standards. For the food/agriculture and resource management policy areas, differentiation was not made between whether the community acknowledged the policy in relation to mitigation or adaptation specifically. These 2 areas may have been connected to climate change either for their capacity as carbon sinks, or for their relation to adaptation. Of "purely" adaptation policies, water was acknowledged in relation to climate change most frequently, though only 24% of communities made this connection.

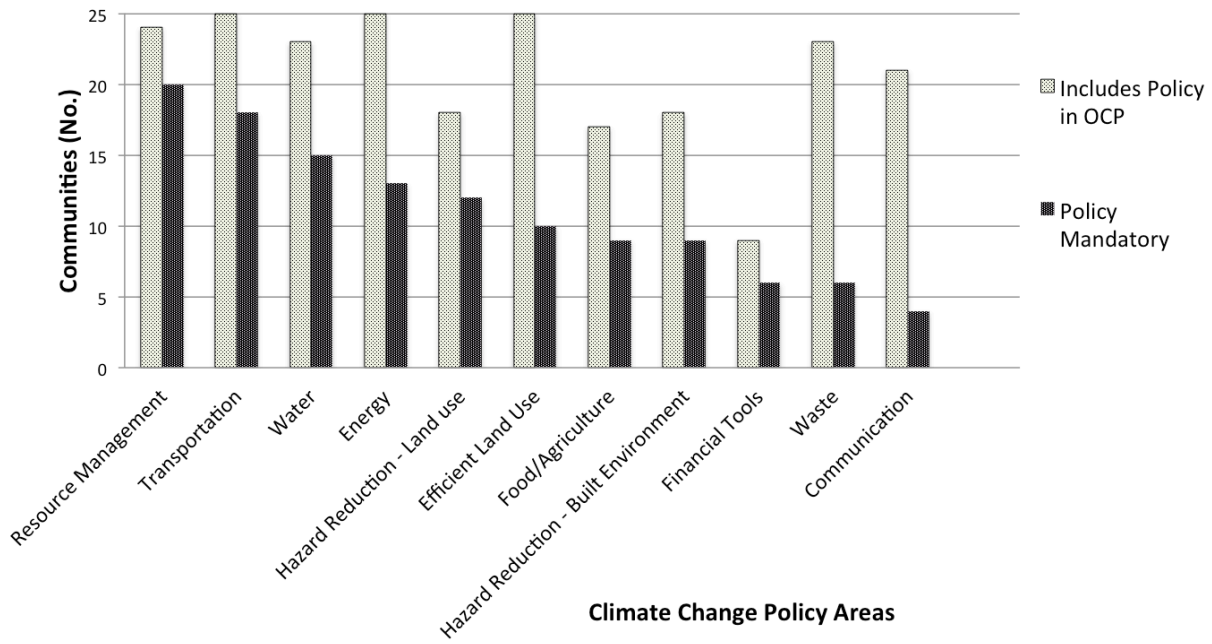
Strength of Climate Change Policy

One measure of policy strength and plan quality is the nature of the language that is used. Policies that employ mandatory language such as "require", "shall", or "will" as opposed to "encourage", "support", or "should" are deemed to be more robust. Municipalities retain flexibility, as they are not legally obligated to implement specific actions or projects within their OCPs, regardless of the language. However, once adopted, all plans, bylaws and public works must be consistent with the OCP, and the plan acts as a guiding document on which to base municipal decisions. Mandatory language is therefore one manner in which to guard against

differing interpretations, and ensure that development reflects a strong vision and set of goals for the municipality.

Policies supporting climate change mitigation and adaptation were, on average, included in 83% of the OCPs that were reviewed. Nevertheless, the plans contained climate-related policies that were mandatory only about 54% of the time. As shown in Figure 5, resource management policies were generally the strongest, most likely because they were written into development permit area guidelines, which usually have a more prescriptive format. Transportation policies were included in all 25 of the plans, and were mandatory in 72% of the OCPs. This relatively high proportion may be reflective of the fact that transportation policy and infrastructure is an area that municipalities have substantial authority over. On the other end of the spectrum, waste is an issue that largely falls within the jurisdiction of the regional districts and was mandatory in only 24% of the plans.

Figure 5: Frequency and Strength of Climate Policy in 25 OCPs



In some instances, a municipality does not have jurisdiction to include mandatory language, such as a policy for the use of organic practices in agriculture. In these cases, government may encourage or support the practice, but not require it. Nevertheless, there are many instances

where mandatory language would greatly increase the strength and quality of policies that local governments have the authority to implement or require. For example, "promote municipal buying practices that emphasize the procurement of recycled products over non-recycled products" (Delta OCP, p. 100) is a policy that could be far stronger through more specific and binding language.

Recommendations

Given the large disparity in the quality of plans, it would be useful for municipalities to have a set framework or guidelines for what should be included in their OCPs. These guidelines could be incorporated into the mandate itself. Berke & French (1994) found that while having a state mandate is positively correlated with plan quality, the calibre of the mandate is also an important determining factor. Mandates that provide specific requirements and quantifiable measures tend to result in more uniform adoption and implementation. Furthermore, the discretionary language that is used immediately releases municipalities from the responsibility of carrying out the vision and policies outlined in the plan. While not all policies that are found within OCPs are entirely within the jurisdiction of local government, certain norms regarding binding language should be established for those policies that are within their authority.

Within plans themselves, a number of specific areas could be strengthened in each category. The fact base was the weakest area, though it is critical for setting a clear and compelling motivation for action, as well as for ensuring that all the various audiences (the public, developers, city staff and planners, etc.) are on the same page with respect to the challenges and opportunities unique to that community. The background information on climate impacts and vulnerabilities affecting all sectors was particularly weak. There has been substantial support for capacity and knowledge building on adaptation from the province and organizations such as ICLEI in recent years, so hopefully this trajectory continues and it finds its way into the pages of OCPs in the near future. Municipalities need to be provided with the tools, scientific research and support to assess the risks of climate change as well as the opportunities and costs of action.

Within the goals category, a lot of variation existed for the baseline and target years set for GHG reduction goals in different plans. Ensuring standardization in this area would be a simple way to

enable the comparison of plans as well as simplify the monitoring process over time. Using the province's baseline of 2007 and target years of 2020 and 2050 would be an obvious choice.

For ensuring policies go further in addressing climate change, continued education on the drivers and impacts of climate change may help municipalities better frame and direct their policies to move a climate agenda forward. Policies must begin incorporating the science of climate change, and informing decisions such as the redrawing of flood plain maps or setting new standards for dikes or other physical hazard reduction features. The existing efforts for these types of examples may be grossly inadequate if climate change is not taken into account.

The implementation section was also quite weak for most plans, and undermines the accountability and integrity of the plan itself. The two plans that scored the highest on the implementation section demonstrated a useful framework that outlined key actions, priorities, timelines and responsible agencies for each policy. This kind of implementation framework should become the norm within OCPs.

Finally, and perhaps most importantly, this research suggests that a provincial mandate to include GHG reduction targets and policies in OCPs can go a long way to ensuring its integration. Given the liability municipalities face with greater impacts of climate change emerging, it would be sensible for the province to expand the current mandate to include goals, policies and actions for adaptation as a requirement of OCPs as well.

Future Research Opportunities

Explaining Variation in Plan Quality

The scope of this research is limited, and does not provide an exploration of the variables that affect plan quality. As Tang *et al*. (2010) point out, climate change is a complex process and may be influenced by differing jurisdictional frameworks, decision-makers' values and experiences, access to information resources, and familiarity with alternatives. The research undertaken by Tang *et al*. (2010) uses three categories of independent variables to explain variation: capacity

variables, climate risk variables and emission stress variables. Future research could examine the following factors that may influence plan quality:

Capacity Variables:

- Number of planners per agency
- Education attainment level
- Tax revenue per capita

Climate Risk Variables:

- Population density
- Distance from coast
- Urban/rural classification
- Historic hazard damage

Emission Stress Variables:

- Emissions per capita
- Average commuting time
- Alternative transportation mode share

In general, it would be expected that as the capacity within a municipality increases, the depth, breadth and overall quality of climate change planning within OCPs would also increase. It is anticipated that capacity would increase with a greater number of planners within the agency, a higher education attainment level within the population, and with higher tax revenue per capita. A second hypothesis is that those communities that face greater risks as a result of climate change are likely to have stronger plans. Therefore, communities that are closer to the coast, those with higher densities and those with high levels of historic hazard damage may have higher quality plans. Finally, it is possible that communities with greater emissions are more likely to have lower quality plans. These communities may rely on commercial or industrial economies that create high levels of emissions, or may retain a sprawling land use pattern that generates automobile dependence and is challenging to retrofit in the short to medium term. It is expected therefore, that high plan quality may be correlated with lower per capita emissions, shorter commuting times, or high levels of alternative transportation mode share.

Despite these hypotheses, some factors may confound the outcomes of the analysis. For instance, while higher education attainment levels may be a factor that increases capacity, knowledge and desire to act upon climate change, it is also likely to lead to a population with higher incomes and levels of consumption. As greater consumers, populations with a concentration of higher incomes are likely to create more GHG emissions, which would be expected to correlate with a reduction in plan quality. Given the complexity of these factors, a multivariate analysis would be recommended to control for influences such as income.

To further the analysis on plan quality variation, a larger sample size could be employed, perhaps evaluating all plans in B.C., or a sample from all regional districts. It would be interesting to compare plan quality among municipalities from different regional districts, and if there are statistically significant distinctions, to investigate the governance context that might lead to higher plan quality using a blend of both qualitative and quantitative analysis. While the integration of climate change into official community or comprehensive plans may currently be limited in other jurisdictions, a comparison across provinces or states may be warranted in the future.

Determining the Effect of Plan Quality on GHG Emissions

An underlying assumption of this research is that higher quality plans (in terms of climate change integration) leads to a greater likelihood of reducing emissions and diminishing the impacts of climate change. This assumption has been substantiated in research looking at the correlation between high quality hazard mitigation policies in comprehensive plans and damage levels after the 1994 Northridge Earthquake in California (Nelson & French, 2002). Nevertheless, given the differences in governance contexts as well as the issues themselves, research specific to climate change planning in B.C. would certainly be justified. A fascinating longitudinal study would be the correlation of high quality plans and GHG reductions over time. British Columbia is once again in a unique position to undertake this research, as all municipalities are responsible for tracking their emissions each year through a standardized framework. A similar study may be done specific to plan quality and adaptation, though this would be far more difficult to accurately measure. Adaptation is significantly more complex

given the uncertainty of alternative outcomes (for example, the future impacts avoided through present action) and the challenges with attributing climatic scenarios solely to climate change.

Defining the Influence of a Provincial Mandate on Climate Change Planning

Numerous studies within the U.S. have shown state mandates to be important indicators of plan quality (Nelson & French, 2002; Tang *et al.*, 2010; Berke & French, 1994). As Nelson & French (2002) point out, local governments may delay action because they fear losing development potential or are hesitant to make investments that neighbouring communities are not moving forward on. Mandates help to level the playing field, particularly for issues of local jurisdiction but of regional concern; for example, containing urban sprawl, conserving natural resources, delivering infrastructure efficiently, and of course, acting on climate change. Nevertheless, not every mandate is made equally. Berke & French (1994) determined that a number of structural and facilitating features define good quality mandates. Strong structural features include the clarity and stated importance of goals, the authority to coerce action within the mandate, and the level of simplicity associated with carrying out the directive. The facilitating features that define a good mandate include the presence of capacity building and support, commitment building with elected and appointed officials, the extent to which coercive measures are used in implementation, and the extent to which funding and resources are available from the state level. Mandates that include these features, and that have specific requirements and quantifiable measures tend to result in more uniform adoption and implementation (Nelson & French, 2002).

Given these considerations, an evaluation of B.C.'s climate change mandate would be a worthwhile endeavour to further aid in the explanation of plan quality variation. It would also be incredibly informative given that the mandate is on the cutting edge and no similar directive has been employed in other provinces or states. Furthermore, given the research findings on the effectiveness of mandates, and the potential liability for inaction on adaptation measures, a directive to include adaptation in OCPs may be a prudent next step for B.C. A deeper inquiry into what this kind of mandate might look like should be undertaken, drawing on the existing literature of high quality mandates as well as learning outcomes from B.C.'s mandate for mitigation policy.

Conclusions

Municipalities in British Columbia have taken a tremendous step forward in beginning to integrate climate change throughout OCPs, the guiding land use and planning document for local government. In doing so, they have an opportunity to set far-reaching, long-term policy that can reduce municipalities' corporate and community GHG emissions, as well as anticipate and plan for the impacts of climate change across all sectors. An evaluation of the OCPs in B.C.'s most populated regions has shown that there is large variation in the extent and quality with which climate change is being addressed. In general, municipalities are doing a reasonable job in setting goals and policies to move the climate agenda forward, but are failing to establish the legitimizing background information or strategies for implementation. Mitigation is integrated in a far more comprehensive fashion than adaptation, which is neglected across all categories. In many cases, plans establish climate-friendly policy, but do not make explicit the connection between climate change and the policy area, particularly for adaptation. Finally, the strength of climate policy within plans is compromised by weak language across many policy areas. As municipalities and other jurisdictions across North America increase their efforts toward climate action, B.C. communities will increasingly become the leaders from which to learn. This research may be used as a guiding framework for municipalities that are seeking to more deeply integrate climate change planning in cross-cutting policy, and for the provincial government to consider a broader mandate for climate change adaptation in OCPs.

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Appendices

Appendix 1: Analysis by Protocol Indicators

	Indicators	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement*	Frequency (/25 plans)	Percent
FACT BASE					**7.2**	**29%**
1	Climate Change Anthropogenic	If climate change is acknowledged as at least partially anthropogenic and/or the plan speaks specifically to the kinds of human activities that cause climate change	Not applicable	80%	12	48%
2	Climate Change as Issue	If climate change is framed as an issue facing the local or global community	Not applicable	88%	15	60%
3	Emissions Inventory - General	If there has been or will be an emissions inventory conducted	M	88%	11	44%
4	Emissions Inventory - Specific	If the results of the inventory is broken down by sector and/or current per capita emissions are provided	M	88%	6	24%
5	Emissions Trend Forecast - General	If the plan mentions an emissions forecast has been or will be conducted (business as usual OR for emission reductions)	M	96%	1	4%
6	Impacts of Climate Change - General	If the plan states there will be impacts of global climate change or names broad areas where impacts might be expected (ex. Sea level rise, increasing temperatures, increased storms)	A	100%	6	24%
7	Impacts of Climate Change - Specific	If the plan identifies the expected impacts specific to the municipality.	A	92%	6	24%
8	Legislative Context	If the plan makes reference to Bill 27 and the mandate to include climate change in the OCP, reduce municipal emissions or reduce community emissions within that bill.	M	92%	11	44%
9	Vulnerability Assessment - General	If the plan mentions certain geographic areas, demographic populations or industries that will be disproportionately affected and/or has or will complete a vulnerability assessment as part of an adaptation/ climate change plan	A	92%	4	16%
10	Vulnerability Assessment - Specific	If the plan gives more detail on 1 or more key vulnerability indicators and how it will affect the vulnerability of the population (ex. Access to resources, wealth, inequality within a population, degree of communal resource allocation, degree of risk sharing, income diversification, institutional context)	A	100%	0	0%

**Percent coding agreement is a measure of consistency and refers to the number of plans in which the 2 researchers attributed the same score. An 80% agreement means that 20 of the 25 plans received the same score for that indicator by both researchers.*

	Indicator	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement*	Frequency (/25 plans)	Percent
GOALS					**13.8**	**55%**
1	Adaptation - General	If the plan has broad goals related to adaptation or reducing vulnerability to climate change	A	80%	9	36%
2	Adaptation - Specific	If the plan has specific goals related to adaptation or reducing vulnerability to climate change (ex. reducing development in hazard areas)	A	84%	4	16%
3	Community Emissions	If there is at least 1 goal, policy or target that is explicitly related to reducing community emissions	M	80%	21	84%
4	GHG Emissions - Long Term	If there are long-term (later than 2025) targets for GHG emission reductions (note: a base year must be identified)	M	100%	10	40%
5	GHG Emissions - Short Term	If there are short-term (2025 or earlier) targets for GHG emission reductions (note: a base year must be identified)	M	96%	17	68%
6	Government Emissions	If there is at least 1 goal, policy or target that is explicitly related to reducing government emissions	M	96%	22	88%

**Percent coding agreement is a measure of consistency and refers to the number of plans in which the 2 researchers attributed the same score. An 80% agreement means that 20 of the 25 plans received the same score for that indicator by both researchers.*

	Indicator	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement*	Frequency (/25 plans)	Percent
POLICIES					14.4	58%
1	Communication	If the plan includes at least 1 policy for public communication, behaviour change, education or participation on climate issues	Not applicable	80%	21	84%
2	Communication - Mandatory	If at least 1 communication policy is written in mandatory language ("will", "shall", "require")	Not applicable	84%	4	16%
3	Efficient Land Use	If the plan includes at least 1 policy for efficient/ compact land use (ex. mixed use/compact development, infill, brownfield development, control of urban service/growth boundaries)	M	88%	25	100%
4	Efficient Land Use - Climate Acknowledged	If the connection between efficient land use and climate change, energy use or GHG emissions is made explicit.	M	84%	20	80%
5	Efficient Land Use - Mandatory	If at least 1 land use policy is written in mandatory language ("will", "shall", "require")	M	84%	10	40%
6	Energy	If the plan includes at least 1 policy for energy reduction strategies (ex. renewable or solar energy, energy efficiency or energy star, green building or energy efficiency standards)	M	96%	25	100%

	Indicator	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement*	Frequency (/25 plans)	Percent
7	Energy - Climate Acknowledged	If the connection between energy and climate change or GHG emissions is made explicit.	M	80%	23	92%
8	Energy - Mandatory	If at least 1 energy policy is written in mandatory language ("will", "shall", "require")	M	80%	13	52%
9	Financial Tools	If the plan includes at least 1 policy for financial mechanisms to incentivize action or collect revenue for capital projects (ex. GHG reduction fee, carbon/gas tax, development cost charges, offsets or funding for GHG reduction projects)	Not applicable	80%	9	36%
10	Financial Tools - Mandatory	If at least 1 financial policy is written in mandatory language ("will", "shall", "require")	Not applicable	88%	6	24%
11	Food/ Agriculture	If the plan includes at least 1 policy for food security or agriculture (ex. conservation of agricultural lands, support programs for farmers, support for organic farming, CSAs, community gardens or farmers' markets)	M/A	92%	17	68%
12	Food - Climate Acknowledged	If the connection between agriculture and climate change, energy or GHG emissions is made explicit.	M/A	92%	9	36%
13	Food - Mandatory	If at least 1 food policy is written in mandatory language ("will", "shall", "require")	M/A	80%	9	36%
14	Hazard Reduction - Built Environment	If the plan includes at least 1 policy for hazard reduction through the built environment (ex. hazard-resistant building code, low-impact design for impervious surfaces, green building/green infrastructure, retrofitting existing infrastructure)	A	80%	18	72%
15	Hazard Reduction - Built Environment - Climate Acknowledged	If the connection between hazards and climate change, energy or GHG emissions is made explicit.	A	84%	1	4%
16	Hazard Reduction- Built Environment - Mandatory	If at least 1 built environment policy is written in mandatory language ("will", "shall", "require")	A	84%	9	36%
17	Hazard Reduction - Land Use	If the plan includes at least 1 policy for hazard reduction through land use planning (ex. location of development to reduce risk, alternative uses for hazard-prone areas, land acquisition strategies)	A	80%	18	72%
18	Hazard Reduction - Land Use - Climate Acknowledged	If the connection between hazards and climate change, energy or GHG emissions is made explicit.	A	96%	2	8%
19	Hazard Reduction - Land Use - Mandatory	If at least 1 land use policy is written in mandatory language ("will", "shall", "require")	A	80%	12	48%

	Indicator	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement*	Frequency (/25 plans)	Percent
20	Resource Management	If the plan includes at least 1 policy for resource management (ex. creation of conservation zones/protected areas, watershed- or ecosystem-based land management, vegetation protection)	M/A	96%	24	96%
21	Resource Management - Climate Acknowledged	If the connection between resource management and climate change, energy or GHG emissions is made explicit.	M/A	92%	3	12%
22	Resource Management - Mandatory	If at least 1 resource management policy is written in mandatory language ("will", "shall", "require")	M/A	80%	20	80%
23	Transportation	If the plan includes at least 1 policy for transportation (ex. alternative transportation strategies, transit-oriented development, parking standards adjustment)	M	100%	25	100%
24	Transportation - Climate Acknowledged	If the connection between transportation and climate change, energy or GHG emissions is made explicit.	M	80%	23	92%
25	Transportation - Mandatory	If at least 1 transportation policy is written in mandatory language ("will", "shall", "require")	M	88%	18	72%
26	Waste	If the plan includes at least 1 policy for waste reduction strategies (ex. zero waste targets, strategies to increase recycling or composting, waste management)	M	100%	23	92%
27	Waste - Climate Acknowledged	If the connection between waste and climate change, energy or GHG emissions is made explicit.	M	88%	10	40%
28	Waste - Mandatory	If at least 1 waste reduction policy is written in mandatory language ("will", "shall", "require")	M	92%	6	24%
29	Water	If the plan includes at least 1 policy for water supply/demand or conservation strategies (ex. water metering, greywater reuse, water restrictions, storm-water management)	A	92%	23	92%
30	Water - Climate Acknowledged	If the connection between water and climate change, energy or GHG emissions is made explicit.	A	96%	6	24%
31	Water - Mandatory	If at least 1 water policy is written in mandatory language ("will", "shall", "require")	A	88%	15	60%

**Percent coding agreement is a measure of consistency and refers to the number of plans in which the 2 researchers attributed the same score. An 80% agreement means that 20 of the 25 plans received the same score for that indicator by both researchers.*

	Indicator	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement*	Frequency (/25 plans)	Percent
IMPLEMENTATION					**8.5**	**34%**
1	Cost Estimates - General	If general cost estimates for GHG emission reductions and/or some financial or budget commitment is made	Not applicable	100%	2	8%
2	Inter-Organizational Coordination - Specific	If 3 or more climate related policies/actions have reference to inter-organizational or inter-governmental coordination OR if a few actions have detailed coordination procedures including timelines	Not applicable	80%	21	84%
3	Measurable Objectives	Is there at least 1 measurable objective (other than GHG emission reductions) related to climate change?	Not applicable	80%	7	28%
4	Monitoring - General	If 1-2 actions have timelines and actions for monitoring OR monitoring is referred to but in general terms	Not applicable	92%	12	48%
5	Priorities - General	If 1-2 actions are prioritized for action	Not applicable	92%	5	20%
6	Related Adaptation Plan	If the OCP makes reference to an adaptation plan that has been or will be developed by the community	A	92%	3	12%
7	Related Mitigation Plan	If the OCP makes reference to a mitigation, climate action, or energy plan that has been or will be developed by the community	M	84%	14	56%
8	Roles and Responsibilities - General	If 1-2 actions have departments, individual or other parties responsible for implementation assigned	Not applicable	80%	4	16%

**Percent coding agreement is a measure of consistency and refers to the number of plans in which the 2 researchers attributed the same score. An 80% agreement means that 20 of the 25 plans received the same score for that indicator by both researchers.*

Indicators removed due to low agreement (<80%)

Indicator	Description	Mitigation (M) vs. Adaptation (A)	% Coding Agreement	Frequency (/25 plans)	Percent
FACT BASE					
Concept of GHG Emissions	If GHGs are mentioned as a source of climate change; plan may identify different GHGs or the greenhouse effect.	Not applicable	76%	16	64%
GOALS					
Action on Climate Change	If the plan states broad intention or goals around reducing GHG emissions or taking action on climate change.	M	76%	20	80%
IMPLEMENTATION					
Integration into Other Plans - General	If the plan states intentions to update related plans, bylaws or processes to include climate change or overall OCP policies	Not applicable	68%	2	8%

Appendix 2: Analysis by Plan

				Category Score					
Municipality	**Year OCP Adopted**	**Year Last Amended**	**Regional District**	**Fact Base (/10)**	**Goals (/6)**	**Policy (/31)**	**Implementation (/8)**	**TOTAL (/55)**	**Normalized Score**
Central Saanich	2008	2010	Capital Region	5	5	22	2	34	57%
Colwood	2008	2009	Capital Region	6	3	21	3	33	54%
Highlands	2007	2010	Capital Region	3	4	18	2	27	45%
Langford	2008	N/A	Capital Region	5	4	21	2	32	52%
Oak Bay	1997	2010	Capital Region	3	2	9	0	14	23%
Saanich	2008	N/A	Capital Region	6	3	20	4	33	56%
Sidney	2007	2011	Capital Region	1	4	11	2	18	34%
Sooke	2010	N/A	Capital Region	3	5	27	3	38	59%
Victoria	1995	2009	Capital Region	2	4	11	4	21	43%
Abbotsford	2005	2010	Fraser Valley	4	4	23	3	34	55%
Harrison Hot Springs	2007	2010	Fraser Valley	1	3	13	3	20	35%
Mission	2008	2010	Fraser Valley	4	4	17	5	30	56%
Maple Ridge	2006	2010	Metro Vancouver	6	3	22	1	32	48%
North Vancouver (City)	2002	2010	Metro Vancouver	4	4	19	4	31	54%
Coquitlam	2006	2010	Metro Vancouver	1	1	13	3	18	27%
Delta	1985	2010	Metro Vancouver	1	3	18	3	25	39%
Township of Langley	1979	2010	Metro Vancouver	2	3	22	1	28	38%
Lions Bay	2008	2010	Metro Vancouver	0	0	12	0	12	10%
Pitt Meadows	2007	2010	Metro Vancouver	1	4	19	4	28	47%
Port Coquitlam	2008	2010	Metro Vancouver	2	3	17	2	24	37%
Richmond	1999	2010	Metro Vancouver	3	4	20	3	30	50%
Surrey	1996	2010	Metro Vancouver	1	4	21	3	29	45%
West Vancouver	2004	2010	Metro Vancouver	4	4	18	3	29	51%
White Rock	2008	2011	Metro Vancouver	0	2	14	5	21	35%
Port Moody	2000	unknown	Metro Vancouver	4	3	19	3	29	47%
AVERAGE				**2.88**	**3.32**	**17.88**	**2.72**	**26.8**	**44%**
				29%	**55%**	**58%**	**34%**		
MEDIAN				**3**	**4**	**19**	**3**	**26.8**	**44%**
RANGE				**0 - 6**	**0 - 5**	**9 - 27**	**0 - 5**		
				0-60%	**0-83.3%**	**29-87%**	**0-62.5%**		