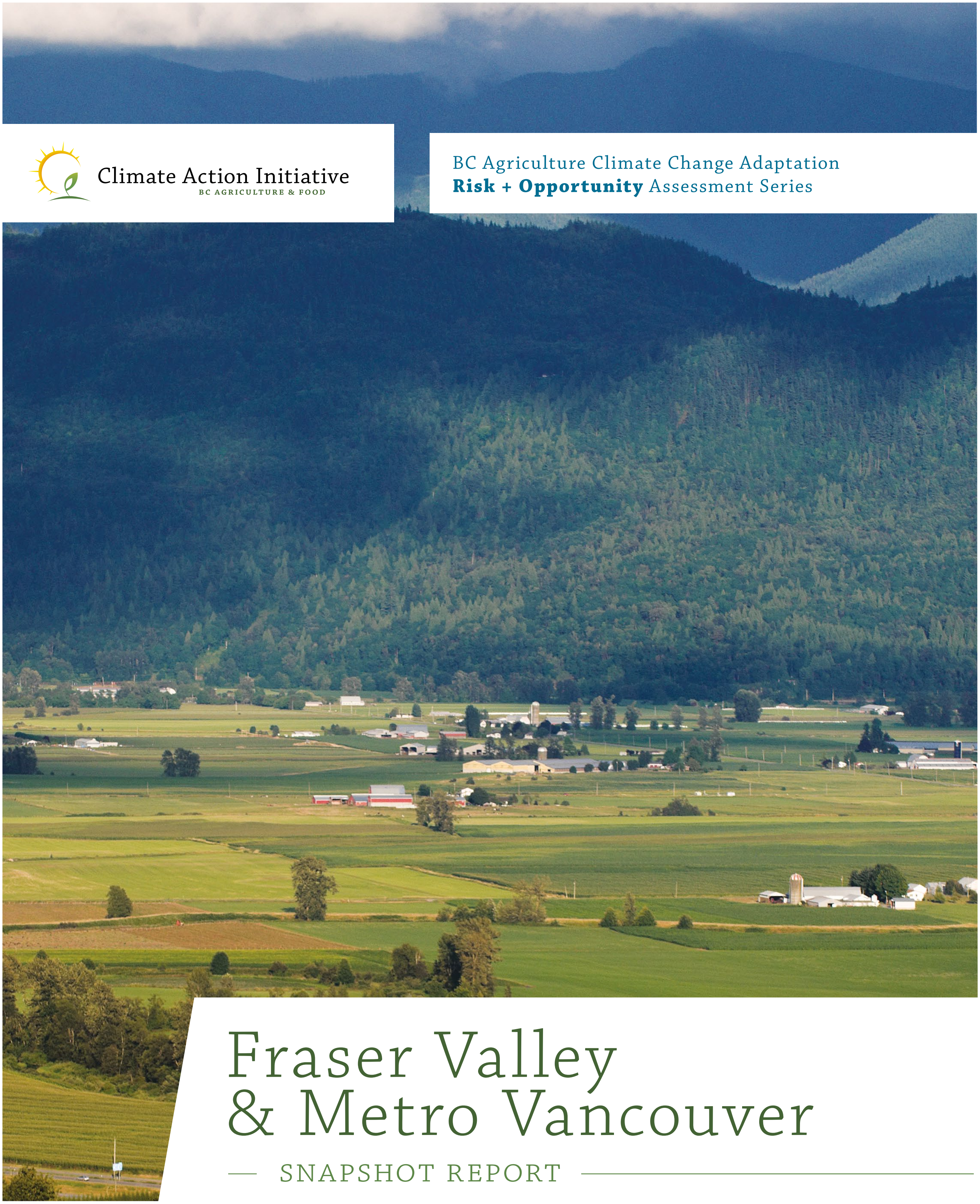
Climate Action Initiative
BC AGRICULTURE & FOOD

BC Agriculture Climate Change Adaptation
Risk + Opportunity Assessment Series



Fraser Valley & Metro Vancouver

SNAPSHOT REPORT

Climate Action Initiative
BC AGRICULTURE & FOOD

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Acknowledgements

This project has been initiated by the BC Agriculture Council's Climate Action Initiative (CAI) to address the priorities identified in the *BC Agriculture Climate Change Action Plan.* The Action Plan is intended to guide the agriculture sector in adapting to a changing climate and mitigating greenhouse gas emissions.

The Action Plan is available at:
www.BCAgClimateAction.ca

This project involved contributions from many people in different capacities from its early stages through to its completion. The project management team assisted in developing, guiding and executing the project: Dr. David Connell (University of Northern BC), Jennifer Pouliotte (BC Ministry of Environment) and Allen James (BC Agriculture Council). In addition, Dr. Connell played a key role in developing the focus group design and providing background research. Rachelle Beveridge assisted with background research, focus groups, analysis of the interviews and development of Chapter 4 of the Provincial Report. Lauren Klose helped with background research and materials for the focus groups.

An Advisory Committee guided the project from conceptual stages through research design and production of the final reports: Allen James, BC Agriculture Council; Ted Van der Gulik, Sean Darling, Ian McLachlan, Orlando Schmidt, Jennifer Curtis and Linda Wilson, BC Ministry of Agriculture; Thomas White, Jennifer Pouliotte and Celine Davis, BC Ministry of Environment; Denise Neilsen, Scott Smith and Doug Edwards, Agriculture and Agri-Food Canada; Stewart Cohen, Environment Canada; and Tom Pedersen, Pacific Institute for Climate Solutions.

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Thank you as well to the many agricultural producers and Ministry of Agriculture specialists who participated in the interviews and focus groups. Without the producers, who volunteered and took time away from their operations to participate, this study would not have been possible.

The results of this project will be applied to two new Climate Action Initiative projects in 2012-2013. The *On-Farm Adaptation Practices* project will explore appropriate farm level adaptation practices for BC agriculture. The *Regional Agricultural Adaptation Strategies* project will pilot a collaborative adaptation planning process involving local and regional government and the agriculture industry organizations as partners.

Contents

Project Rationale & Methodology

The **BC Agriculture Climate Change Adaptation Risk + Opportunity Assessment** is intended to improve collective knowledge of how changes to the climate may impact agricultural commodities in key regions of BC, and the risks and opportunities associated with these impacts. The most important element of this assessment has been gathering perspectives from agricultural producers about their ability to adapt to current and projected challenges and opportunities, as well as identification of approaches, tools and resources required to better support adaptation.

To address the project's goals, a review of existing research in the areas of climate science and climate change and agriculture was conducted. Data regarding the current state of the BC sector was also reviewed. Original data was collected through thirty-seven interviews and twelve focus groups with producers and specialists across the province. Interviews were focused on assessing how well individual producers felt they could adapt to a range of current challenges and opportunities. The focus groups brought together small groups of producers and other specialists to discuss the projected changes in climate, and the associated risks and opportunities for their operations, regions and commodities.

This project is an initial step in building knowledge and understanding of the implications of climate change for BC agriculture. The incredible diversity of the BC agriculture sector cannot be captured in a single study. Due to the limited breadth and scope of this study, a select number of commodities and regions were included. However, this study does offer a foundation or baseline; a starting point for further dialogue as well as guidance for development of approaches and resources to enhance BC's agriculture sector in a changing climate.

The overall findings of this project are available through a provincial report. In addition, a series of region/commodity "Snapshot" reports have been developed. This "Snapshot" report is intended to communicate the findings and key action items associated with ***agricultural production*** in the ***Fraser Valley and Metro Vancouver region*** of British Columbia. Commodities included in this region were: ***field vegetables, greenhouse vegetables, poultry, dairy and berries***. The study's overall recommendations (that apply across the province) are available through an *Executive Summary* document.

Report structure

- ***Agricultural Profile*** provides a high level description of the sector, its major characteristics and context
- ***Adaptive Capacity*** highlights challenges, strengths and variations in the Fraser Valley and Metro Vancouver sector's ***current*** capacity to adapt to challenging conditions
- ***Climate Science*** provides an introduction to the climate science, including a review of provincial and regional level climate trends and projections
- ***Impacts, Risks & Opportunities*** outlines the major climate change impacts, risks and opportunities for various commodities
- ***Key Actions*** highlights the priority actions identified through the focus groups

Agricultural Profile

Historical role of agriculture in the Fraser Valley & Metro Vancouver

In the 1830s, Langley became an agricultural centre in British Columbia with the Hudson's Bay Company's commercial operation in Langley Prairie.[1] This farm produced a mix of dairy products, grain and root crops. Limited transportation infrastructure made distribution a challenge but by the 1860s, farms were also being developed in Delta and farms in Maple Ridge, Pitt Meadows and Surrey were providing food for residents of New Westminster and Vancouver.[2]

During this period of early agricultural development, the Fraser River flooded frequently and this helped to retain soil fertility and rejuvenated wetlands.[3] However, with increasing settlement, flooding became costly and diking and reclamation projects were undertaken to contain the river.[4] Despite these efforts, significant flooding occurred in the Valley in 1894.

With the completion of the Canadian Pacific Railway along the north side of the Fraser River, export market opportunities expanded. By 1885, processing infrastructure for the dairy industry evolved in Chilliwack with a creamery and the first cheese factory in Western Canada.[5] In 1886, the federal government developed an experimental farm in Agassiz to support agricultural research and demonstration.[6]

By the turn of the century, the Fraser Valley was producing quantities of hay, oats, root vegetables and beef and dairy cattle.[7] In the delta area of the Fraser River, hay production, pasture and livestock including dairy, beef cattle and horses (for use in coastal logging operations) were all important elements of commercial production.[8] Forage production continued to be a focus in Delta into the middle of the 1900s.[9]

In 1910, the BC Electric rail line expanded transportation and distribution throughout the Fraser Valley, a period of rapid growth ensued.[10] Increasing urbanization following World War I also increased market opportunities for Fraser Valley farmers. Shifts in production and specialization began as transportation linkages and distribution improved. Cheaper grains from the Prairies replaced local grain production and producers in the region began to focus more on perishable crops for market in Vancouver.

Although supply management wasn't established until the 1970s, in the 1920s both Fraser Valley dairy and egg producers initiated collective marketing which helped to stabilize income for producers and supply for consumers.[11] Also in the 1920s, the Sumas Lake was drained to create Sumas Prairie and over 130 sq km of fertile crop land.[12] With improvements in technology and mechanization, some farmers were able to tend larger parcels and production became increasingly specialized.

Another major flood devastated the Fraser Valley in 1948 causing millions of dollars in damage to property, agriculture and infrastructure.[13] As a result, 600 km of flood control dikes were constructed from Chilliwack to the mouth of the river.

The 1950s and 1960s brought unprecedented pressure on the agricultural land base in some areas of the Lower Mainland. For example, in 1956, 12,500 acres were rezoned in Richmond from agricultural to residential use, virtually cutting in half the amount of agricultural land in the municipality.[14] Despite the implementation of the Agricultural Land Reserve (ALR) in the 1970s, development pressures have continued to impact agriculture throughout the Fraser Valley and Metro Vancouver.[*15]

However, the agriculture sector in the region has also continued to evolve and adapt to its changing circumstances, developing new production opportunities and new markets in order to remain competitive. Today the Fraser Valley Regional District's farm population is about 3% of its total population;[16] in Metro Vancouver the farm population is 0.4% of total population.[17]

Agricultural land base, soils & climate

Located just north of the US border, the Fraser Valley is a broad floodplain on the Lower Fraser River that drains westward to the sea.[18] The Valley's climate varies with respect to average temperatures and rainfall but is broadly influenced by its location off the Pacific coast and proximity to the Coast Mountains and the Cascade Mountains.[19] The Fraser Valley and Metro Vancouver's agricultural areas are characterized by mild winters, warm summers and a relatively narrow range of temperatures.[20] The region has one of the longest frost free periods in Canada and the temperature infrequently drops below zero degrees Celsius.

The annual rainfall and temperatures vary considerably from the eastern end of the Fraser Valley to the Fraser River's delta. Chilliwack receives an average of 1,700 mm of precipitation per year and almost 1,400mm of this falls from October to April (inclusive). By contrast, in Delta/Tsawwassen, average annual rainfall is just over 900mm.[21] The average temperatures are similarly variable, with the warmer winter averages toward the coast (moderated by marine influences) and the warmer summer highs toward the eastern end of the Valley. Irrigation is required for most crops in most areas in the summer.

The soils within the Fraser Valley are some of the most fertile in Canada.[22] However, as is the case across the province, settlement has occurred on top of, and in close proximity to, prime agricultural land. Through much of the Valley, soils have a broad range of characteristics and capability ratings (there are 58 different soil types in Abbotsford alone[23]) but the majority are class three or better and with proper drainage and/or irrigation, can be improved. Excess water can be a limiting factor in both Richmond and Delta but with drainage soils can be improved to suit many crops.[24] Salinity of soils is also a challenge in some parts of Delta.

About 4% of the total Agricultural Land Reserve land is located in the ALR's South Coast region (including the Sunshine Coast and Squamish/Lillooet as well as the Fraser Valley and Metro Vancouver).[25] The agricultural land in the area is split between two regional districts (Fraser Valley Regional District and Metro Vancouver) and more than a dozen municipalities. Although Metro Vancouver includes 21 municipalities and 13 of them include land in the ALR, five municipalities — Delta, Township of Langley, Pitt Meadows, Richmond and Surrey — are home to 90% of the ALR land within Metro Vancouver.[26]

Characteristics of Fraser Valley & Metro Vancouver agriculture

A remarkable variety of agricultural products and farm types are found within the Fraser Valley and Metro Vancouver's agricultural areas. Altogether there are more than 5,000 farms in the region and the average age of producers in the region is 53.[27] The average farm size in the Fraser Valley Regional District is

* About 9% of Greater Vancouver ALR land has been excluded since the creation of the Reserve. About 7% of Fraser Valley Regional District ALR land has been excluded during this time.

about 22 hectares, compared with the province-wide average of almost 143 hectares.[28] In Metro Vancouver, the average farm size is about 16 hectares.[29]

The Fraser Valley Regional District (FVRD) and Metro Vancouver's farms generate more than 62% of the province's gross farm receipts (about $1.6 billion).[30] The FVRD generates the most of any region in the province with (almost $1 billion in gross farm receipts) on 1.6% of the province's ALR lands.[31] Metro Vancouver's agricultural operations generate the second largest quantity of gross farm receipts in the province.

In recent years, the Fraser Valley Regional District has been one of the fastest growing population centres in BC and in both the FVRD and Metro Vancouver the cost of agricultural land has skyrocketed. Although (according to Statistics Canada) the average cost per acre of agricultural land in BC is $4,113,[32] the Fraser Valley's agricultural land prices can range from $50,000 to over $100,000 per acre depending on location and existing production system.[33] Yet at the same time, between 1991 and 2006 there was a 22% increase in the amount of land being farmed in the Fraser Valley Regional District.[34]

This area is home to a relatively high proportion of the province's supply managed operations (68% of dairy operations and 80% of poultry operations) with the majority located within the Fraser Valley.[35] As part of the supply managed system, dairy, egg and poultry operations have relatively high and stable farm revenues and are significant contributors to overall gross farm receipts for the BC sector.[36] Primarily associated with the dairy sector, the region also produces field crops for feed; about 24,000 hectares in the FVRD and almost 12,000 hectares in Metro Vancouver including corn for silage, alfalfa and other hay and fodder crops.[37]

The large majority of the greenhouse vegetable and floriculture production in BC is concentrated in Metro Vancouver and in the Fraser Valley Regional District. Despite the rapid growth in greenhouse production, in 2006 only 0.5% of Metro Vancouver and 0.16% FVRD's ALR lands were under glass.[38] The greenhouse sector experienced a period of significant growth been the mid-1990s and 2004, but over the last several years has had challenges with competitiveness.[39]

> *"When prices were very poor, it was important to have [an alternative source of income]. In base years we maintained the cranberries but didn't invest further — we worked on the soil business… We knew there were going to be really good years and really poor years. The longer you farm you know that if you have too many poor years you'll never replace your equipment and will start to go backwards.*
>
> — cranberry producer, Richmond

In 2006, almost 44% of all land in field vegetable production in BC was located in Metro Vancouver and the FVRD produces the second highest proportion of BC's field vegetables.[40] More than 25 different types of field vegetables are grown throughout the region including green beans, sweet corn, green peas, broccoli and brussel sprouts. Virtually all of the potatoes in the area are grown in Metro Vancouver. The field vegetable sector has faced a number of challenges in recent years; one of the greatest has been the reduction in vegetable processing capacity in the Lower Mainland.[41]

The vast majority of the berry production in BC occurs in the Fraser Valley and Metro Vancouver. While cranberry production has somewhat stabilized and blueberry production has increased, hectares in strawberries and raspberries have been dropping in recent years. These shifts reflect trends in profitability. Metro Vancouver produces about 92% of the cranberries in BC and is home to 48% of the cranberries in Canada.[42] Likewise, BC has become one of the largest producers of highbush blueberries in the world and most of the industry is concentrated in the Lower Mainland.[43]

In addition to the commodities identified above, the Fraser Valley and Metro Vancouver are home to many other types of farms including mushroom operations and nursery operations, organic farms of various kinds, as well as farms producing a mix of commodities.

Current Resilience & Adaptive Capacity

Adapting to changing and challenging conditions of all kinds is a constant element of agricultural practice, and producers have long been in the business of maximizing their resources to adjust to variability. This variability can occur in a range of areas including weather, markets, input prices and regulations. To effectively manage their operations farmers have to continually learn, change and adjust their approaches, as well as collaborate with a broad range of partners.

Adaptive capacity describes the ***presence of necessary resources*** and the ***ability to mobilize those resources*** to effectively respond to various challenging conditions in both the immediate and long-term. Resources may be at the farm or sector level, or a result of the broader social, biophysical, economic, or institutional context. In addition, knowledge resources, the ability to re-organize and capacity for ongoing learning are critical to the ability to mobilize effective responses to climate change.[44]

In part because future climate conditions may be unexpected or unprecedented, managing the effects of climate change requires, above all, flexibility to address a range of potential impacts and to change course as required.

Figure 1 outlines many elements that factor into the agriculture sector's ability to adapt. These elements are expressed as five interrelated types of resources: financial, physical, human & social, knowledge and policy & regulatory.[45]

Evaluating the approaches, resources and tools ***currently*** utilized by producers to manage through challenging or changing conditions, is a first step in exploring the resilience of the industry.[46] For this reason, the interviews conducted with producers and other specialists focused on existing resources and tools employed to manage through variability or difficult conditions, as well as current barriers or challenges to adapting and overall resilience.

Some studies evaluate adaptive capacity through quantitative data. Various indicators can be used to measure the industry's capacity in certain areas.[47] This study does not employ a quantitative approach, in part because the BC sector's diversity does not lend itself well to this type of analysis. In addition, many elements of adaptive capacity cannot be meaningfully expressed in quantitative terms.

For this reason, the majority of the data that informs the analysis below was drawn from the interviews with producers and other sector specialists; additional data was collected throughout the focus

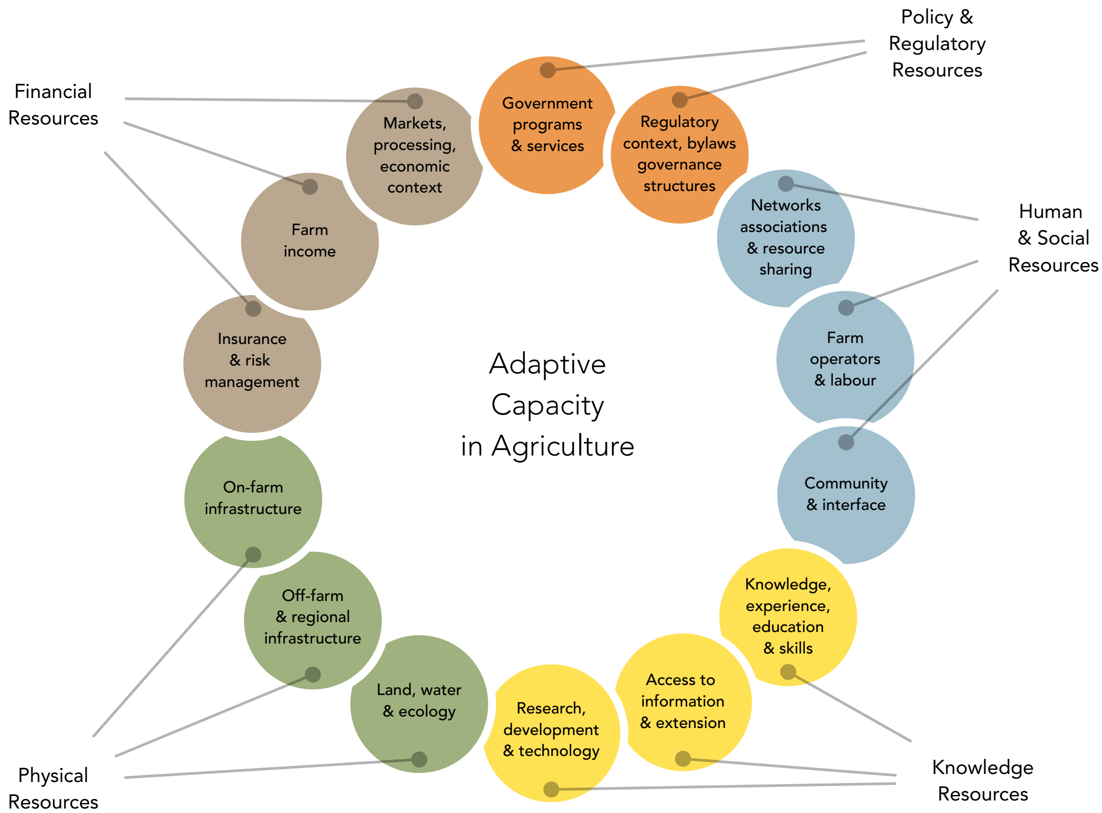

FIGURE 1. ADAPTIVE CAPACITY IN BC AGRICULTURE

group sessions. The analysis is divided into the five categories of adaptive capacity identified in Figure 1 but with a focus on the specific issues and themes that emerged through the research.

Financial resources

The ability of the industry to cope with challenging and changing conditions is strongly influenced by the availability of sufficient and stable financial resources. The diversity of production systems, farm sizes and farm types across the Fraser Valley and Metro Vancouver translates into equally variable financial resources.

Farm businesses struggling with marginal economic circumstances are not likely to prioritize investment in new approaches or technologies. In addition to overall farm income, stability of this income also affects ability to adapt. Rising or fluctuating input costs is a common challenge for BC producers that destabilizes net income. However, while farmers cannot control input costs, some parts of the sector have more stability and predictability with respect to pricing for their products.

At present the most stable operations in BC are predominantly those within the supply managed system (dairy, poultry, eggs). Operations with relatively stable income are in a stronger position to consider investments with longer payback periods and to test new approaches or technologies. Parts of the industry with stable income are also more able to undertake collective investment in industry development.

The extent of exposure to global markets and variable or depressed commodity prices is a major contributor to unstable farm revenues. A number of commodities produced in the Fraser Valley including berries and field and greenhouse vegetables are competing in markets with low cost/price commodities from other jurisdictions. Other factors that impact overall farm incomes and their stability include the presence of off-farm income, the business model employed and the scope of the operation.

Periodic economic setbacks, such as extreme weather, can also compound and make upgrading, innovating and investing difficult. This type of setback was experienced by field vegetable producers in the Fraser Valley and Metro Vancouver area. Due to extreme precipitation in the fall of 2010, vegetable producers suffered substantial crop losses and received $4 million in crop insurance and an estimated $2.3 million (in Agri-Recovery) to assist with return to production in 2011.[48]

In order to remain competitive, some agricultural producers have consolidated, some work cooperatively and some have transitioned to high value and niche crops. Diversification of products, markets and income streams are identified by producers as a means for maintaining profitability when prices, markets and growing conditions fluctuate. In particular, vegetable and berry producers may incorporate a mix of crops to buffer against potential losses. Some producers have explored opportunities such as organic certification or regional and direct marketing. With respect to flexibility and diversity of markets, it is a tremendous advantage to producers in this region to be in close proximity to large urban markets and to the border.[49]

For commodity producers (particularly those most exposed to unstable prices and weather conditions) Business Risk Management Programs,[50] including production insurance, income stabilization and emergency compensation are viewed as providing important protection from losses. However, when producers experience significant losses due to weather related events, the responsiveness and timing of compensation or recovery supports is critical to producers attempting to return to production.

Human & social resources

The primary asset for enhancing the resilience of agriculture is farmers themselves. However, across the province, the current human and social resources of the sector are being stretched and this is impacting the ability to manage through difficult and changing conditions.

Farm operators

As noted in the agricultural profile, the demographics of the sector indicate that many producers are nearing retirement. When difficult conditions arise that require new approaches and investments, producers contemplating retirement are more likely to retain the status quo or to consider exiting the industry, which may also be the more cost-effective option. Producers with a longer planning horizon (new entrants or those with clear succession plans) are more likely to adapt to change or adopt new technologies and practices.

Networks & organizations

Producers use informal networks and word of mouth to share information about daily issues, challenges and new approaches. These informal networks are particularly important for producers with smaller scale operations, who may not participate in associations.

A large number of very active industry organizations are located in the Fraser Valley (and some in Metro Vancouver) including many of the commodity organizations, marketing boards and the BC Agriculture Council. Industry organizations provide a range of services for producers by conducting research, sharing information and working with other partners to manage immediate issues or to improve the circumstances of the industry as a whole. Some industry organizations also serve as the main interface between the sector and government and the public. Proximity to these associations and their resources is a benefit for producers in this area.

The Fraser Valley and Metro Vancouver combined also have a critical mass of producers able to support businesses providing agricultural goods and services including input and equipment suppliers and consultants. The BC Ministry of Agriculture also maintains a high proportion of its staff in Abbotsford.

However, as government has stepped away from providing certain supports to producers, the pressure on industry organizations to fill these gaps is growing and the staff, volunteers and funding resources of these organizations are being stretched. This is particularly problematic for smaller industry organizations, for those without a levy or where revenues are impacted by downturns in producer profits.

Knowledge resources: Information, extension & research

The Fraser Valley has thousands of producers with an incredible depth and breadth of knowledge and experience in agricultural systems. At the same time, when producers encounter new or challenging circumstances, or wish to bolster their decision-making, they seek out information through a range of sources.

Web-based resources are increasingly drawn upon by producers for all types of information. Recently developed tools like the irrigation calculator, can be easily accessed on-line.[51] Producers can also draw on web resources from comparable jurisdictions. However, for geographic or commodity specific information, most producers continue to utilize more traditional options, including educational workshops, field days, conferences or direct consultation with experts. Producers also share information with each other or seek it out through suppliers (of equipment, seeds, inputs etc).

However, as the BC Ministry of Agriculture's role in extension has been substantially reduced, more producers across BC now pay for private consultants, or rely on (commodity) industry associations to provide extension and information. As noted, the Fraser Valley region has a high concentration of producer associations that offer educational resources. However, availability of extension is variable and gaps exist for producers without sufficient financial resources (to pay for extension) or producers that are new to the sector.

With respect to agricultural research in the region, the Pacific Agri-Food Research Centre in Agassiz continues to function with a focus on horticulture, poultry and dairy research.[52] UBC's Dairy Education and Research Centre is located in conjunction with the Agassiz facility. Industry organizations conduct a broad range of applied research, but with limited financial resources, more pressing issues may take precedence over research.

> *"I'm in my 60s now. If I was in my 40s I think I would look at it differently. At university we took an Agricultural Economics course and they showed us that people react along a bell curve. When you're old you have money, but you're stuck in your ways and don't invest back in the business the same way. I'm putting it into other retirement stuff. But my neighbor, who's 40, is going straight ahead.*
>
> — vegetable producer, Abbotsford

Increasingly, producer organizations are becoming engaged in collaborative research with various partners across government, or within research facilities. For example, the Pacific Berry Research Centre at the University of the Fraser Valley and the new Cranberry Research Centre being developed in Delta.[53] Despite these research resources, there are limited opportunities to conduct regionally specific research and a number of specific gaps in research are noted by producers (some of these are identified in the Key Actions section).

Physical resources

The nature and condition of on-farm and surrounding physical resources plays an important role in the ability of producers to adapt to difficult conditions. This is particularly true with respect to variability and extremes in weather, which can challenge the existing infrastructure and available physical resources

On-farm infrastructure: Equipment, technology & farm practices

The condition and efficacy of on-farm physical resources is important for farm resilience and producers are continually investing in improving and adjusting their equipment, technology and practices. Fraser Valley and Metro Vancouver producers have adopted dozens of approaches to managing new, variable or challenging conditions. Examples of practices and technologies employed include: efficient irrigation systems, drainage improvements, nutrient management planning and enhancement of pollination. A number of additional examples are provided in the box below.

Current management practices & approaches

- Diversification (spread risk)
- Water efficient techniques & technology
- Variety or breeding trials
- Drainage infrastructure installation & maintenance
- Bee hives purchase or hand pollination
- Planting or harvesting window adjustment
- Consultants/extension support
- Shading, whitewash or thermal curtains (greenhouse)
- Misters, cross-ventilation (poultry)
- Emergency back-up supplies
- Ditch management (on-farm & municipal/regional)

However, the extent to which producers are flexible with regards to investing in new technologies and practices is defined largely by other factors including: knowledge and information, financial resources and willingness to alter current approaches. The previously noted financial and informational limitations, and in some cases the small scale of production, or production on leased land, can be limiting factors for adopting more costly on-farm infrastructure.

Local & regional infrastructure

Much of the physical infrastructure that farm businesses depend on is located beyond the boundaries of the farm. Regional and local infrastructure plays a central role in the ability of producers to manage through challenging and variable conditions.

In the Fraser Valley and Metro Vancouver, infrastructure that requires collective and cooperative approaches for effective agricultural adaptation include: drainage and ditching, dikes, water supply and irrigation and overall land management. How local and regional governments manage infrastructure also influences the degree to which producers are willing to invest in improving their own operations. For example, if broader drainage infrastructure is not sufficiently managed, this impacts the functionality of on-farm systems and creates a disincentive for producers to invest in drainage improvements.

The associated impacts for agriculture of close proximity to urban and residential development and expansion are greater in the Fraser Valley and Metro Vancouver than in any other part of the province. Changes made to the land base have both immediate and long-term impacts on agricultural production. Interface issues are on-going and in some cases impact the ability of producers to effectively manage their operations.

Policy & regulatory resources

The policy and regulatory framework shapes the interface between government and the agriculture sector. Agriculture is embedded in a complex regulatory framework with numerous government agencies. This can create a challenging and fragmented environment for producers managing through difficult or variable conditions.

Producers also raised concerns regarding policy and regulatory frameworks that constrain producers with respect to their management options, which in turn reduce their ability to respond to changing or difficult conditions. Areas of particular concern were drainage management and water availability (during highest times of need). The need for better coordination and cross-jurisdictional approaches was also raised for areas such as invasive species monitoring and management, land use decisions and water management infrastructure.

The Climate Science

Weather, variability & climate change

If there's one thing farmers know, it's the weather. Weather is what happens on a particular day at a particular location. Farmers are continually required to adapt to weather conditions to effectively plan and manage their businesses.

In contrast, climate refers to long-term trends, patterns and averages over time. These are more difficult to observe through day-to-day or year-to-year experiences or records of weather. However, over a period of decades, recorded observations can be used to characterize the climate and identify changes.

Anyone who pays close attention to weather forecasts appreciates that predictions of weather are often limited in their accuracy. This is partly because of the many factors that impact climate systems (which in turn influence the weather we experience). In BC, we are familiar with the 3–7 year cycles of El Niño and La Niña ("ENSO"), which dramatically impact the average weather that we experience (see Figure 2). Compared to La Niña years, conditions in BC during El Niño years are typically warmer and drier in winter and spring, and less stormy in southern BC.

Adding to the complexity, the Pacific Decadal Oscillation (PDO) is a known pattern that shifts over longer time periods (20 to 30 years) and this impacts temperature and precipitation conditions here in BC. It also has a warm and cool phase, and so it can reflect either an enhancement or dampening of the impacts of El Niño and La Niña conditions in a given year. BC may have shifted to a cool PDO phase around 1998.[54]

Figure 3 below shows the difference between climate variability, oscillations, and climate change. The many factors that impact the weather create significant variation in what we experience from year to year. However, we are still able to chart averages over long periods of time.

BC climate change projections

According to thousands of climate scientists analyzing climate data around the world, the evidence to date is unequivocal: the global climate is changing, and becoming warmer.[55] As can be appreciated from the above discussion of variability and oscillations, this does not mean that conditions everywhere are becoming consistently warmer. All of the variables that impact climate will continue to influence the weather in many different ways.

In BC for example, warming has primarily been felt in an upward shift in BC's coldest winter temperatures. Winter average temperatures have been increasing more than summer average temperatures. In other words, BC has been getting less cold more rapidly than it has been getting more hot.[56] And changes will still impact each region of the province differently.

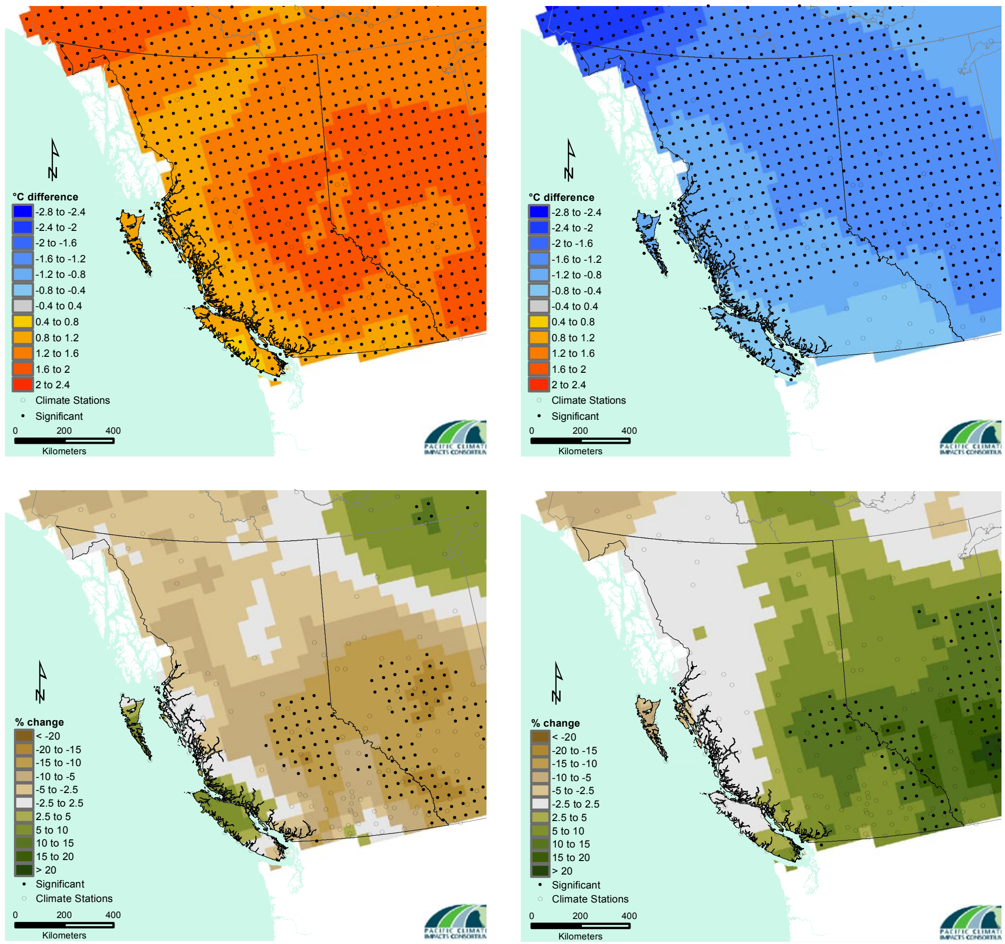

FIGURE 2. ENSO PATTERNS IN BC

The top two maps depict temperature differences (1900–2004) from the average during El Niño years (left) and La Niña years (right). The two bottom maps depict precipitation variations from average (again with El Niño at left, La Niña at right). Source: Pacific Climate Impacts Consortium, www.pacificclimate.org | Data source: Environment Canada CANGRID dataset

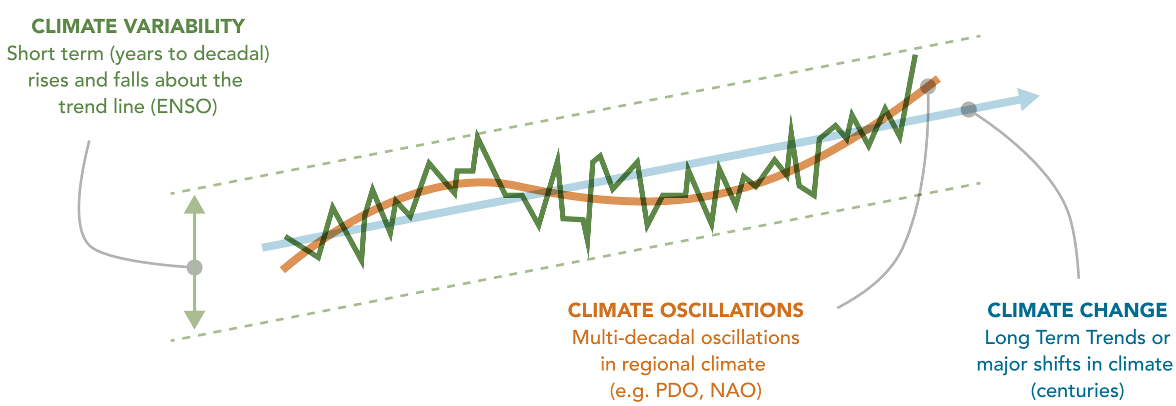

FIGURE 3. CLIMATE VARIABILITY, OSCILLATIONS & CHANGE

Diagram showing difference between climate variability, oscillations, and climate change. Adapted from original, courtesy of Pacific Climate Impacts Consortium, www.pacificclimate.org

So while the term "global warming" makes sense if you talk about the overall trend, at a regional level, "climate change" is a more appropriate way to describe what is occurring.

While rising sea levels do not directly impact all regions, this could potentially reduce the overall agricultural land base of the province. Global sea level has risen more than 20 cm since 1899,[57] but this varies considerably by location due to land movement (rising or falling) and climate and weather variability. Future projections show that this will continue. Estimates for the BC coast over the next century suggest a possible sea level rise of at least 80 to 120 cm at the Fraser River Delta, and 50 to 80 cm at Nanaimo.[58]

The tables below summarize potential changes that will affect agricultural production in the province. This provides overall changes on average for the whole province. There are significant variations in trends and projections for the different regions of BC, and the next section addresses these differences for the Fraser Valley and Metro Vancouver specifically.

Fraser Valley & Metro Vancouver Region climate change projections

While regional climate data is improving rapidly in BC, at a local level there remain great differences in the data availability and a limited set of climate modeling studies to draw from. As a result, this summary draws from regional modeling where

CLIMATE PROJECTIONS FOR BRITISH COLUMBIA IN THE 2020S

Source: Pacific Climate Impacts Consortium, www.Plan2Adapt.ca

	Time of Year	Projected Change from 1961–1990 Baseline	
		Range (BC)	Average (BC)
Average Temperature	Annual	+0.5 °C to +1.5 °C	+1.0 °C
Precipitation	Annual	+0% to +7%	+4%
	Summer	−4% to +5%	+0%
	Winter	+1% to +8%	+4%
Snowfall	Winter	−11% to +2%	−2%
	Spring	−55% to −7%	−30%
Growing Degree Days	Annual	+76 to +234 degree days	+163 degree days
Frost-free days	Annual	+6 to +16 days	+10 days

CLIMATE PROJECTIONS FOR BRITISH COLUMBIA IN THE 2050S

Source: Pacific Climate Impacts Consortium, www.Plan2Adapt.ca

	Time of Year	Projected Change from 1961–1990 Baseline	
		Range (BC)	Average (BC)
Average Temperature	Annual	+1.3°C to +2.7 °C	+1.8 °C
Precipitation	Annual	+2% to +11%	+6%
	Summer	−8% to +6%	−1%
	Winter	−2% to +16%	+8%
Snowfall	Winter	−16% to +2%	−10%
	Spring	−70% to −20%	−58%
Growing Degree Days	Annual	+191 to +459 degree days	+305 degree days
Frost-free days	Annual	+12 to +28 days	+20 days

possible, and supplements this with broader scale studies as necessary.

Regional climate projections are produced by the Pacific Climate Impacts Consortium (PCIC) at a regional district level. The data for the Fraser Valley region* is presented in the tables below to illustrate the range of projected changes for this area.

Temperature projections in the Fraser Valley are consistent with projections for the rest of the province. Average annual and seasonal temperatures are expected to continue to increase, with corresponding increases in ***growing degree days*** and ***frost-free days***.

* Data for other parts of region (including Greater Vancouver) are available at www.plan2adapt.ca.

The Metro Vancouver (or Greater Vancouver) region exhibits very similar patterns to those shown for the Fraser Valley, with some exceptions. Projections for the Metro Vancouver region indicate an increase of 275 growing degree days by the 2020s, and +498 degree-days by the 2050s, and slightly fewer additional frost-free days than further up the Valley.[59]

To illustrate the magnitude of projected temperature changes, the average annual temperature in BC by the 2080s is projected to increase by 2.8°C. This means that an average year in the 2080s will be as warm as the warmest years we have experienced in the past century.[60] While 2080 might seem like a long way off, this change will happen in stages over the intervening period.

CLIMATE PROJECTIONS FOR THE FRASER VALLEY REGION IN THE 2020S

Source: Pacific Climate Impacts Consortium, www.Plan2Adapt.ca

	Time of Year	Projected Change from 1961–1990 Baseline		
		Range (Fraser Valley)	Average (Fraser Valley)	Average (BC)
Average Temperature	Annual	+0.6 °C to +1.4 °C	+1.0 °C	+1.0 °C
Precipitation	Annual	−1% to +7%	+4%	+4%
	Summer	−16% to +6%	−9%	+0%
	Winter	−3% to +8%	+3%	+4%
Snowfall	Winter	−26% to −4%	−13%	−2%
	Spring	−59% to −4%	−32%	−30%
Growing Degree Days	Annual	+99 to +294 degree days	+203 degree days	+163 degree days
Frost-free days	Annual	+7 to +20 days	+14 days	+10 days

CLIMATE PROJECTIONS FOR THE FRASER VALLEY REGION IN THE 2050S

Source: Pacific Climate Impacts Consortium, www.Plan2Adapt.ca

	Time of Year	Projected Change from 1961–1990 Baseline		
		Range (Fraser Valley)	Average (Fraser Valley)	Average (BC)
Average Temperature	Annual	+1.1 °C to +2.6 °C	+1.8 °C	+1.8 °C
Precipitation	Annual	−2% to +10%	+7%	+6%
	Summer	−29% to +0%	−14%	−1%
	Winter	−3% to +14%	+6%	+8%
Snowfall	Winter	−40% to −13%	−25%	−10%
	Spring	−73% to −20%	−56%	−58%
Growing Degree Days	Annual	+238 to +570 degree days	+394 degree days	+305 degree days
Frost-free days	Annual	+15 to +37 days	+25 days	+20 days

The annual amount of ***precipitation*** is projected to stay the same or decline through the 2020s. Much of this decrease in precipitation occurs during the summer. Warming in winter and spring will mean that an increasing amount of that precipitation will fall as rain, and less as snow. The Greater Vancouver region projections show a greater decrease in winter snowfall than further up the valley (e.g., between −41% to −6%, an average of −23%, for the 2020s).

A study of ***extreme rain events*** in the Greater Vancouver area[61] found that the number of high intensity rainfall events showed an increasing trend from 1950–2005. This study also showed that the intensity of rainfall events occurring in April, May and June has increased significantly. Short duration events (up to 2 hours) were particularly more intense. Other studies link such high intensity rain events to an increasing risk of more frequent landslides in southwestern BC.[62]

Extreme weather events are projected to occur more frequently in BC in the future, and studies have shown some specific trends already. These include an increase in heavy rainfall events in the spring, and an increase in extreme wet and extreme dry conditions in summer. The intensity and magnitude of precipitation events is projected to increase in the future.[63]

Projections to the 2050s suggest that ***annual runoff*** will increase by around +14% on the Fraser River at Hope.* Seasonally, these projections show increasing flows in spring and decreasing flows in summer. ***Peak flows*** will occur slightly earlier in the spring than they have in the past.[64] Groundwater recharge rates may decrease, leading to slightly lower groundwater levels that could reduce baseflow at times of low flow.[65]

Projections for the Fraser delta region suggest a relative ***sea level rise*** of 80 cm to 120 cm by 2100.[66] This takes into account local land subsidence as well as rising ocean levels due to climate change. Currently, a storm surge combined with high tides in El Nino years could overtop existing flood protection infrastructure, even without additional sea level rise.

* The Pacific Climate Impacts Consortium is currently conducting modeling studies to better understand what changes in hydrology will mean for future flood risk for the Fraser River and other areas. (M. Schnorbus, PCIC, pers. comm. 20/02/12).

Impacts, Risks & Opportunities

POTENTIAL AGRICULTURAL IMPACTS OF SIGNIFICANCE IN THE FRAISER VALLEY & METRO VANCOUVER REGION IN THE 2020S

Changing Conditions	Potential Agricultural Impacts
Changing hydrological regime, decrease in summer precipitation	Decrease in productivity and quality of crops and livestock under water stress, increased costs, reduction in water supply (at times of high demand), earlier salination of Fraser River water at intake points for parts of Delta, increase in management complexity
Increasing precipitation and variability of precipitation (especially in spring & fall)	Interruptions to planting, input applications and harvesting, increase in excessive moisture and site-specific flood risk, increase in pressure on drainage and water management, interruptions to pollination, decrease in light levels, increase in nutrient and input leaching, increase in management complexity
Increase in flood risk*	Increase in crop and infrastructure damage and loss, relocation or loss of livestock, interruptions to supply lines, salination of soils
Changing crop suitability ranges (increase in variability; increase in average temperatures, GDDs, FFDs)	Inconsistent productivity, quality & therefore prices; increase in suitability for new varieties of forage and field vegetable crops, increase in suitability of new crops
Changes in pests and diseases	Increase in winter survival rates, increase in number of cycles in a year, introduction of new pests and diseases, increase in management costs, complexity, uncertainty, increase in delays or prevention of pollination
Increase in extreme weather events (storms, wind, extreme heat)	Decrease in productivity and quality, increase in building maintenance and damage costs, decrease in heating costs, increase in cooling and ventilation costs, interruptions to regional infrastructure and supply lines
Climate change impacts to other growing regions	Increase in feed or other input costs, increase in demand for food production/local food

* There exists the potential for rising flood risk, but this is very site specific, varying by location, local watershed features and the timeframe (M. Schnorbus, PCIC, pers. comm. 20/02/12).

To develop a practical understanding of what the projected changes mean for the Fraser Valley and Metro Vancouver region, producers from the dairy, poultry, greenhouse vegetable, berry and field vegetable industries were engaged in separate workshops, focusing on the 2020s climate change scenario described previously. This section presents the results of this exploration of potential impacts, risks and opportunities for agricultural operations. Findings in this section also incorporate information gathered through interviews and broader background research regarding climate change impacts.

Water supply

For all agricultural production systems, water is an essential input that has no substitutes. An inadequate water supply will at the least reduce productivity and quality, and at most render an agricultural system unviable. The combination of decreasing summer precipitation together with higher evapotranspiration rates and crop water demand contribute to a potential water deficit at this time of year — the degree of risk varies for different operations, depending on their type of water source. Water stress can lower crop productivity and/or quality of crops for human consumption and for livestock, and can also decrease productivity and quality for dairy and poultry operations, and processors.

The potential challenge in the Fraser Valley and Metro Vancouver region was not seen to be a lack of water supply, but rather an inability to *access* water when and where needed. This is a significant hurdle due to the cost of infrastructure and the extent of cooperation and coordination that is required to effectively manage the range of stakeholders and interests involved.

For producers in the Fraser River delta area, there is an added complication. As sea level rises and peak flows in the Fraser occur earlier, the salt wedge at the mouth of the river pushes upstream earlier in the season. This means that, at intake points, river water will become salinated earlier on, cutting off the option to irrigate even earlier. This could also contribute to salination of soils if water with elevated salt levels is applied to fields. Few options exist for producers to develop alternative water sources. As the situation in this and other areas becomes more acute, changing the intakes on the Fraser River may be required, and there may be a more convincing case for investing in storage and irrigation infrastructure to address water supply challenges.

Overall increase & variability of precipitation & extreme rainfall events

The projected increase in fall, winter and spring precipitation in the 2020s gives rise to a number of impacts for the agriculture industry. The overall increase is projected to occur along with a rise in variability of precipitation and more frequent extreme rainfall events.

The most commonly mentioned impact arising from these conditions is an accumulation of moisture (over an extended or short duration) that exceeds the local drainage capacity, resulting in water-logged soils and/or localized flooding.

Depending on the duration of these conditions, the direct impacts range from lower crop productivity and quality, to crop damage, or even complete losses. This issue is a central challenge for producers, and is considered a limiting factor for production in the region.[67] Effective management is typically costly and complex, requiring significant investments in infrastructure as well as coordination across geographic, regulatory and stakeholder boundaries.

The increasing variability of precipitation, and especially extreme rainfall, also causes real challenges with planning for planting and harvesting of crops, activities that are typically possible during a short window of time in spring and fall. Adjustments in timing can be made in some cases, but this increases risk and can cut into the potential growing season length, and already slight profit margins. An additional factor is that by the fall all inputs have been committed, so returns are dependent entirely on the value of what can be harvested. As noted previously, field vegetable producers experienced this situation to an extreme in 2010, when unusually wet conditions made it impossible to harvest vegetable crops and producers experienced significant losses.

These conditions also pose escalating risks around nutrient leaching and input losses (fertilizers, pesticides, seed, etc). Groundwater quality in the Fraser Valley is already an active area of research and management; projected conditions would exacerbate current pressures on water quality and managing inputs.

For greenhouse production in particular, the increase in precipitation also means lower light levels due to cloud cover. This can lower greenhouse productivity significantly, but can be improved through artificial lighting. However, this comes at an added cost for infrastructure and energy use.

River & coastal flooding

The occurrence of widespread inundation of land in the floodplain as a result of rising water levels, dike overtopping and/or a dike breach, poses a high risk situation for production in this region.

Fraser River flooding was a significant concern for some producers in the region; however, there is little information at present about how flood risk from the Fraser might change under future climate scenarios. There exists the potential for rising flood risk, but this is very site specific, varying by location, local watershed features and the timeframe.[68]

Crop and infrastructure damage and loss, relocation or loss of livestock, and interruptions to supply lines are some of the major impacts of this scenario. All of these entail significant financial costs and psychological impacts for producers and communities. For perennial crops, recovery could take years for replanted areas to generate revenue.

Sea level rise and increasing occurances of storms pose major threats in parts of Delta and Richmond where agricultural land is concentrated. In addition to the general impacts of flooding, the longer term implications of salinated soils in the case of sea dike overtopping or breach is a fundamental threat to agriculture in this region. The rate and depth of infiltration of salt water into the soils affects how much this situation can be managed, if at all. Mitigation options exist but depend on investment and coordination across multiple levels of government.

Shifting range & variability of growing season conditions

What might appear at first glance to be an opportunity for enhanced production in BC is in fact a great deal more complex. Potential opportunities to grow new varieties or crops each come with the risks and costs of making a change. This is particularly so for perennial crops such as blueberries and cranberries, which can take more than 6 years to come into full production.

On average, a warmer climate would improve productivity and quality of a number of crops, if other climate variables were to remain the same. This creates the potential to switch to higher value products, diversify crops, try out longer maturing or more productive varieties and take advantage of multiple harvests. However, in addition to a rise in average temperature and the number of growing degree days, projections also include increasing spring precipitation, increasing variability, more extremes, and pressures on water supply. In effect, while more growing degree days would lead to a longer *potential* growing season, the *actual* growing season is limited by the timing of frost, extreme rainfall or hail, and other such events which are projected to become more variable and/or more frequent.

While shifts in average conditions could, in time, drive a transition, in the more immediate term it is likely to be the increase in variability and extremes that will increase uncertainty, costs, losses and damage. Field vegetable and berry producers in particular noted that increasingly variable conditions translates into more inconsistent productivity and quality of their products, making it difficult to meet buyers' demands and to secure an adequate income.

A similar challenge exists with respect to processors. For example, for field vegetable producers, a certain degree of flexibility around planting times enables producers to work around unusually wet conditions in spring. However, the number of processors in this region has dropped and those remaining are structured to optimize their throughput during the season, providing very little room for producers to adjust the timing of their deliveries. The result is that producers are squeezed by poor planting conditions in the early part of the season, and processing schedules at harvest time, reducing their ability to manage effectively for the conditions.

Changes to pests, diseases & pollinators

Agricultural systems are tightly linked to other biological and ecological processes that will also be impacted by a changing climate. The challenge posed here is complex by nature, as the web of impacts makes it difficult to anticipate, plan and prepare for, the many possible interactions that could occur. The arrival of new pests and diseases, and further pressures on pollinators are of particular concern as they could have substantial and long-term negative consequences for production and options for prevention and management are limited.

Milder winter conditions will increase the reproduction and survival rates of many pests and diseases, also enabling additional pest cycles to occur within a season. This increases pressure on current conventional, integrated and organic pest management systems and is likely to result in greater use of pesticides as the limits of other management options are surpassed. Predator species (beneficial insects) could also thrive in milder conditions, offsetting enhanced pest populations.

Milder conditions and a changing climatic regime more generally, are also likely to increase the risk of new pests, diseases and invasive species appearing in the Fraser Valley and Metro Vancouver. The complexity of pest management is taken to another level with the introduction of species or varieties that are not currently present in this region. Lag time between the threat emerging and a response being implemented creates potential for severe damage and losses to occur, and for the new species to establish. The presence of certain pests and diseases, or chemicals used to control them, could lead to restrictions on exports, further harming the industry.

Increasing spring rainfall, and especially extreme rainfall events, would interfere with pollination of crops within the short window required to enable full crop development. This was seen as a significant risk for berry production, as there very limited alternative options. The result would be lower productivity, and potentially even complete losses.

Increase in extreme weather events

Producers are always looking for the right balance between costs and potential revenue. Economic viability of systems like dairy, poultry and greenhouses are tightly linked to managing costs of external inputs like energy (for heat and lighting), water, feed, and nutrients. In the context of variable or extreme conditions, increasing or altering use of certain inputs is an option available (to these industries) to limit reductions in productivity and quality that would otherwise result. In this respect, they are less sensitive to climate change and extremes, but will incur increased management costs. Warmer winter temperatures could decrease heating costs, while warmer summers add to ventilation costs.

Damage and disruption due to extreme weather events was consistently rated by producers as having high impact and low manageability. More frequent extreme heat events can negatively impact poultry, dairy and greenhouse operations in particular. These operations experience reduced quality and productivity, and even livestock losses, under conditions of more frequent or extended extreme heat. While technology and management practices to reduce heat and humidity impacts exist, the investment required is typically not seen as justified for relatively infrequent events. Poultry producers noted that high humidity is more challenging to manage than extreme heat alone.

At the same time, many agricultural systems in BC are closely linked to supply and distribution lines across regions and borders. This makes them vulnerable to disruptions arising from extreme weather event impacts. More intense storms can cause damage to plants, crops, livestock and infrastructure. In particular, regional infrastructure and supply lines can be interrupted, causing problems especially for industries reliant on power and imported feed supplies — this was considered a significant risk and difficult to manage, by poultry producers.

Climate change impacts in other growing regions

Climate change impacts in other growing regions will affect market conditions for BC production as well. These impacts are likely to lead to increases in feed costs, for industries like poultry that are reliant on feed imports or could threaten supply (in extreme conditions). Negative impacts in key growing regions elsewhere could also increase prices and demand for BC products.

Key Actions

The purpose of the BC Agriculture Adaptation Assessment is to develop a baseline assessment of potential risks and opportunities due to climate change, for the BC agriculture sector as a whole. For quick and easy reference, a provincial report *Executive Summary* document has been developed, which outlines key actions that apply across the province.

The dialogue that has occurred at the regional and commodity levels (through interviews, focus groups and informal discussion) has contributed critical information for the analysis and key actions in the provincial report, and provided a first look at the important issues regionally.

> *"If you ask farmers across the country what is the number one issue, they will say profitability and input costs. So when we start to talk about sustainability it has an economic component (profitability) an environmental component (making sure that your environmental footprint is minimal…) and it has a social component (people like looking at nice farmland and they like to see a certain amount of biodiversity). So I think the trick is going to be to accomplish that sustainability piece with all three elements in mind so we don't overload the farm with costs and there are a number of ways to do it.*
>
> — turkey producer, Abbotsford

Key action items identified through the focus group session are noted below. The specific issues raised by specific commodities and those cross-cutting the sector are an important first step toward a regional approach to agricultural adaptation.

Fraser Valley & Metro Vancouver / dairy, field vegetable, poultry, berry & greenhouse producer focus groups

Food security & agriculture

Prioritization of agricultural production and food security in British Columbia at the policy level was identified as a key first step in supporting the sector to manage the challenges associated with climate change.

Research

A broad range of research priorities were identified across the focus groups. However, there was common interest in research to support on-going adjustments to adapt to climate change. Areas of need included increased investment and improvement of research regarding climate information, research and monitoring. Producers felt that more climate and weather stations, improvements to longer-term forecasting (beyond a few days), more accurate rainfall projections and improved humidity projections would all be helpful. A better understanding of flood risks and impacts was a priority for the livestock sectors in particular. Vegetable producers prioritized increased research and demonstration for soil management practices for managing projected conditions.

Investment in ***variety trials, breeding and demonstration*** were of common interest across commodities. For berry producers, identification of important traits for localized testing and breeding, as well as berry trials within various micro-climates of the region was a high priority. For dairy producers, research into yields and nutrient values of new potential crops was deemed to be of interest and poultry producers identified research into new feed grain varieties that could be profitable and produce better yields as an area of interest.

Strengthening a proactive approach to ***monitoring, surveillance and management of pests, weeds and diseases*** was a priority for action. Improved knowledge of viruses/bacteria survival rates under projected climate change was identified as an important area for poultry.

Education & extension

A general need to raise awareness about climate change and its impacts for agriculture was seen to be a prerequisite to the sector (and others) taking adaptive action. An important area of focus for berry producers was strengthening the dissemination of information regarding pests and vegetation management research and improving extension, particularly for new growers. Increasing awareness of risks associated with extreme events and acknowledgement of the associated management challenges was deemed important.

Management practices & approaches

Producers are already accustomed to managing through variable conditions and challenges of many kinds. Nonetheless, a number of priority areas for action were identified for increasing adaptive capacity for climate change. Capturing of rain water and rain water storage, as well as continuing to improve irrigation infrastructure and efficiency are priority areas. Continued improvement of drainage and pumping capacity are important for managing extreme precipitation. For livestock operations, investment in technologies such as misters and tunnel ventilation could be helpful for managing more extreme temperatures. For leased lands, non-ownership is a barrier for capital investment and cost-share arrangements would better support the necessary upgrades.

> “*Short term I'm worried about flooding. Long-term I just worry about whether I'm going to get enough water for our crops because they may start to monitor wells. Are we going to be allowed to spread manure here? There's a social issue here — how will we deal with it? They're going to hammer industry I know that but we need to make changes and conscious decisions every day. You can hammer farmers as much as you want but what about all of us? We all need to do it together.*
>
> — dairy producer, Agassiz

Collective approaches for infrastructure management

For all of the commodity groups in the Fraser Valley and Metro Vancouver, the ability to adapt is influenced by the broader infrastructure. There is a need for collective approaches and management of off-farm infrastructure to better facilitate agricultural adaptation. Management of drainage and ditches was an area of common concern, in particular in relation to changing land uses and impacts on neighbouring farms. Studies to evaluate potential impacts of proposed development on surrounding agricultural production systems, including effects on hydrology and ecology (e.g., pollination patterns) were seen as an important step.

Some commodities raised the potential for improving water storage infrastructure and, in parts of Delta, access to (non-salinated) irrigation water, particularly later in the season, was a high priority for future agricultural viability. Continuing to improve cross-sector and geographic coordination of nutrient management was seen to be possible and necessary.

Restoration, reinforcement and increasing the height of diking infrastructure was of concern to producers who would experience significant losses if dikes were breached. An improved understanding of potential losses for farms in a flooding situation, as well as development of proactive, integrated and broad-based emergency plans were also identified as areas for investment. Additionally, a need for planning and upgrades for regional drainage programs including canals, ditching, and pumping to deal with wetter springs and impacts from upland development were seen to be high priorities.

Coordination & integration of government regulations

Across all of the focus groups, concerns were raised about the need to improve overall coordination and integration of decision-making. The practicality of ditch cleaning regulations was seen as in need of review, as was the inconsistent regulatory and policy approaches across neighbouring municipalities. All of the key infrastructure areas noted in the preceding section were identified as requiring improved coordination, cooperation and integration.

In one focus group it was observed that the regulatory approaches could strike a more harmonious balance between supporting agriculture and maintaining the environment. Producers also noted that at times consultations didn't seem to truly value the concerns of agricultural community. With the increasing complexity and variability of farm management, cross-agency and cross jurisdictional cooperation and coordination was seen to be a priority.

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