

BC Agriculture Climate Change Adaptation **Risk + Opportunity** Assessment Series

Cattle Production Central Interior — SNAPSHOT REPORT ————



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

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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.

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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 *cattle production* in the *Central Interior Regior* of British Columbia.* 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 Central Interior 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 cattle production
- *Key Actions* highlights the priority actions identified through the focus groups

^{*} In the context of this report, the Central Interior includes the Cariboo-Chilcotin and Thompson-Nicola Regions. Focus groups were held in Kamloops and Williams Lake, so climate impacts data was drawn primarily from producers in the surrounding areas.



Historical role of agriculture in the Central Interior

HE HISTORY OF agricultural production in the Central Interior is predominantly shaped by the development and fortunes of cattle ranching. Settlement in BC's interior was spurred by the identification of its agricultural potential, specifically for ranching. BC's earliest ranches developed following the cattle drives, from the Oregon Territory into BC's interior, to supply gold mining communities with beef.¹ By the 1860s, agricultural products were being generated at the mile houses along the Cariboo Wagon Road.²

When the gold rush ended, ranching continued although the production systems in the interior changed over time. Many ranches relied on the native bunchgrass for grazing but this source was overgrazed. By the late 1800s ranchers began to develop dams and irrigation ditches to produce forage crops which helped to feed cattle through hard winters.³ With the construction of the Canadian Pacific Railway, access to urban markets improved, but BC markets also became more accessible to Alberta's ranching businesses and competition was stiff.⁴

Cattle prices increased during World War I and the industry grew. The first bull sale was held in Kamloops in 1919 and these annual sales continue today. By 1929 there were over 290,000 beef cattle in BC.⁵ Cattle producer associations began to form early; there were already seven local associations when the BC Stock Breeders Association was created in 1914.⁶ This provincial association became the BC Cattlemen's Association in 1929 which today includes more than 70% of producers (whose membership is approximately 1,200 ranchers).⁷

With the Depression and the drought of the 1930s, the BC cattle industry was hit hard and the industry contracted but prices recovered with World War II. A substantial shift occurred in the 1950s when the Alberta cattle industry began to finish its animals with grain.⁸ With limited access to grain feed BC ranchers began to ship their animals to Alberta for finishing and slaughter. This approach continues today, with about 95% of the calves raised in BC sent to Alberta for finishing.⁹

A rangeland and cattle focused research station was developed in Kamloops in 1947.¹⁰ The Kamloops Range Research Unit remains today, part of the Pacific Agri-Food Research Centre and research areas have included range management, forage crops, cattle management, soils and plant physiology.¹¹

Over the past decade, BC's cattle industry has weathered some exceptionally difficult times but recent price increases have brought some relief. Today a number of the ranches in the Central Interior are still owned and operated by descendants of the original settlers and agriculture remains an important economic contributor from Kamloops to Williams Lake.

The proportion of the Central Interior Region populations involved in agriculture remains considerably higher than the provincial average.^{*12}

Agricultural land base, soils & climate

The terrain of the Central Interior Region is diverse, including mountain ranges, forest and grasslands. Much of the agricultural area is characterized by rolling plateaus that are well suited to cattle and livestock production.¹³ The region's landscape includes grasslands and treed highlands and much of the vegetation is dominated by sub-boreal spruce and Interior Douglas-fir ecosystems.¹⁴ About 35% of the forest land base is in lodgepole pine forest.¹⁵ The Mountain Pine Beetle has done substantial damage in this area and there have been changes in hydrology as a result of widespread loss of trees.¹⁶

The quality of the soils in much of the region are a limiting factor, but areas with river bench soils are able to produce high quality alfalfa as well as root vegetables and potatoes.¹⁷ Some valleys have high clay content but, with careful soil management, can produce a range of forage and field crops.¹⁸

The climate is generally warm and dry in the summer and winters are cold with moderate precipitation. The Cariboo-Chilcotin Region includes almost 80,000 sq km so its climate varies (to the east of Fraser River is the Cariboo and to the west is the Chilcotin).¹⁹ The Region lies in the rainshadow of the Coast Mountains and its south western portions are driest with precipitation and humidity increasing slightly toward the east and more toward the north.²⁰ The growing season varies greatly, generally shortening with increased elevation.

The climate of much of the Thompson-Nicola area is classed as Continental and is semi-arid with one

* The farm population in the Cariboo Chilcotin is 5.6% of the population and 3% of the population in the Thompson Nicola Region. The provincial average is 1.5%.

of the driest areas in southern Canada between Spences Bridge and Kamloops. The average annual precipitation in this area is 270mm (10.6 inches).²¹ Unsurprisingly, availability of water is a substantial limiting factor in the Thompson-Nicola area and agricultural production would be minimal without irrigation. In 2006, there were over 25,000 hectares in this region under irrigation; the most of any regional district in the province. Where irrigation is utilized, it can significantly improve the capability of agricultural land and increases the potential range of crops for the area.²²

In 2010, the total area within the Agricultural Land Reserve (ALR) for the Central Interior Region was about 1,491,998 hectares; about 31% of the total ALR land base.²³ The quantity of Central Interior land within the ALR has remained relatively constant.**

Characteristics of Central Interior agriculture

In 2006, the average farm size in the Central Interior area was 409 hectares, considerably larger than the provincial average of 143 hectares.²⁴ At the time of the last Census there were 2,370 farms in the region and a farm population of a little over 7,000 with an average farm operator age of 54.²⁵ The agricultural land base available to the cattle industry in the interior of BC is substantially supplemented by Crown owned range that is used for grazing.

Some of this land is leased but much is managed through grazing licences or permits (one to ten year agreements between the Crown and ranchers).²⁶ Producers pay to access this land and are required to share with other users and to follow grazing practices that conserve soil, forage and natural resources of the range.²⁷ As noted above, through much of the Central Interior water is a highly valued resource and agriculture is increasingly competing with other users. For this reason there has been a focus on stewardship measures including efficient irrigation systems.²⁸

In 2006, field crops accounted for almost 97% of (private) farmland use in the Thompson Nicola Region.²⁹ Predominant field crops consist primarily

^{**} Provincially, it is estimated that about 66% of the Agricultural Land Reserve is owned by ranches. http://www.cattlemen.bc.ca/industry.htm

of alfalfa as well as barley, tame hay and other fodder crops. While there used to be more apple production in the region, by 2006 it had dropped to under 60 hectares. At 160 hectares, vegetable production was at a 20 year high in the region at the last census including onions, corn, carrots and a small number of greenhouses (the area under glass doubled between 1986 and 2006).³⁰

In the Cariboo-Chilcotin Region, 55% of the farms have some beef cows and cow-calf operations are the most common type.³¹ Field crops include alfalfa, tame hay and fodder and mixed grain; all are important contributors to the local sector. While rangelands are used to pasture from spring to early fall, winter feeding (which can last four to six months) relies on hay and silage stores produced in the region, or imported from other jurisdictions.³²

The cattle industry across BC is dominated by cow-calf operations but the operations vary widely in size and revenues. There are many small cattle operations in BC with almost 60% earning less than \$50,000 in farm cash receipts per year.³³ However, there are a small number of ranches operating at a much larger scale with thousands of cattle. One of the best known is the largest cattle ranch in Canada. The Douglas Lake ranch, located near Quilchena, has approximately 20,000 cattle.³⁴

As an industry competing in commodity markets, the BC cattle industry has typically been vulnerable to fluctuations in prices and in recent years has experienced a number of additional challenges. A prolonged slump has occurred due to: the response to Bovine Spongiform Encephalopathy (BSE) including associated border closures and regulatory changes, rising feed and fuel costs, a relatively high Canadian dollar and multiple droughts.³⁵ Despite all of the above challenges, many cattle operations have weathered these challenges and today, for the first time in a number of years, there is some price recovery occurring.

Current Resilience & Adaptive Capacity

DAPTING 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.³⁶

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.³⁷

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.³⁸ 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.³⁹ 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;



FIGURE 1. ADAPTIVE CAPACITY IN BC AGRICULTURE

additional data was collected throughout the focus group sessions. The analysis is divided into the five categories of adaptive capacity identified in the diagram below but with a focus on the specific issues and themes that emerged through the research.

Financial resources

In recent years the cattle industry in BC has struggled with profitability for a number of reasons previously noted. Farm businesses struggling with marginal economic circumstances are not likely to prioritize investment in new approaches or technologies.

As noted above, the BC cattle industry competes in a global commodity market and is exposed to fluctuating prices, as well as rising input costs. Periodic economic setbacks, such as extreme weather, can also compound and make upgrading, innovating and reinvesting difficult. BC's cattle industry has experienced substantial losses due [Challenging years] impact operations in the sense that you postpone a lot of work you are supposed to do: you use less fertilizer [and] maintenance work gets postponed. You do the minimum of field work because fuel prices are high... You downsize operations to bare minimum [and] conserve whatever little cash you have at hand, just make it through.

—cattle producer, Vanderhoof

to drought conditions in recent years. In 2007, a portion of the \$7.5 million (federal and provincial government) Drought Assistance Program went to direct assistance for producers who had low crop yields due to record drought conditions.⁴⁰ For losses associated with drought, flooding and wildfire in 2010, cattle producers are estimated to have accessed \$1.75 million in Agri-Recovery support for feed assistance and pasture restoration in 2011.⁴¹ However, the BC Cattlemen's Association estimated the 2010 producer losses at over \$11,000,000.⁴²

Cattle operators employ a number of strategies to manage through difficult and variable circumstances. Consolidation and destocking has been occurring reflecting some operators leaving the industry and others growing.⁴³ A common approach for managing challenging conditions is diversification, including on-farm opportunities such as agri-tourism, timber harvesting (and agroforestry systems) or increasing off-farm income. Generally producers will reduce herd size — selling to increase income and reduce costs — in difficult times and build the herd when prices improve. With difficult conditions such as drought, herds are also reduced to maintain the grass.

Business Risk Management Programs⁴⁴, including production insurance, income stabilization and emergency compensation are viewed as providing important protection from losses. However, for the cattle sector there is concern that the formulaic approaches used at present do not take into account the types losses being experienced. When producers experience significant losses due to weather related events, the responsiveness and timing of compensation is critical. For repeated losses, due to either gradual changes or extreme conditions, compensation based on average yields may not be sufficiently flexible to respond to what is occurring on the ground. Compensation based on income margins is similarly problematic for commodities experiencing prolonged downturns.

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 ranchers 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 • It's important for morale during tough times to gather with people who understand the pressures producers are under. The BC Cattlemen's Association has worked to deal with predators but the cumulative effect of drought, fire and wolves is tough.

— cattle producer, Nicola Valley

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 and more remote operations, who may not participate in associations.

The BC Cattlemen's Association is a very active industry organization that provides a range of services and programs to its members.⁴⁵ Programs cover a range of topics including health and food safety, environment and management practices. The BC Cattlemen's Association also represents the sector in working with government, with a dozen regional cattle associations and approximately 50 "locals" that make up the membership of the provincial association.⁴⁶

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, volunteer and funding resources of these organizations are being stretched.

Knowledge resources: Information, extension & research

The Central Interior has many cattle ranchers with decades of experience in their industry. 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.⁴⁷ 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 cattle industry has a strong association that provides a number of educational resources. However, availability of extension is variable and gaps exist for producers without sufficient financial resources (to pay for extension) or producers in more remote areas.

Limited research support for the cattle industry is maintained through the federal research centre in Kamloops, and the Thompson Rivers University has conducted both grasslands research and houses the BC Regional Chair in Cattle Industry Sustainability.⁴⁸

Despite these research resources, there has been limited regional level research in recent years. A number of gaps in research are noted by producers, particularly in relation to difficult conditions (such as drought) as well as perceived changes to hydrology/run-off and increasing concerns regarding water resources.

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. Cattle producers have adopted numerous approaches to managing new or challenging conditions. Examples of practices and technologies employed include: adjustment of grazing management, implementation of efficient irrigation systems and development onfarm water storage. A number of additional examples are provided in the box below.

Current management practices & approaches

- → Variety trials & adjustment of varieties
- → Grazing to match conditions
- → Irrigation infrastructure & upgrades
- → Drought planning
- → Water source development
- → Soil & water management practices
- → Business Risk Management programs
- → Consolidation or destocking
- → "Stacked" enterprises (diversified financial strategy)

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, are 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. Access to water and future water supply is of substantial concern for cattle producers in the interior. While producers are improving irrigation efficiency and their own practices, broader water availability, infrastructure and accessibility have a substantial impact on the ability to retain productivity in adverse conditions, and on the options available in the future.

The impact of surrounding landscape and land management has been very apparent to cattle producers in the Central Interior with the significant changes resulting from the mountain pine beetle. Producers noted that patterns of hydrology (runoff) have been altered by mountain pine beetle kill and tree removal.

Changes that are made to the land base have both immediate and long-term impacts on agricultural production. In the Central Interior, infrastructure that requires collective and cooperative approaches for effective agricultural adaptation include: water supply, access and storage, invasive species monitoring and management and land management.

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. I don't want to be an industry that relies on government subsidies to sustain itself; "farming the system" instead of producing something. At the same time, it's frustrating when other places provide programs so you can't compete on a level playing field.

—cattle producer, Lumby

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 fire management and grazing management. The need for better coordination and crossjurisdictional approaches was also raised for areas such as invasive species monitoring and management, wildlife management and water management and infrastructure.



Weather, variability & climate change

F 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 1998.⁴⁹

Figure 3 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.⁵⁰ 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.⁵¹ 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 1899,⁵² 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.⁵³

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 Central Interior specifically.

Central Interior 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.

The relative increase in precipitation in the Central Interior over the past century was more pronounced than in other regions, since the region was drier to begin with.⁵⁴ Looking ahead, temperature projections for the Central Interior are consistent with what was described for the province on average. Most of the region is projected to have approximately the same number of growing degree days in the 2050s, as Salmon Arm has now.⁵⁵

Precipitation projections are generally consistent with those for the province overall—with the annual amount of precipitation staying the same or increasing in all seasons except the summer. The one significant departure is that the Central Interior is expected to see a greater decrease in summer precipitation than the provincial average. Warming in winter and spring will mean that an increasing amount of that precipitation will fall as rain in most parts of the region, while less falls as snow (particularly in spring). But in the southwest area of the Cariboo-Chilcotin region, the amount of snowpack in spring is projected to stay the same or increase.⁵⁶

Streamflow in the Cariboo-Chilcotin region is dominated by the influence of snowmelt, resulting in a relatively predictable pattern of high flows in the spring, and low flows in fall and winter. Warming will shift streamflow patterns as less precipitation falls, or

CLIMATE PROJECTIONS FOR THE CENTRAL INTERIOR REGION IN THE 2020S

Source: Pacific Climate Impacts Consortium, www.Plan2Adapt.ca | Regional climate projections are produced by PCIC at a regional district level. Data shown in tables is for the Cariboo region, and is generally consistent with other parts of the Central Interior. Specific figures for other parts of the Central Interior can be accessed at www.Plan2Adapt.ca

	Time of Year	Projected Change from 1961–1990 Baseline		
		Range (Central Interior)	Average (Central Interior)	Average (BC)
Average Temperature	Annual	+0.4 °C to +1.4 °C	+1.0 °C	+1.0 °C
Precipitation	Annual	-1% to +7%	+4%	+4%
	Summer	-9% to +7%	-4%	+0%
	Winter	+1% to +8%	+4%	+4%
Snowfall	Winter	-12% to +3%	-2%	-2%
	Spring	-59% to +0%	-29%	-30%
Growing Degree Days	Annual	+80 to +247 degree days	+160 degree days	+163 degree days
Frost-free days	Annual	+7 to +19 days	+12 days	+10 days

CLIMATE PROJECTIONS FOR THE CENTRAL INTERIOR REGION IN THE 2050S

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

	Time of Year	Projected Change from 1961–1990 Baseline			
		Range (Central Interior)	Average (Central Interior)	Average (BC)	
Average Temperature	Annual	+1.2 °C to +2.5 °C	+1.8 °C	+1.8 °C	
Precipitation	Annual	0% to +12%	+6%	+6%	
	Summer	-15% to +4%	-7%	-1%	
	Winter	-2% to +14%	+8%	+8%	
Snowfall	Winter	-15% to +2%	-9%	-10%	
	Spring	-74% to -17%	-55%	-58%	
Growing Degree Days	Annual	+170 to +465 degree days	+306 degree days	+305 degree days	
Frost-free days	Annual	+13 to +33 days	+23 days	+20 days	

is stored, as snow. Projections for this region suggest an overall decrease in runoff, particularly in summer, which will contribute to lower soil moisture in the fall. Some models also show drier winter conditions in headwater regions of the Cariboo-Chilcotin.⁵⁷

Extreme weather events are projected to occur more frequently in BC in the future, and studies have shown some specific trends already.⁵⁸ 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.

Forest fires have become more frequent and severe in western North America, and this trend is projected to continue.⁵⁹

Impacts, Risks & Opportunities

POTENTIAL AGRICULTURAL IMPACTS OF SIGNIFICANCE FOR CATTLE PRODUCTION IN THE CENTRAL INTERIOR REGION IN THE 2020S

Changing Conditions	Potential Agricultural Impacts
Changing hydrological regime, decrease in summer precipitation, decrease in snowpack	Decrease in summer/fall water supply, decrease in quality and amount of water supply for livestock, water stress and decreased productivity for forage and rangeland (leads to overgrazing in other areas), increased productivity and ability to graze harder (in case of wet spring plus early dormancy), more frequent drought conditions, increase in water storage and irrigation needs
Increase in variability of conditions	Increase in management complexity, acceleration of cumulative impacts, challenge to current approach to production
Warmer winter temperatures	Increase in frequency of rain-on-snow events and thaw-freeze cycles, increase in hazardous conditions for livestock, increase in winterkill of grasses, increase in management costs
Increase in average temperatures, growing degree days and growing season length	Increase in suitability for new varieties of forage crops, increase suitability of new crops
Increasing wildfire risk	Increase in severity and frequency of damage due to wildfire (infrastructure, equipment, crop and rangeland), costs of preparing, managing and responding to imminent wildfire, cost of losses, psychological trauma

O DEVELOP A PRACTICAL UNDERSTANDING of what the projected changes mean for the Central Interior region, a small group of cattle ranchers were engaged in workshops in Williams Lake and Kamloops, focusing on the 2020s climate change scenario just described. This section presents the results of this exploration of potential impacts, risks and opportunities for cattle ranching in the Central Interior. Findings in this section also incorporate information gathered through interviews and broader background research regarding climate change impacts. *Impacts to the water supply*—precipitation, soil moisture and in stream—are a high priority issue for cattle ranchers in the Central Interior. The two sides to this issue are availability and accessibility of water. Producers noted that dry conditions in the summer are typical for this region, so the concern is how an increasingly limited water supply will be allocated to satisfy increasing demands from various users. Infrastructure for storage, distribution and irrigation was a preferred option for improving access to water. This was generally considered a difficult impact to manage, particularly due to costs and complexity of water management. Managing a limited water supply for livestock watering purposes was considered easier than for forage or hay crops, due to the degree of control that is possible by an individual rancher.

On the other hand, the right combination of conditions—namely an increase in spring precipitation together with earlier dormancy in fall—could increase productivity and allow for more intense grazing. This is not difficult to take advantage of, but is constrained where rules for grazing on Crown lands are not flexible.

Increasingly variable and extreme conditions will challenge the capacity of the cattle ranching industry, and pose significant risks. The limits to predictability that are inherent to this aspect of climate change make this a difficult issue to manage. While cattle ranchers are very accustomed to dealing with change due to the nature of their industry, the cumulative impacts of variability and extreme weather events add to all of the other challenges facing the industry and there is little precedent, within the current production model, for effectively managing this.

The challenges posed by *warming winter temperatures* were seen in the potential for more thaw-freeze cycles that can lead to hazardous conditions for livestock and winterkill of grasses. Manageability of these impacts was considered moderate, as long as producers plan and invest proactively in needed infrastructure (e.g., fencing).

The *shifting range of growing conditions* was considered a small opportunity with respect to changing varieties of *forage* crops. This was a straightforward management issue, assuming the presence of an adequate water supply. Shifting into *new* agricultural crops represented both a greater opportunity and a greater management challenge due to the risk and costs involved in making a change to new production systems. New knowledge, technology and equipment is needed and trial by error is part of any transition. At the same time, diversification opportunities may attract new people into agriculture, and create the opportunity for existing ranchers to lease land to new producers.

The *increasing risk of wildfire* poses a high potential degree of impact and is difficult to manage given current capacity. The impacts of mountain pine beetle and forest management practices on the fuel load combine with hotter and drier conditions to pose a significant risk. This risk was seen as greater when it comes to loss and damage to rangeland, while protecting assets was seen as more manageable.



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.

Key action items identified through the focus group session are noted below. The specific issues raised by cattle producers in the Central Interior are an important first step toward a regional approach to agricultural adaptation.

Central Interior / cattle 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.

• The pace at which [the climate] changes will determine how readily producers adapt to it. And they are a fairly adaptable bunch. They just need to have some time and some accurate forecasting as to what's happening. So they need good intelligence from the scientific community in order to make good decisions. We need adequate research and decent extension to get the information across to them.

- industry specialist, Kamloops

Water storage, access & management

The prioritization of agricultural water use and access was raised as one of the highest priorities in both focus groups, along with the need for investment in water development and storage and collective management approaches. More key actions pertaining to water are highlighted below.

Education & extension

Building knowledge at both the industry level and at the government level was seen to be a priority. Producers don't want a top-down or governmentdriven approach but would like to have information to support decision-making and innovation at the industry level. Learning from what people are already doing in other places is a good strategy. More knowledge sharing within the industry would also

be beneficial, as well as partnering with academics to co-produce a scientific basis for action; developing applied knowledge will motivate producers. Financial support that is tied to education and training would also be beneficial, as would more support for the industry in the area of extension.

Research

Areas of priority for research are looking at grass varieties and species for adapting to climate change. Also, suitability modeling and testing for forage varieties and improving research support for monitoring and management of invasive species. Hydrological studies are needed, particularly with the on-going impact of loss of tree cover due to pine beetle kill. This research needs to focus on improving understanding of water sources and the causes and contributors of flooding and runoff and how to better control and manage this. With the Regional Innovation Chair in Cattle Industry Sustainability at Thompson Rivers University and growing interest in agriculture at the University of Northern British Columbia, the industry, academics and government could collaborate and take proactive steps to develop leading research and knowledge.

Management practices & approaches

Managing a ranching operation requires knowledge of many practices and approaches for managing through change, variability and extremes. However, in the context of climate change, strengthening support and investment in water storage and funding for water sources and improved access were deemed to be high priority. Invasive plant monitoring is also needed. It was suggested that the Environmental Farm Practices/ Beneficial Management Practices programs could assist in developing fire proofing to assist producers to plan for, and manage, increasing wildfire risk.

Producers pointed out that at present producers who are innovative and act first take all of this risk and receive no financial support for innovating (while others who follow often receive support).

Collective approaches for regulatory regimes & infrastructure management

As is the case across the province, many of the key adaptation issues in the Central Interior relate to off-farm infrastructure and collective management decisions. Developing collective and cross-agency approaches is a priority. Key areas of need identified include: development of a broad (cooperative) invasive plant monitoring system, strategies for wildlife management, water storage and management and development of collective fire management strategies that include ranchers.

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