

Jurisdictional Scan

# British Columbia's Early Adoption of Agricultural Climate Adaptation Programming

Ministry of Agriculture  
Climate Change Adaptation Program



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## **Disclaimer**

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## Acronyms

AWDM	Agriculture Water Demand Model
BC	British Columbia
BMP	Beneficial Management Practice
CAI	British Columbia Agriculture Climate Change Adaption Initiative
CARICOM	Caribbean Community and Common Market
CAT	Climate Action Team
CCAP	Climate Change Adaptation Program
CCCCC	Caribbean Community Climate Change Centre
CCRIF	Caribbean Catastrophic Risk Insurance Facility
CDKN	Climate Development and Knowledge Network
FAIP	Farm Adaptation Innovator Program
FAO	Food and Agriculture Organization of the United Nations
IDRC	International Development Research Council
IICA	Inter-American Institute for Cooperation in Agriculture
PMF	Performance Management Framework
LAC	Latin America and the Caribbean
LA	Latin America
M&E	Monitoring and Evaluation
MOE	Ministry of Environment
RAS	Regional Adaptation Strategies
RAP	Regional Adaptation Projects
SMSC	Small and Medium Sized Cities

## Executive Summary

The agricultural scientific community has established that the adverse ecological and economic impacts of climate change on agriculture can be reduced through successful adaptation. In that context, agricultural adaptation as a policy response is regarded as an important influence in shaping agricultural decision-making, promoting adaptation and building resilience in the sector. While jurisdictions such as the USA, Australia, New Zealand, Manitoba, Ontario and British Columbia (BC) have already developed and/or implemented agricultural adaptation programs, some countries in Latin America and the Caribbean (LAC) are still at an early stage in the process. In agricultural circles, the BC Ministry of Agriculture Climate Change Adaptation Program (the “Program”) is regarded as one of the more advanced planned adaptation interventions that can provide learning for adaptation planning and programming in jurisdictions in LAC.

This jurisdictional scan seeks to provide a synopsis of the BC program and to identify the knowledge products, i.e. tools and methodologies that can be contextualized to agricultural adaptation programs in LAC. The scan is done through a review of Program documents and reports. A brief overview of the Program is undertaken, including a description of the institutional and funding arrangements, approach to program planning and delivery, development of Program framework, and products generated by the Program. Other programs funded by the Ministry of Agriculture and that contribute to climate change adaptation are also noted. The processes and tools shown in the Program that are transferable to planned adaptation programs in LAC countries are highlighted.

The review showed that while the economic and institutional contexts may differ in BC and LAC, agriculture in both regions is exposed to the same climate-related stressors and impacts. The study observed similarities between climate change adaptation programming methodologies in both regions, and that the framework for program planning in LAC generally aligns with the framework applied in the BC program. In addition to the common methodological approach, the BC program produces processes and products that can be contextualized to adaptation programming in LAC. The regional approach and the stakeholder-led and bottom-up approach to adaptation planning, together with the strong emphasis on adaptive research, are valuable examples for LAC countries. Water-related stressors – i.e. drought and floods, extreme heat and precipitation, sea level rise, and related impacts such as pests and diseases – and wildfires are the major climate-related risks to agriculture in BC and LAC. Therefore, the various flood and drought mitigation strategies being piloted and tested in BC are likely to find wide application in LAC.

The study concludes that, given the limited capacities and resources in most LAC countries, external support might be required to help them to integrate the processes and products that are available from the BC program into country level and/or regional level adaptation programs. Finally, recommendations that are intended to strengthen agricultural adaptation planning in LAC and to help improve the effectiveness of adaptation programs that are already implemented are offered.

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# 1. Introduction

## 1.1 Background

The agricultural scientific community has established that the adverse impacts of climate change on agriculture can be reduced through successful adaptation, which would likely cost less than the costs of the impacts that would otherwise occur without adaptation.<sup>1</sup> In that context, agricultural adaptation as a policy response is regarded as an important influence in shaping agricultural decision-making and promoting adaptation to mitigate the negative impacts of climate change and build resilience in the sector. While jurisdictions such as the USA, Australia, New Zealand, Manitoba, Ontario and BC have already developed and/or implemented agricultural adaptation programs, many others are still at an early stage in the process.<sup>2</sup> Professionals in agriculture and climate change regard the BC Ministry of Agriculture Climate Change Adaptation Program (the “Program”) as one of the more advanced programs that can provide learning for climate adaptation planning and development in other jurisdictions including countries in Latin America and the Caribbean (LAC).

## 1.2 Purpose of the review

This jurisdictional scan seeks to identify the tools and methodologies applied in the BC Agriculture Climate Change Program that can inform the planning and development of agricultural adaptation programs in LAC. Section 2 provides a brief overview of the Program. The third section highlights the aspects of program planning and development that can be applied to planned adaptation programs in LAC countries. In that regard, the section highlights processes including the approach to program planning, and products such as the adaptive tools that are likely to have application in LAC countries. Section 4 offers recommendations that might inform the Inter-American Institute for Cooperation in Agriculture (IICA) Canada support for planned adaptation programs in LAC.

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<sup>1</sup> Impacts of climate change on agriculture include: increase of mean temperature; increased variability temperature and rainfall patterns; changes in water variability; flooding, ponding, excess moisture and drainage issues; drought; pests and disease outbreaks; the frequency and intensity of “extreme events”, sea level rise and salinization, and perturbations of ecosystem (FAO, 2013).

<sup>2</sup> Given the generally held perception that the potential negative impacts of climate change are expected to vastly outweigh the potential benefits, countries seem to largely focus investments in climate change adaptation.

## 2. Program methodology

### 2.1 Foundation: BC Agriculture Climate Change Adaptation Program

The BC Program closely aligns with the British Columbia government's 2010 climate change adaptation strategy.<sup>3</sup> The principle that underpins the strategy is that building resilience to climate change cannot be accomplished exclusively through the actions of the BC government. Broad-based collaboration and partnership among Ministries, sectors, institutions and private stakeholders is required to accomplish that goal. The Ministry of Environment (MOE) adaptation strategy defines three strategies to build resilience to climate change:

**1. Build a strong foundation of knowledge and tools to help public and private decision-makers prepare for climate change**

- Engaging climate science to provide the high quality applied science information that required by decision-makers (e.g. policy makers, planners, private sector);
- Developing and providing the knowledge and tools that can be used by decision-makers taking adaptation action. The tools are to help decision-makers to identify and evaluate adaptation options;
- Building observation networks, such as climate monitoring systems and drought warning systems; and
- Supporting knowledge transfer, education, and outreach activities by organizations that work to help decision-makers prepare for climate change.

**2. Make adaptation a part of government business, to ensure that climate change adaptation is integrated in policies, planning and regulations across government**

- Integrating climate change adaptation policies, regulations and planning; and
- Taking a collaborative and coordinated approach to implementing adaptation programs; that is, involving multiple stakeholders across the public and private sectors in adaptation interventions

**3. Assess risks and implement priority adaptation strategies in key climate sensitive sectors**

- These assessments are to be supported by science and relevant technical experts, engaging public and private sector stakeholders in the process.

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<sup>3</sup> See <http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs/adaptation>

## 2.2 Overview: Agriculture Climate Change Adaptation Program

The Program goal is to build resilience to climate change. The strategic objective is that “agricultural production is sustained and enhanced as the sector proactively adapts to climate change” (Ministry of Agriculture. 2014, Performance Measurement Strategy). The Program provides funding for development and implementation of collaborative regional adaptation strategies; piloting, demonstration and sharing of innovative adaptation strategies at the farm level; communications about adaptation and adaptation programming; and program administration, program management and project development functions. These investments are intended to help the agriculture sector to lead and improve its capacity to adapt successfully to climate change, and thereby to enhance its competitiveness and sustainability. The general approach is to build adaptive capacity in the agriculture sector by increasing the knowledge of stakeholders regarding climate change risks and the implications; building the human and social resources; and developing the tools and adaptive measures for on-farm application. Elements of the Program include:

**Educational component:** focused on building knowledge and creating an understanding of climate change; building the human and social capacities among industry stakeholders to access the relevant adaptation information, resources and tools to make decisions in favour of adaptation and to implement priority adaptation strategies and actions;

**Financial assistance:** limited government-provided financial incentives to assist agricultural producers to implement on-farm the priority strategies and build the physical infrastructure that can accommodate climate change impacts. At this stage, the farm level projects are only pilots and demonstrations. The findings from these pilots will be shared with farmers through knowledge sharing events; and

**Support for research, innovation and project development:** program provides support to agricultural producers, producer organizations and other parties to conduct research; develop, test, pilot and roll-out priority strategies and actions that promote adaptation.

## 2.3 Institutional and funding arrangement

The B.C. Ministry of Agriculture engaged the BC Agriculture & Food Climate Action Initiative (CAI) to plan, develop and implement the Program.<sup>4</sup> The mandate of the CAI is to: (1) increase industry understanding of the implications of climate change, (2) respond to and address climate change issues and opportunities, (3) strengthen agriculture’s climate change networks, (4) act as a forum for sharing resources, information and tools, and (5) communicate and collaborate with relevant BC government agencies. Tools and resources developed through the Program are made publicly available. These tools and resources are to enable BC’s agricultural producers to evaluate vulnerability to the impacts of climate change and to integrate climate change adaptation into decision-making. The CAI and the

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<sup>4</sup> The CAI was established by the BC Agriculture Council in 2008, and is led by an advisory committee of agricultural producers, food processors, and representatives from various government agencies. The initiative is supported by the Investment Agriculture Foundation of BC with funding provided by Agriculture and Agri-Food Canada and the BC Ministry of Agriculture.

Ministry of Agriculture's Climate Action Team collaborate closely in Program delivery. The Program is funded by a five year (2013-2018) federal-provincial-territorial initiative called Growing Forward 2 (GF2). Approximately \$5.7 million (Canadian) has been allocated for the program over the funding period.

## **2.4 Program framework**

CAI's program development (Figure 1.) includes: (1) creation of a climate action plan for BC agriculture in 2010, (2) undertaking risk and opportunity assessments in 2012, and (3) developing Regional Adaptation Strategies (RAS) from 2013 onwards, and initiating the Farm Adaptation Innovator Program (FAIP) in 2014. The key components of the Program currently are the: (1) RAS program and (2) FAIP. The development of the components, their objectives and modes of operation, as well as ancillary climate change related projects and interventions are discussed in the following section.

### **2.4.1 Regional Adaptation Program**

#### **Regional Risk and Opportunity Assessment<sup>5</sup>**

Risk and opportunity assessments were conducted to identify and prioritize the climate change related risks and opportunities for the specific commodities produced in the key agricultural regions of BC. An advisory committee was formed to participate in the assessments. Membership of the advisory committee included representatives of the B.C. agriculture industry, provincial and federal agriculture and environment agencies, and Pacific Climate Impacts Consortium, a key climate change research organization. Through a participatory risk-based approach<sup>6</sup> that included personal and focus group interviews with agricultural producers and industry stakeholders the level of adaptive capacity in the industry was assessed, the perspective of agricultural producers about industry capacity to adapt to current and projected risks and opportunities was solicited, and approaches, tools and resources required to better support agricultural adaptation to climate change were identified (CAI. 2012, Risk & Opportunity Assessments).

#### **Regional Adaptation Strategies (RAS)<sup>7</sup>**

The regional risk and opportunity assessments clearly identified the strategic need to take action not only at the farm level but also at the broader regional level. Through collaborative planning processes agricultural producers, local government, and technical specialists have evaluated the regional climate related risks and developed priority strategies and actions to mitigate those risks. The processes included local background research and studies of climate data provided by the Pacific Climate Impact

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<sup>5</sup> See [www.bcagclimateaction.ca](http://www.bcagclimateaction.ca)

<sup>6</sup> A participatory risk-based approach was used because, among other reasons, the approach allows information to be presented in ways that can be used to make decisions where data is lacking and uncertainty cannot be accurately assessed. It also allows risks to be prioritized and used as the basis for defining both short and long-term goals and actions (Risk & Opportunity Assessment, 2012).

<sup>7</sup> See [www.bcagclimateaction.ca/regional/overview/adaptation-strategies](http://www.bcagclimateaction.ca/regional/overview/adaptation-strategies)

Consortium (PCIC).<sup>8</sup> Pilot RAS were completed in 2012/2013 in the Cowichan, Delta, and the Peace regions; RAS have been completed for the Cariboo region (2014) and the Fraser Valley (2015); and the Okanagan regional strategy will be completed in 2016. The objectives of the RAS are to:

- Foster collaborative planning among agricultural producers, and local and provincial government agencies;
- Strengthen understanding of climate change impacts for agriculture;
- Develop regionally suitable options, strategies and actions for adaptation; and Implement plans for collaborative implementation.

### **Regional Adaptation Projects**

Regional adaptation projects are being undertaken to implement the priority actions in the regional strategies. The projects are designed to address the complex regional adaptation issues and deliver results in the key areas of: (1) collaborative solutions to regional issues, (2) farm-level tool kits and manuals, (3) producer decision-support tools, and (4) raising the profile of agricultural adaptation. The outputs include tools, resources and recommendations to facilitate adaptation decision-making by farmers and industry stakeholders, weather monitoring and information systems, and priority adaptive strategies for on-farm adoption and regional implementation. Appendices 1-5 describe the RAS projects, their objectives and the climate change risks they are designed to mitigate.

The RAS projects include projects intended to:

- Tackle the relevant adaptation concerns such as water management and supply or management of extreme events (e.g. wildfire, flooding) that require stakeholder collaboration at the regional level (e.g. Cooperative maintenance & enhancement of agricultural dams, Pilot drought alert system);
- Develop practical planning tools and adaptive technologies to assist farmers to plan, evaluate and reduce the risks associated with changing climate and climate variability. The tools and technologies developed are specific to the risks facing the region and individual farms (e.g. Integrated farm water planning pilot, Wildfire preparedness & mitigation planning & resources);
- Generate the useful information and tools including adaptation options that enable producers to make informed investment and production decisions that increase productivity and throughput, reduce risks, and build on-farm resilience (e.g. Agriculture weather monitoring & decision-support tool, Collaborative pest monitoring pilot); and
- Build information networks, create knowledge and provide information to enhance the understanding of the public and industry stakeholders in matters concerned with agricultural climate change adaptation (e.g. Agriculture & climate change education and outreach). This education is to facilitate initiatives to integrate adaptation in community and regional decisions.

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<sup>8</sup> PCIC is a regional climate service centre at the University of Victoria that provides practical information on the physical impacts of climate variability and change in the Pacific and Yukon Region of Canada. PCIC collaborates with climate researchers and regional stakeholders to produce knowledge and tools in support of long-term planning.

**Figure 2.1: Development of the BC Agriculture Climate Change Adaptation Program**



Source: Ministry of Agriculture and Climate Action Initiative, 2015.

#### **2.4.2 Farm Adaptation Innovator Program (FAIP)<sup>9</sup>**

Unlike the RAS, the FAIP is an application driven process. Its goal is to build adaptive capacities in the areas of physical resources, knowledge resources, and human and social resources. The objectives are to: (1) promote innovations in farm practices, approaches and technologies that support climate change adaptation, (2) demonstrate the suitability of farm practices for mitigating climate change impacts, (3) develop knowledge, information resources and human resource capacity, and (4) increase the effectiveness of networks and associations (CAI. 2014, Farm Adaptation Innovator Program).

**Physical Resources:** Investments in physical resources focus on developing farm physical infrastructure such as water storage, dike and drainage systems, and crop protection technologies to improve the resilience of farm land, water and ecological systems, and reduce climate change related production risks. “Adapting BC Horticulture through Protected Crop Research and Demonstration” is a project in this area.

<sup>9</sup> See <http://www.bcagclimateaction.ca/farm-level/adaptation-innovator-program>

**Knowledge Resources:** Knowledge resources emphasize the creation of knowledge through applied research; the utilization of experiences, education and skills in adaptation; and the transfer mechanisms to move the results of research, i.e. the innovations and technologies, into on-farm practice. An example of a knowledge resource project is the “Keyline Water Management: Field Research and Demonstration” project.

**Human and Social Resources:** The purpose of this component is to develop the human and social capital needed to adapt to climate change. The focus is to increase the business management and planning skills of agricultural producers to empower them to adapt through appropriate cultural farm practices and farm management. The objective is also to improve the capacity of producer organizations to better serve and build the capacity of farmers. “Innovative Management Practices for Resiliency” is a project in this area.

The FAIP adopted a science-based approach in developing the adaptive innovations, technologies and practices that support and enable climate change adaptation. The FAIP actively engaged the scientific community including academic and research institutions, as well as producers, agricultural organizations, agri-businesses, and farm cooperators. Before becoming fully subscribed, funding was available for projects in soil and crop management (horticulture, orchards, viticulture, seeded forage, and forage grown for seeds); livestock pasture and range management; water management; and whole farm and business management. Fifteen projects are underway across B.C. Appendix 6 lists the FAIP projects.

The **Farm Practices & Climate Change Adaptation series** is another farm-level adaptation initiative. This project, which preceded the FAIP, evaluated how current and innovative farm practices may support adaptation for climate change. The key objectives were to:

- Develop a basic framework to analyze adaptive agricultural practices in relation to conditions (risks and opportunities), locations and production systems in BC;
- Utilize the framework to assess practices for their potential to strengthen farm resilience (in a changing climate); and
- Identify areas for further research, demonstration or pilot work, as well as possible barriers to implementation.

The farm practices evaluated were conservation tillage, drainage, management intensive grazing, shelterbelts, nutrient management, and water storage. The information generated will help to identify factors involved in farm management decision-making, and identify the potential for specific practices to increase resilience to climate change.<sup>10</sup>

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<sup>10</sup> The reports can be seen at: <http://www.bcagclimateaction.ca/farm-level/farm-practices>

## **2.5 Approach to Program development**

### **Anticipatory approach**

Some regions of BC are already experiencing the effects of climate change, and it is expected that agricultural producers will in the future experience a greater range of climatic conditions and extreme weather conditions that will exert significant impacts on agricultural production systems. The underlying rationale for the program is that the adaptation investments made in the present are likely to cost significantly less than the future losses the industry might sustain if these investments were not made. The approach seeks to engender in the present the preparation necessary to withstand the scope and intensity of projected impacts resulting from climate variability.

### **Stakeholder-led and bottom-up approach**

The Regional Adaptation program was built from the bottom-up. Groups of stakeholders including participants from local government and their committees, the BC Ministry of Agriculture and the agriculture sector were integrally engaged and collaborated in developing the program, i.e. providing counterpart funding; identifying climate related risks and impacts; developing the regional adaptation strategies and the actions to counteract the risks and impacts; and giving general in-kind support.

### **Science-based approach**

Extensive reviews of published reports from other jurisdictions and within BC related to the agriculture sector, climate change adaptation, and adaptation assessments were made by the Program planners. The literature of the Intergovernmental Panel on Climate Change (IPCC) provided information about the impacts of climate change and adaptation in agriculture. The science literature and the Pacific Institute for Climate Solutions (PICS) and the Pacific Climate Impacts Consortium (PCIC) provided applied scientific information, including past trends and future climate projections for BC. Research conducted by Australia's Commonwealth Scientific & Industrial Research Organization (CSIRO), and the work undertaken in other jurisdictions provided valuable information about agricultural climate change adaptation programs; climate and weather variability and projected climate changes, and the associated risks and impacts; regional characteristics of agriculture; and the resources required to build adaptive capacity and resilience in agriculture.<sup>11</sup>

### **Regional approach**

The key agricultural regions of BC are diverse in ecology, climate, and agriculture. Given that diversity, climate adaptation was approached from a regional perspective in the Program. This allowed regional scale multi-stakeholder collaborative and adaptation planning to address climate change in the appropriate local context.

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<sup>11</sup> BC Agriculture Climate Change Adaptation: Risk & Opportunity Assessment Provincial Report, 2012 provides details of the approach. <http://www.bcagclimateaction.ca/wp/wp-content/media/AdaptROseries-Provincial.pdf>

## 2.6 Other agricultural climate change adaptation-related programs

### 2.6.1 Beneficial Management Practice (BMP) Program

The goal of the BMP Program is to increase agricultural sustainability and contribute to a cleaner, healthier environment. The program includes financial incentives to encourage farmers to adopt certain agri-environmental practices that will help to reduce greenhouse gas (GHG) emissions from farm operations, and help to reduce the risks associated with climate change.<sup>12</sup> The preferred practices include maximizing water use efficiency; planting crops and crop varieties that are drought resistant; adjusting storm water management for heavier run-off; reintroduction of native grasses for pasturing; use of organic matter, crop cover and shading to retain soil moisture, and other agricultural practices that support environmental stewardship and adaptation (BC Agriculture Council, 2014). Other provinces in Canada also operate similar BMP programs.

### 2.6.2 Agriculture Water Demand Model

The Agricultural Water Demand Model (AWDM), a water management planning tool, was first developed for the Okanagan, a major agricultural region in BC. The AWDM is part of the response to the pressures on water resources in the region. Climate change impacts are projected to increase the usage of stored water during the summer months, and also to increase the amount of water required to grow a crop. The AWDM is designed to provide current and future agriculture water demands for the Okanagan Basin. The intent of the model is to inform decisions about reserve water for agriculture. The model calculates water use on a property-by-property basis and sums each property to obtain the total water demand for the entire basin or sub-basins. Crop, irrigation system type, soils and climate data are used to calculate the water demand. The tool can be used for any region provided with the appropriate land use and climate information (B.C. Ministry of Agriculture, 2015).

### 2.6.3 Adaptive Design and Assessment Policy Tool (ADAPTTool)

Climate change adaptation programs operate in dynamic and complex environments. These environments can make it difficult to predict the outcomes of even well designed adaptation programs, and may lead to their failure to achieve planned objectives, and accommodate unintended consequences. To address this situation, the International Institute for Sustainable Development (IISD) developed ADAPTTool, an experimental analytical Excel spreadsheet that provides a structured way to: (1) analyze how policies and programs support adaptation to both anticipated and unanticipated climate change impacts, and (2) identify areas to improve performance under climate change conditions. ADAPTTool shows whether policies and programs support adaptation to a particular stressor, and whether the policies or programs themselves are inherently adaptable (due to the features of their design and implementation). The premise is that as conditions change, policies and programs may become less effective or even counterproductive. Adaptive policies and programs increase adaptability and help avoid these kinds of failures. Policies and programs that are adaptable to changing external

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<sup>12</sup> For information about the BMP program, see [www.bcac.bc.ca](http://www.bcac.bc.ca), [www.agf.gov.bc.ca](http://www.agf.gov.bc.ca) and <http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/programs/growing-forward-2/beneficial-management-practices>. See also [www.bcefp.ca](http://www.bcefp.ca) for information about the linked Environmental Farm Plan program (reference guide Chapter 12 “Climate Change”).

conditions can better avoid unexpected failures and unintended consequences, and take advantage of new opportunities (IISD, 2013).

The ADAPTool was piloted in BC to provide the Ministry of Agriculture with a detailed and rigorous assessment of the potential for multiple policies/programs to support climate change adaptation in the sector, and to generate related discussion, networking and understanding among key staff, program leads and colleagues in other ministries. Fourteen programs were selected for assessment, based on their importance to the agriculture sector, their interface with climate adaptation, whether program changes were being considered, and whether there were “champions” in the program who were interested in participating. The programs assessed were: AgriStability, Production Insurance, the Regional Agrologist Network, Strengthening Farming, Agroforestry, Range Management, Invasive Alien Plant Program, Pest Management/Plant Health, the Environmental Farm Plan program, the Beneficial Management Practices program, Agricultural Emergency Management, Agriculture Water Management program, Water Act modernization and the Agri-Food Business Development program. The Excel spreadsheet serves as the basis for scoring each program in response to a set of assessment questions. The questions cover both planned adaptability (i.e., how well the policy or program anticipates the likely impacts of the stressor) and autonomous adaptability (or adaptability to unanticipated impacts of the stressor) (IISD, 2013).<sup>13</sup>

Table 2.1, below, summarizes the agriculture climate change adaptation interventions in BC. While the BC agriculture climate change adaptation program directly targets agricultural adaptation, the BMP and the AWDM indirectly facilitate adaptation. The ADAPTool contributes to agricultural adaptation by helping to ensure that adaptation policies and programs are both effective and adaptive. Information about the success of the BMP and AWDM, what constitutes success, and lessons learnt from them are not available.

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<sup>13</sup> See [https://www.iisd.org/pdf/2014/adapttool\\_bc\\_ag.pdf](https://www.iisd.org/pdf/2014/adapttool_bc_ag.pdf) for more information about ADAPTool and the results of the pilot application in BC.

**Table 2.1: Summary of Agricultural Climate Change Interventions in BC**

Intervention	Scope	Goal	Approach
BC Agriculture Climate Change Adaptation Program  Regional Adaptation Strategies (RAS) Program  Farm Adaptation Innovator Program (FAIP)	<ul style="list-style-type: none"> <li>• Capacity development</li> <li>• Knowledge generation and sharing</li> <li>• Development of information networks</li> <li>• Fostering collaborations among stakeholders</li> <li>• Development, piloting, testing of adaptation decision-making tools</li> <li>• Development, piloting, testing of adaptive technologies, innovations and practices</li> </ul>	Strengthen resilience of the agriculture sector to climate change	Build adaptive capacity in the sector
Beneficial Management Practice (BMP)	Financial support	Reduce agricultural greenhouse gas emissions  Promote climate change adaptation	Promote adaptive agricultural practices
Agriculture Water Demand Model (AWDM)	Water use planning & management	Reserve water for agricultural purposes	Water management
ADAPTool assessment	Analysis of agricultural climate change policies and programs	Facilitate the design of effective and adaptive agricultural climate change policies and programs	Policy and program analysis

## **3. Transferability of processes and products**

### **3.1 Context scan: BC and LAC**

The context scan is used to determine which tools and methodologies applied in the BC Program that can be contextualized to agriculture climate change adaptation programs in LAC. The analysis treats LAC as a region and does not consider the economic conditions and agricultural production systems of the individual countries.

#### **Institutions and economic resources**

Some LAC countries differ with BC in terms of institutional frameworks, agricultural support systems, economic resources, and in some aspects, the timing, nature and severity of climate change impacts. A significant proportion of the agricultural sector in LAC is composed of resource constrained small holder farmers practicing subsistence farming. There are often limited resources available for adaptation at the farm level, industry and government. Perhaps in most countries, adaptation funding is largely provided by international development organizations. All of the above have implications for how agricultural adaptation programs are planned and delivered in LAC.

#### **Climate, ecosystems and agriculture**

Latin America, like BC, is heterogeneous in climate, ecosystems, and agriculture. Natural ecosystems include humid tropical areas; dry forests, savannas, grasslands and deserts, temperate forests, and mountain alpine regions. The different ecosystems exist even within countries such as Mexico, Brazil, Argentina and Chile (IPCC, 2001). The differences give rise to differing patterns of vulnerability to climate change, requiring that agriculture adaptation programs be tailored to fit the local context.

The Caribbean islands, on the other hand, are homogeneous in ecosystem, climate and agriculture. Given this homogeneity and similarities in climate change vulnerabilities across the region, a regional approach to climate change adaptation is taken in the Caribbean.<sup>14</sup>

#### **Climate change impacts**

The LAC countries are vulnerable to climate change impacts, including sea level rise, pests, and invasive species, ocean acidification, changes in rainfall patterns, increased temperatures, and changing hazard regimes including hurricanes of greater intensity, floods and droughts (Mercer et al 2012). The impacts of these vulnerabilities on agriculture in LAC and BC are similar. Among the impacts are more prolonged and severe dry seasons leading to increased occurrences of drought and water shortages for rain-fed agriculture, irrigation, heat and water stresses for livestock and spontaneous wildfires during summer months; more erratic and unseasonal rainfall with increased flooding, landslides, and soil erosion; rising sea levels combined with larger storm surges causing coastal erosion and altering salinity of coastal

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<sup>14</sup> The Caribbean Community Climate Change Centre (CCCCC) coordinates the Caribbean region's response to climate change. It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the Caribbean Community and Common Market (CARICOM) Member States through the CARICOM Secretariat.

agricultural lands; and higher average temperatures and humidity levels giving rise to increased occurrences of pests and disease outbreaks (MOE, 2010; Risk & Opportunity Assessment, 2012; and World Bank, 2012). The major climate change impacts on agriculture in BC and LAC are drought and flooding. The observation was made that from floods, to droughts, to landslides, water-related disasters are increasingly frequent and severe in LAC. In that regard, some of the knowledge and products developed in BC to mitigate drought and flooding are likely to have broad application in LAC.

### 3.2 Climate change adaptation programming in LAC

Several climate change adaptation initiatives have been implemented at the national and/or regional level in LAC. The initiatives include projects and interventions to:

- Mainstream adaptation into policies, planning and regulation;
- Help citizenry to understand the vulnerabilities to climate change and build adaptation capacity;
- Develop decision-making tools and adaptation plans that are grounded in research and scientific knowledge;
- Identify appropriate climate change adaptation strategies and measures;
- Conduct regional studies concerning the economics of climate change and the impact on economic sectors including agriculture; and
- Explore adaptation responses through risk mitigation (e.g. implementation of adaptive strategies) and risk transfer (e.g. catastrophic risk insurance)<sup>15</sup> (Mercer et al, 2012 and CCRIF, 2010).

#### Examples of the initiatives include:

- Adaptive research funded by the International Development Research Centre (IDRC) to support adaptation projects in the water sector, i.e. support sustainable water management in LAC. The intent is to build a strong base of evidence on adaptation options to safeguard water resources, and to inform decision-makers about the most effective use and targeting of climate change funding.<sup>16</sup>
- Project by the Nature Conservancy to research, analyze and model the impacts that climate change will have across Latin America, in places like the Gulf of California, Brazil's Atlantic Forest, Ecuador's dry forests, Mexico's storm-plagued Yucatán Peninsula, and Guatemala's Atitlán watershed. The goal is to restore forests and healthy watersheds that will help to protect local populations from landslides caused by heavy hurricane rains.<sup>17</sup>

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<sup>15</sup> The projects in the Caribbean include: "Caribbean Planning for Adaptation to Climate Change" (1997–2001); "Adaptation to Climate Change in the Caribbean" (2001–2004); "Mainstreaming Adaptation to Climate Change" (2004–2009); and the "Special Program on Adaptation to Climate Change: Implementation of adaptation measures in coastal zones" (2007–2011).

<sup>16</sup> <http://www.idrc.ca/EN/Programs/Climate-Change>

<sup>17</sup> See <http://www.nature.org/ourinitiatives/regions/latinamerica/latin-america-adapting-to-climate-change.xml>

- Project by the Woodrow Wilson Center to, through a series of seminars, help to stimulate local development of new policy and programmatic tools to help LAC countries meet the financial, organizational, and political challenges that climate change presents. The seminars showcase international expertise and provide policymakers across a variety of ministries with useful tools, models, and thinking about climate change adaptation that can address the region's urgent need for responses to climate change impacts.<sup>18</sup>
- World Bank project to strengthen climate adaptation planning for small and medium sized cities (SMSC) in LAC. The objective is to support SMSC with adaptation planning for floods and landslides, two of the most recurrent climate-related hazards in the region.<sup>19</sup>

The methodologies in the above LAC adaptation projects generally include an assessment of risks and vulnerabilities; capacity building activities; the dissemination of adaptation knowledge and information; and the development of adaptive tools and measures, which are essentially consistent with the BC model. However, it is not apparent that participatory planning and adaptation research are as strong in LAC adaptation programs as they are in BC. While these projects are not specific to agricultural climate change adaptation, the methodologies can be easily applied to the sector's adaptation programs.

### **3.3 Transferable processes and approaches**

#### **Regional Adaptation program approach**

The regional approach to agriculture climate change adaptation (as seen in the Regional Adaptation program) is likely to be broadly applicable to many countries in Latin America, especially the larger and more ecologically diverse territories such as Brazil, Argentina, Chile and Peru that have different agro-ecological regions. The approach includes assessments of the risks and opportunities presented by climate change; the development of adaptive technologies and innovations to mitigate the specific risks, and strategies to exploit the opportunities; and the creation of an action plan to implement those processes. The regional approach to climate change may also allow adaptation intervention to be managed on a smaller scale and thereby reducing some of the complexities that are normally associated with managing larger national scale adaptation programs.

#### **Stakeholder-led, bottom-up and participatory approach**

The approach recognizes that building resilience to climate change is likely to be more successful by integrating stakeholders, partners and experts into the effort. The investments made to foster collaboration and engage the Ministry of Agriculture, local government, agricultural producers, academic institutions, other ministries, environmental NGOs, federal agencies, and industry partners in the processes and projects (identifying and prioritizing climate related risks and impacts; developing specific adaptive strategies and actions; implementation of program interventions; and building networks, information and communication channels) has several advantages. It helps to ensure that the

<sup>18</sup> <https://www.wilsoncenter.org/collection/climate-change-adaptation-latin-america>

<sup>19</sup> <http://www.worldbank.org/en/results/2014/01/31/climate-change-adaptation-planning-in-latin-american-and-caribbean-cities>

right partners are engaged in the right processes and projects; and build the broad base support for climate change adaptation programs, that promotes advocacy, and enables stakeholders to take ownership of the adaptation program that emerges.

### **Farm Adaptation Innovator Program and adaptive research**

The science-based approach, emphasis on and investments in adaptation research apparent in the BC program provide a good example for LAC. Rigorous efforts to develop and test the technical merits of on-farm adaptive technologies, and the active engagement of academic and research institutions, agricultural producers, agricultural organizations, and agri-businesses are of obvious merit. The Caribbean Agricultural Research and Development Institute (CARDI), is engaged to some degree in climate change adaptation research. The extent to which tertiary academic institutions and other agricultural research institutions resident in LAC are involved in testing and demonstrating the technical merits of indigenous adaptive measures or in developing, piloting and rolling out innovative adaptive technologies and strategies requires further investigation. These institutions can, however, through products generated by empirical research, make an important contribution to agricultural climate change adaptation in the region.

### **Adaptive Design and Assessment Policy Tool (ADAPTTool)**

Agricultural climate change adaptation programs operate in complex and dynamic environments that can affect their effectiveness and sustainability. The ADAPTTool can be applied to any climate change stressor, and can be used in diverse geographical contexts. Climate change adaptation planners and analysts in LAC could use the tool to evaluate the effectiveness of a particular adaptation program or groups of programs in supporting adaptation, as well as their ability to adapt to changing economic, political, social and environmental conditions. The use of the tool can help to ensure that adaptation programs that are effective and adaptable are selected for implementation.

### **Beneficial Management Practice (BMP) & Agriculture Water Demand Model (AWDM)**

Research has demonstrated that many farm production practices can help to alleviate the negative impacts of climate change. For that reason, the adoption of production practices or innovations is one of the most frequently advocated strategies for adapting the agricultural sector to climate change. In LAC, many proven production practices (indigenous and common) are known and accessible. While LAC countries may not have the resources to provide financial support to farmers, home-grown programs similar to the BMP might be established to facilitate and encourage the extensive adoption of adaptation practices (especially those that do not require significant on-farm capital investments or financial outlays). A well-functioning agricultural extension service providing information, technical, marketing and material support where feasible, might help to trigger the desired widespread adoption of the practices. Droughts are among the common climate related stressors that jeopardize agricultural production and the livelihoods of significant numbers of small and under-resourced farm households in LAC. In that regard, the AWDM would be a very useful tool for ministries of agriculture and agricultural planners in LAC. The AWDM, modified to fit the diverse local contexts can facilitate adaptation by helping to secure water resources for agricultural production, assisting farmers to manage water demand, increasing the efficiency of water use, and improving irrigation management. This would help

to ensure that adequate supplies of water are available to support crop and livestock production even during periods of drought.

### **3.4 Transferable technologies and innovations**

As in BC, water-related hazards, e.g. drought and floods, are the major climate-related risks to agriculture in LAC. In that regard, many of the adaptive products (e.g. those concerned with water storage and water use planning, irrigation and water management, drainage and flood mitigation) that are being developed and tested in BC are likely to have wide applicability throughout LAC. The projects include: (1) flooding preparedness & mitigation pilot, (2) drainage and sub-irrigation project, (3) integrated farm water planning pilot, (4) cooperative maintenance and enhancement of agriculturally significant dams, (5) agricultural vulnerabilities to coastal flooding; and others. Appendices 1-5 list the projects, their objectives and the risks they are designed to address. The Beneficial Management Practice Program and the Agriculture Water Demand Model are also likely to have relevance for adaptation programming in LAC.

### **3.5 Inter-American Institute for Cooperation in Agriculture (IICA) Canada**

Building resilience of agriculture systems and integrated risk management in a changing climate are among IICA Canada's priority areas. Farmers, agricultural organizations and ministries of agriculture are faced with increasing climate change related risks, and the attendant costs of reducing the risks, adapting to climate change and building resilient production systems, even with limited resources. Adaptation planning for future climate change impacts is a risk management strategy that aligns with IICA resilience and integrated risk management emphasis and focus. In that regard, technical assistance that facilitates climate adaptation broadly is promoting resilience and risk management. The recommendations offered in Section 4.2 are intended to help to inform IICA Canada's support for agricultural adaptation and resilience in LAC.

Table 4.1, below, summarizes the applicability to LAC of B.C. approaches and tools.

**Table 4.1: Summary of Applicable British Columbia Approaches and Tools**

Approach/Tool	Purpose	Comments
<b>Regional approach to adaptation</b>	Contextualize adaptation program to the local agricultural and ecological environments	Given the ecological diversity in LAC, the approach allows agricultural adaptation programs to be designed that addresses the specific suite of climate change stressors in an agro-ecological region.
<b>Multi-stakeholder and participatory approach</b>	Integrate industry stakeholders, partners and experts in planning and implementing adaptation programs	The approach helps to ensure that: (1) the right partners are engaged in the right processes and projects, (2) relevant interest groups are represented, (3) a broad base support for climate change adaptation programs is built, and (4) stakeholders take responsibility for the adaptation programs they develop. These factors are extremely important, given the limited technical and financial capacities in LAC.
<b>Science-based approach</b>	Develop, test and make accessible the appropriate decision-making and planning tools, and the technically feasible adaptive technologies and innovations that support adaptation	Academic institutions, agricultural research organizations, agri-businesses, NGOs, ministries of agriculture, and others can, through research, make a significant contribution to agricultural climate adaptation in LAC. Efforts to actively engage the above entities in adaptation research, as well allocating resources for research, are likely to be worth the investments.
<b>Adaptive Design &amp; Policy Assessment tool (ADAPTtool)</b>	Analyze how policies and programs support climate adaptation  Identify areas to improve policy/program performance under changing external conditions	The ADAPTtool can be used to demonstrate the efficacy of policies and programs in LAC that are designed to address climate variability, and to assess the extent to which those policies and programs are adaptable to changing external conditions (e.g. the availability of external financial support for adaptation).
<b>Beneficial Management Practices Program (BMP)</b>	Increase agricultural sustainability and contribute to a cleaner, healthier environment	Farmers in LAC are key players in adapting the agricultural sector to climate change. Programs such as the BMP (supported by a well-functioning extension service) can be developed to encourage farmers to adopt proven production practices that reduce greenhouse gas emissions from farm operations, and mitigate the risks associated with climate variability.
<b>Agriculture Water Demand Model (AWDM)</b>	Assess the current and future agricultural demand for water	A major climate related stressor in LAC is drought, which jeopardizes the livelihoods of significant numbers of small and under-resourced farm households. The AWDM can be a useful tool for agricultural practitioners and planners in ensuring that adequate supplies of water are available for agriculture even during periods of drought.
<b>Adaptive technologies and innovations</b>	Directly counteract current and projected climate change risks and stressors	In LAC, the major climate related risks to agriculture are water related, i.e. droughts and floods. The array of technologies and innovations developed or being developed in BC to address drought and flooding are applicable to LAC.

Table 4.2 and Table 4.3 offer an overview of the approaches, tools and adaptive technologies/innovation generated by the BC climate change adaptation program that are relevant to, and that can help to improve, agricultural climate change adaptation planning and implementation in LAC.

**Table 4.2: Collation of Adaptive Tools & Technologies (RAS projects)**

Tool	Utility/Purpose
<ul style="list-style-type: none"> <li>• Integrated Farm Water Planning Pilot</li> <li>• Collaborative Water Management Phase 1</li> <li>• Business Case for a Regional Extension Services</li> <li>• Extreme weather events preparedness and mitigation pilot project</li> <li>• Agricultural production and economic vulnerabilities associated with coastal flooding in BC's Lower Mainland</li> <li>• Flooding preparedness and mitigation pilot project</li> <li>• Livestock surface water assessment and options</li> <li>• Cooperative Maintenance &amp; Enhancement of Agriculturally Significant Dams</li> <li>• Enhanced Collaboration for Agricultural Drainage &amp; Ditch Management</li> </ul>	Address water related hazards (droughts and floods)
<ul style="list-style-type: none"> <li>• Forum: Agricultural production and economic vulnerabilities associated with coastal flooding in BC's Lower Mainland</li> <li>• Options to enhance local agricultural processing and storage</li> </ul>	Provide options for adaptation
<ul style="list-style-type: none"> <li>• Peace agriculture weather monitoring and decision support tools</li> <li>• Increasing Availability of Agriculturally Relevant Weather Data</li> <li>• Collaborative Monitoring Pilot</li> </ul>	Monitor weather systems and provide information to agricultural producers
<ul style="list-style-type: none"> <li>• Agricultural Water Workshop Series</li> <li>• Feasibility Study: Defining a new approach to Agricultural Land Use Inventory in the Peace</li> <li>• Evaluation of irrigation potential in the BC Peace region</li> <li>• Delta farm-level adaptation: Pilot and demonstration priorities</li> </ul>	Generate the knowledge that supports adaptation efforts
<ul style="list-style-type: none"> <li>• Wildfire Preparedness and Mitigation Planning and Resources</li> <li>• Collaborative communications strategy</li> </ul>	Prevent wildfire outbreaks

**Source:** Adapted from CAI. 2013. Regional Adaptation Strategies (Cowichan, Delta, Cariboo, Peace & Fraser Valley)

**Table 4.3: Collation of Adaptive Tools & Technologies (FAIP projects)**

Emphasis	Tool	Utility/Purpose
<p><b>Production management and physical farm infrastructure</b></p>	<ul style="list-style-type: none"> <li>• Adapting BC horticulture through protected crop research and demonstration</li> <li>• Adapting to low light growing conditions using high tunnel structures</li> <li>• Improving on-farm drainage management to reduce the impacts of climate change in Delta, BC</li> <li>• Vented orchard covers to protect cherries from rain and hail</li> </ul>	<p>Support farm land, water and ecological systems management to reduce climate change weather related production risks Build climate resilient farm infrastructure – such as water storage, irrigation systems or drainage systems</p>
<p><b>Knowledge generation, and development of adaptive technologies and innovations through applied farm research</b></p>	<ul style="list-style-type: none"> <li>• Keyline water management: field research and education in the capital region</li> <li>• Expanding cherry production in BC under climate change</li> <li>• Climate change impact risk assessment tool for ponds used as livestock water sources</li> <li>• Innovative forage practices</li> <li>• Strategies to improve forage yield and quality while adapting to climate change</li> </ul>	<p>Producers utilize knowledge, information, experience, education and skills to make adaptation decisions, choose appropriate adaptive options and implement them</p>
<p><b>Human and social development</b></p>	<ul style="list-style-type: none"> <li>• Innovative practices for resiliency</li> <li>• Economic, social and environmental benefits of riparian rehabilitation as a climate change adaptation strategy</li> <li>• Evaluation of trips damage to potatoes in a changing climate</li> <li>• Using management-intensive grazing for adapting to and mitigating climate change</li> </ul>	<p>Facilitate business management and adaptation planning at farm level Increase the effectiveness of organizations to better serve and build the adaptive capacity of farmers</p>

Source: Adapted from CAI. 2014. Farm Adaptation Innovator Program Guide

## **4. Conclusions & recommendations**

### **4.1 Conclusions**

This study provides a synopsis of the BC Ministry of Agriculture climate change adaptation program and considers its applicability in LAC. The study has showed that while the economic and institutional contexts may differ in BC and LAC, agriculture in both regions is exposed to the same climate-related stressors and impacts. The study observed similarities between climate change adaptation programming methodologies in both the regions, and that the framework for program planning in LAC generally aligns with the framework applied in the BC program. In addition to the common methodological approach, the BC program produces processes and products that can be contextualized to adaptation programming in LAC. The regional approach and the stakeholder-led and bottom-up approach to adaptation planning, together with the strong emphasis on collaborative partnerships and adaptive research, are valuable examples for LAC countries. Water-related stressors, i.e. drought and floods are the major climate-related risks to agriculture in BC and LAC. Therefore, the various flood and drought mitigation strategies and water management projects being piloted and tested in BC could find wide application in LAC. The study concludes that agriculture adaptation programming in LAC can benefit from the BC program in the areas described above.

### **4.2 Recommendations**

Given limited resources and capacities, it is likely that most LAC countries will continue to require external support to develop, implement and improve adaptation programs, and integrate into them best practices and products identified in the BC program. In this regard, the study identified the following areas where IICA Canada may provide technical support to LAC countries:

1. Collaborative research to determine where individual LAC countries are currently situated with respect to agricultural climate change programs, i.e. review of existing governance, management and policy-making structures to increase adaptability; risk profiles; programs developed and implemented; constraints, limiting factors in program development and implementation; and resources required to successfully develop and implement adaptation programs. It is expected that some countries might be more advanced in the process than others.
2. An assessment to determine how the processes and products identified in previous sections might be integrated into national and/or regional adaptation programs in LAC. Considerations may be given to the human, institutional, financial and other resources that are required and how they can be accessed.
3. The BC Ministry of Agriculture is considering developing a performance management framework to formally evaluate the agricultural climate change adaptation program. Support to LAC countries to develop performance management frameworks will help to improve the performance of current adaptation programs and provide valuable learning to inform development of more effective and

better implemented programs in LAC. Support in this area is consistent with IICA Canada's results-based management focus.

These recommendations are intended to strengthen agricultural adaptation planning in LAC and to help improve the effectiveness of adaptation programs. A large proportion of the populations in LAC depend on the natural resource base for their livelihoods. These vulnerable populations normally bear the brunt of climate change impacts. Successfully implemented adaptation programs in LAC are expected to help protect the livelihood of these rural populations, promote agricultural and broader economic development, and maintain vital ecosystem services, among other benefits.

## 5. References

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# Appendices

## Appendix 1: Cowichan Regional Adaptation Strategies Projects

Risks & Projects	Objective
<p><b>Risks:</b> Drought, flooding, extreme weather events</p> <p><b>Projects:</b></p> <p><b>1. Integrated Farm Water Planning Pilot</b></p> <p>Develop and deliver “Farm Water Plan” pilot project</p> <p>Also supports:</p> <ul style="list-style-type: none"> <li>• Increase demonstration, technical information and incentives for managing storm water</li> <li>• Storm water and drainage management planning and implementation for Cowichan farms</li> <li>• Maximize agricultural water use conservation and efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• To increase awareness of the potential impacts of climate change on farm-level water management</li> <li>• To develop a holistic and integrated approach to farm-level water planning that will improve all aspects of water management</li> <li>• To increase the ability of Cowichan farmers to manage through more variable precipitation, extended dry periods and/or excessive precipitation events</li> </ul>
<p><b>2. Collaborative Water Management Phase 1</b></p> <p>Integrate climate change impacts, water and agriculture into existing and new regional plans</p> <p>Also supports:</p> <ul style="list-style-type: none"> <li>• Develop collaborative storm water &amp; drainage management for the agricultural land base</li> <li>• Increase demonstration, technical information &amp; incentives for managing storm water</li> <li>• Identify &amp; fill information gaps regarding Cowichan region water resources</li> <li>• Expand capacity for water storage &amp; irrigation in the Cowichan region</li> <li>• Maximize agricultural water use conservation &amp; efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Increase collaboration between regional partners on water related strategies</li> <li>• Effectively integrate agricultural climate change and water issues into regional planning and decision-making</li> <li>• Create specific project plans and develop funding options for priority water-related projects with a particular focus on strategies to:               <ul style="list-style-type: none"> <li>- Develop collaborative storm water and drainage management for the agricultural land base</li> <li>- Identify and fill information gaps regarding Cowichan region water resources</li> <li>- Expand capacity for water storage and irrigation</li> </ul> </li> </ul>
<p><b>3. Business Case for a Regional Extension Services</b></p> <p>Conduct a scan and evaluation of options for funding agricultural extension</p>	<ul style="list-style-type: none"> <li>• Identify options for sustainable local extension services suitable for the Cowichan context</li> <li>• Increase the availability of extension support and expertise in the Cowichan, particularly for new entrants and farm businesses in transition</li> </ul>

Source: CAI. 2013. Regional Adaptation Strategies, Cowichan

### Cowichan: Regional Adaptation Strategies Projects (continued)

Risks & Projects	Objective
<p><b>4. Extreme Weather Events Preparedness and Mitigation Pilot Project</b></p> <ul style="list-style-type: none"> <li>• Undertake risk assessment (Phase 1)</li> <li>• Develop support tools for emergency preparedness (Phase 2)</li> </ul>	<ul style="list-style-type: none"> <li>• Increase knowledge and understanding of vulnerabilities to extreme events for agricultural operations in the Cowichan</li> <li>• Reduce the vulnerability of agricultural operations to the negative impacts associated with extreme events (e.g. flooding, wind, extreme heat, wildfire)</li> <li>• Pilot a group approach to planning, preparedness and mitigation for extreme events in agricultural areas</li> </ul>
<p><b>5. Options to Enhance Local Agricultural Processing and Storage</b></p> <p>Identify barriers and opportunities for increasing local processing and storage of Cowichan agricultural products</p>	<ul style="list-style-type: none"> <li>• Identify options/solutions for addressing challenges and opportunities facing the value-added food processing industry</li> <li>• Develop strategic direction for enhancing processing and storage</li> <li>• Increase the options/flexibility for Cowichan producers to process and store primary products</li> </ul>

**Source:** CAI. 2013. Regional Adaptation Strategies, Cowichan

## Appendix 2: Delta: Regional Adaptation Strategies Projects

Risks & Projects	Objective
<p><b>Risks:</b> Flooding</p> <p><b>Projects:</b></p> <p><b>1. Agricultural Production and Economic Vulnerabilities Associated with Coastal Flooding In BC's Lower Mainland</b></p> <p>Evaluate (economic and food security) implications of sea level rise and inundation for Delta's agricultural land base</p> <p>Also supports:</p> <ul style="list-style-type: none"> <li>• Incorporate agricultural issues into decision-making processes regarding sea level rise and diking</li> <li>• Undertake dike improvements &amp; raise dike levels to address sea level rise</li> <li>• Improve flooding impact mitigation measures</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen the understanding of the vulnerabilities of BC's agricultural sector to coastal flooding (due to sea level rise and storm surge events)</li> <li>• Provide an evaluation of potential impacts to farm businesses, agricultural production and agricultural soils</li> <li>• Strengthen the basis for decision-making, planning and action regarding coastal flooding for agricultural producers, producer organizations and local and provincial governments</li> </ul>
<p><b>2. Forum: Agricultural production and economic vulnerabilities associated with coastal flooding in BC's Lower Mainland</b></p> <p>Facilitate information exchange regarding sea level rise projections, risks and current plans/processes</p> <p>Also supports:</p> <ul style="list-style-type: none"> <li>• Strategy 1.1 Incorporate agricultural issues into decision-making processes regarding sea level rise &amp; diking</li> <li>• Strategy 1.2 Undertake dike improvements &amp; raise dike levels to address sea level rise</li> <li>• Strategy 1.3 Improve flooding impact mitigation measures</li> </ul>	<ul style="list-style-type: none"> <li>• Build collaboration and partnerships to address issues identified in the study</li> <li>• Integration of agricultural vulnerabilities data/considerations in planning and decision-making regarding coastal flooding mitigation</li> <li>• Development and implementation of strategies to address identified issues and vulnerabilities</li> </ul>
<p><b>3. Flooding Preparedness and Mitigation Pilot Project</b></p> <ul style="list-style-type: none"> <li>• Enhance community and farm-level emergency planning for agricultural operations at risk of inundation</li> <li>• Provide information regarding site-specific flood mitigation measures to producers</li> </ul>	<ul style="list-style-type: none"> <li>• Improve the level of planning preparedness for flooding at the municipal, agricultural community, and individual producer levels within the Corporation of Delta</li> <li>• Provide flooding preparedness planning support for 5-10 Delta producers</li> <li>• Strengthen the tools available for producers (potentially across the province) to voluntarily plan and prepare for flooding</li> <li>• Identify practical measures to increase farm resilience to flooding impacts</li> </ul>

Source: CAI. 2013. Regional Adaptation Strategies, Delta

## Regional Adaptation Strategies Projects (continued)

Risks & Projects	Objective
<p><b>4. Delta Farm-Level Adaptation: Pilot and Demonstration Priorities</b></p> <ul style="list-style-type: none"> <li>• Pilot and demonstrate drainage management options</li> <li>• Develop research and demonstration projects with a focus on salinity reduction and management</li> <li>• Conduct agronomic and economic viability scan for more salt-tolerant crops</li> <li>• Pilot and demonstrate management approaches in Delta (research plots or with willing producer partners)</li> <li>• Identify partners and priorities</li> </ul>	<ul style="list-style-type: none"> <li>• Identify research, demonstration and pilot priorities</li> <li>• Build collaborative approaches for project development and implementation</li> <li>• Strengthen linkages between producer groups and researchers</li> <li>• Develop implementation options and/or projects to accomplish actions associated with research, demonstration and pilots</li> </ul>
<p><b>5. Collaborative Communications Strategy</b></p> <ul style="list-style-type: none"> <li>• Initiate a collaborative communications strategy</li> <li>• Develop and implement a collaborative communications strategy</li> </ul>	<ul style="list-style-type: none"> <li>• Build collaboration between producer groups and other groups in Delta with an interest in agriculture/food security/climate change adaptation</li> <li>• Increase public knowledge and understanding of local agriculture and climate change adaptation issues</li> <li>• Strengthen community support for the agriculture sector in Delta</li> </ul>

Source: CAI. 2013. Regional Adaptation Strategies, Delta

## Appendix 3: Cariboo: Regional Adaptation Strategies Projects

Risks & Projects	Objective
<p><b>Risks:</b> Flooding, drought, wildfires</p> <p><b>1. Wildfire Preparedness and Mitigation Planning and Resources</b></p> <ul style="list-style-type: none"> <li>• Collaborative approaches to fuel &amp; wildfire management</li> <li>• Develop collaborative agriculture wildfire plans</li> <li>• Farm-level wildfire damage mitigation planning</li> <li>• Develop agriculture specific wildfire preparedness and mitigation resources</li> <li>• Develop individual farm/ranch level wildfire plans</li> </ul> <p>Also supports:</p> <ul style="list-style-type: none"> <li>• Develop collaborative fuel-management strategies for high-risk agricultural interface areas</li> </ul>	<ul style="list-style-type: none"> <li>• Minimize the damage to agricultural productivity and infrastructure associated with wildfire events</li> <li>• Improve collaboration with the agricultural community, in wildfire preparedness, mitigation and recovery</li> <li>• Strengthen the (agriculture-specific) information and resources available in emergency situations</li> <li>• Identify costs, issues and barriers around implementation of mitigation measures</li> </ul>
<p><b>2. Livestock Surface Water Assessment and Options</b></p> <ul style="list-style-type: none"> <li>• Maintain rangeland productivity in a changing climate</li> <li>• Pilot alternate livestock water development options</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate existing (and potential future) livestock water shortages and surface water limitations</li> <li>• Identify parameters for resilient surface water development</li> <li>• Maintain rangeland productivity</li> <li>• Maintain livestock health and production yield through water shortages</li> <li>• Provide recommendations for locally suitable options for livestock water maintenance and development</li> <li>• Encourage strategic land based investment in water development on Crown range</li> </ul>
<p><b>3. Cooperative Maintenance &amp; Enhancement of Agriculturally Significant Dams</b></p> <ul style="list-style-type: none"> <li>• Maintain and enhance agriculturally significant dams</li> <li>• Inventory and prioritize existing dams/water storage</li> <li>• Develop cooperative approaches to dam assessments, upgrades, maintenance and management</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure future availability of sufficient and sustainable water supply for agricultural production</li> <li>• Identify potential cost and risk-sharing models for agricultural dams</li> <li>• Build collaboration and partnerships to address agricultural dam upgrades and maintenance Identify, describe and document co-benefits associated with dams and their maintenance/upgrades</li> </ul>

**Source:** CAI. 2013. Regional Adaptation Strategies, Cariboo

## Appendix 4: Peace: Regional Adaptation Strategies Projects

Risks & Projects	Objective	Performance Indicators
<p><b>Risks:</b> flooding, drought, wildfires</p> <p><b>1. Feasibility Study: Defining a new approach to Agricultural Land Use Inventory in the Peace</b></p> <ul style="list-style-type: none"> <li>Undertake agricultural water demand modeling</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the feasibility of conducting an alternative form of ALUI including:               <ul style="list-style-type: none"> <li>Assessing local data needs that might be met through ALUI/AWDM processes</li> <li>Evaluating data collection methods</li> </ul> </li> <li>Define a new and cost-effective approach that will support various agricultural initiatives in the region</li> </ul>	<p><i>Near-term performance indicators include:</i></p> <ul style="list-style-type: none"> <li>Identification of an ALUI approach that is practical and cost-effective for the Peace region</li> <li>Identification of local data needs that would be met by ALUI &amp; AWDM</li> <li>Application of findings to decisions regarding next steps for ALUI and AWDM for the Peace region</li> </ul>
<p><b>2. Evaluation of Irrigation Potential in the BC Peace Region</b></p> <ul style="list-style-type: none"> <li>Evaluate priority areas for agricultural water storage and/or irrigation infrastructure development</li> <li>Undertake cost-benefit/feasibility study of irrigation and collective water storage options for key agricultural areas</li> </ul>	<ul style="list-style-type: none"> <li>To help establish the future potential for irrigation and water demand for crop production in the Peace region</li> <li>To help identify structure and scale-appropriate irrigation systems based on current and future cropping scenarios</li> <li>To identify physical and institutional constraints related to irrigation in the Peace region</li> <li>To establish preliminary cost-benefit estimates for various irrigation and cropping scenarios</li> </ul>	<p><i>Near-term performance indicators include:</i></p> <ul style="list-style-type: none"> <li>Availability of new and more detailed information regarding irrigation potential associated with various supply sources</li> <li>Effective distribution and communication of findings to local agricultural organizations and local government</li> <li>Improved understanding of irrigation potential in the Peace region</li> <li>Application of findings to next steps with AWDM</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>Consideration and integration of findings by local agricultural groups and local governments – specifically in local and regional planning</li> <li>Implementation of additional research and/or feasibility activities (if warranted by finding)</li> </ul>

Source: CAI. 2013. Regional Adaptation Strategies, Peace

## Peace: Regional Adaptation Strategies Projects (continued)

Risks & Projects	Objective	Performance Indicators
<p><b>3. Peace Agriculture Weather Monitoring and Decision Support Tools</b></p> <ul style="list-style-type: none"> <li>Evaluate options for improving weather data collection and analysis (e.g. costs, timelines, long-term sustainability)</li> <li>Implement selected option and ensure availability of weather data to producers</li> </ul>	<ul style="list-style-type: none"> <li>To establish a collaborative approach to expanding and maintaining the weather monitoring network within the BC Peace region;</li> <li>To Increase the quantity and quality of weather data available to support producer decisions (real-time, seasonal and long-term); and</li> <li>To increase the availability of relevant decision support tools for Peace region producers.</li> </ul>	<p><i>Near-term performance indicators include:</i></p> <ul style="list-style-type: none"> <li>Increased weather monitoring in agricultural areas with significant gaps</li> <li>Improvement of overall geographic coverage of weather monitoring data</li> <li>Availability of Peace-specific decision support tools</li> <li>On-going participation of partners in collaborative maintenance of monitoring system</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>Continued maintenance of monitoring network</li> <li>Expansion of both monitoring network and its linkages to agricultural research</li> <li>Development of additional agricultural decision support tools</li> </ul>
<p><b>4. Increasing Availability of Agriculturally Relevant Weather Data (Phase 1)</b></p> <p>Evaluate options for improving weather data collection and analysis</p>	<ul style="list-style-type: none"> <li>Identify options for improving access to weather data for agricultural purposes</li> <li>Develop a strategy for increasing availability of weather data for agricultural producers in the Peace</li> <li>Increase the quantity and quality of weather data available to support producer decisions (seasonal and short-medium term)</li> </ul>	<p><i>Near-term performance indicators include:</i></p> <ul style="list-style-type: none"> <li>Development of a strategy to address agricultural weather data gaps</li> <li>Adoption of the strategy by industry organizations</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>Implementation of strategy to address weather data gaps including: <ul style="list-style-type: none"> <li>New monitoring stations (if deemed necessary)</li> <li>Integration of existing monitoring into agricultural networks</li> <li>New weather data informational tools</li> </ul> </li> </ul>

Source: CAI. 2013. Regional Adaptation Strategies, Peace

## Peace: Regional Adaptation Strategies Projects (continued)

Risks & Projects	Objective	Performance Indicators
<p><b>5. Collaborative Monitoring Pilot</b></p> <ul style="list-style-type: none"> <li>• Convene key partners to determine best approach for sustainable monitoring of pests, diseases, weeds and invasive species</li> <li>• Implement monitoring to collect critical data regarding pests, diseases, weeds and invasive species</li> </ul>	<ul style="list-style-type: none"> <li>• Determine priority gaps – areas of risk – and issues with respect to monitoring and data processing/sharing</li> <li>• Increase availability of data and analysis for the BC Peace regarding the presence of agriculturally significant pests, diseases, weeds</li> <li>• Improve the ability to evaluate if (and how) the prevalence and distribution of pests, diseases and weeds in the BC Peace is changing and to quickly identify risks to agricultural production</li> <li>• Improve long-term capacity to track changes occurring in prevalence and distribution of pests</li> </ul>	<p><i>Near-term performance indicators include:</i></p> <ul style="list-style-type: none"> <li>• On the ground monitoring of economically significant pests, pathogens and weeds (in the BC Peace)</li> <li>• Availability to producers of the monitoring information of monitoring data</li> <li>• Improved local capacity and expertise to monitor pests, pathogens and weeds</li> <li>• Improved linkages with AAFC experts and data processing opportunities</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>• On-going monitoring of BC Peace (economically significant) pests, pathogens and weeds</li> <li>• Long-term capacity to monitor changes in distribution and prevalence of pests, pathogens, weeds</li> </ul>

Source: CAI. 2013. Regional Adaptation Strategies, Peace

## Appendix 5: Fraser Valley: Regional Adaptation Strategies Projects

Risks & Projects	Objective	Performance Indicators
<p><b>Risks:</b> flooding, drought</p> <p><b>1. Freshet flooding and Fraser Valley agriculture: evaluating impacts and options for resilience</b></p> <p>Determine agricultural economic and production impacts associated with freshet flooding and assess options to mitigate losses, increase resilience, and speed recovery.</p>	<ul style="list-style-type: none"> <li>Evaluate the potential costs and production impacts associated with freshet flooding</li> <li>Identify and evaluate options for mitigation of flooding impacts and losses for agriculture</li> <li>Identify &amp; evaluate options for efficient and effective post-flood recovery</li> </ul> <p>Strengthen sector awareness, engagement and preparedness regarding flood risk in the Fraser Valley</p>	<p><i>Near-term performance indicators:</i></p> <ul style="list-style-type: none"> <li>Availability of data and analysis regarding agricultural economic, land base and production vulnerabilities associated with freshet flooding</li> <li>Increase awareness, engagement and preparedness regarding flood risk and potential impacts to agriculture</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>Implementation of options/strategies for mitigation</li> <li>Implementation of options/strategies for effective post-flood recovery</li> <li>Integration of findings into planning and decision-making regarding flooding preparedness and mitigation</li> </ul>
<p><b>2. Enhanced Collaboration for Agricultural Drainage &amp; Ditch Management</b></p> <p>Develop a coordinated cross-agency approach to agricultural ditch &amp; drainage management</p> <ul style="list-style-type: none"> <li>Assess the current state of agricultural ditches and drainage in FVRD</li> <li>Develop options to improve coordination of ditch and drainage management</li> </ul>	<ul style="list-style-type: none"> <li>Assess the current state of agricultural ditches/drainage and evaluate potential impacts of climate change</li> <li>Identify areas of priority for management and infrastructure improvements</li> <li>Strengthen communication and coordination for effective and timely ditch and drainage maintenance</li> <li>Create a primary updated consistent information source for producers about ditch and drainage maintenance</li> </ul>	<p><i>Near-term performance indicators:</i></p> <ul style="list-style-type: none"> <li>Completion of assessment</li> <li>Completion of ~2 workshops</li> <li>Availability of updated information about processes/requirements re: agricultural ditches</li> <li>Clear points of contact for producers regarding drainage/ditch maintenance</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>Improved resource availability for addressing runoff, ditching and drainage approaches</li> <li>Implementation of streamlined processes for producers to address challenges associated with drainage and ditching</li> </ul>

## Fraser Valley: Regional Adaptation Strategies Projects (continued)

<p><b>3. Agricultural water workshop series</b></p> <ul style="list-style-type: none"> <li>• Address critical information gaps to assist producers with water management decisions</li> <li>• Strengthen knowledge transfer of water management tools, technologies and resources</li> </ul>	<ul style="list-style-type: none"> <li>• To provide producers with: <ul style="list-style-type: none"> <li>- Information regarding the current and future regulatory and water supply contexts in the region</li> <li>- Access to expertise regarding existing water management tools and resources</li> <li>- Technical information regarding agricultural water management</li> </ul> </li> <li>• Local demonstration/s of successful implementation of best practices and technologies</li> </ul>	<p><i>Near-term performance indicators include:</i></p> <ul style="list-style-type: none"> <li>• Completion of two workshops in the Fraser Valley events on water regulation, supply and management</li> <li>• Completion of (1) tour of FVRD innovative water management sites</li> <li>• A high level of interest in aforementioned workshops/tour</li> <li>• Availability of a knowledge transfer resource as a result of sessions</li> <li>• Increased knowledge of regulatory changes, water supply and climate change issues</li> <li>• Increased interest in adoption of resources, practices and technologies</li> </ul> <p><i>Medium to long-term performance indicators (beyond project timeline/scope):</i></p> <ul style="list-style-type: none"> <li>• Continued distribution of knowledge transfer resource</li> <li>• Increased uptake in existing water management resources and increased demand for additional knowledge transfer/water resources</li> </ul> <p>Increased optimization of agricultural water (implementation of adaptive approaches)</p>
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Source: CAI. 2013. Regional Adaptation Strategies, Fraser Valley

## Appendix 6: Farm Adaptation Innovator Program Projects

Adaptive Resource	Projects	Focus
<b>Physical</b>	<ul style="list-style-type: none"> <li>• Adapting BC horticulture through protected crop research and demonstration</li> <li>• Adapting to low light growing conditions using high tunnel structures</li> <li>• Regional moisture sensor network and crop irrigation predictive model</li> <li>• Improving on-farm drainage management to reduce the impacts of climate change in Delta, BC</li> </ul>	<ul style="list-style-type: none"> <li>• Land, water, ecology – practices and management that support farm land, water and ecological systems and reduce climate change weather related production risks</li> <li>• Farm infrastructure – infrastructure such as water storage, irrigation systems or drainage or water control works</li> </ul>
<b>Knowledge</b>	<ul style="list-style-type: none"> <li>• Keyline water management: field research and education in the capital region</li> <li>• Expanding cherry production in BC under climate change</li> <li>• Climate change impact risk assessment tool for ponds used as livestock water sources</li> <li>• Vented orchard covers to protect cherries from rain and hail</li> <li>• Innovative forage practices</li> <li>• Strategies to improve forage yield and quality while adapting to climate change</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge, experience, education and skills</li> <li>• Access to information and extension – approaches that effectively match modes of farmer information acquisition with new knowledge (knowledge transfer)</li> <li>• Research, development and technology – applied farm research, development and technology</li> </ul>
<b>Human &amp; Social</b>	<ul style="list-style-type: none"> <li>• Innovative practices for resiliency</li> <li>• Economic, social and environmental benefits of riparian rehabilitation as a climate change adaptation strategy</li> <li>• Evaluation of trips damage to potatoes in a changing climate</li> <li>• Using management-intensive grazing for adapting to and mitigating climate change</li> </ul>	<ul style="list-style-type: none"> <li>• Farm operators and labour – increasing the business management and planning abilities of farm operators and labour</li> <li>• Networks, associations, and resource sharing – increasing the effectiveness of organizations to better serve and build the capacity of farmers</li> </ul>

Source: CAI. 2014. Farm Adaptation Innovator Program Guide

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