



**Regional  
Extension  
Program**

# **Environment and Climate REGIONAL GUIDEBOOK Islands and South Coast**

Vancouver Island, Gulf Islands, Sunshine Coast



Prepared for the  
**B.C. Ministry of  
Agriculture and Food**  
January 2024



# Contents

Introduction to the guide.....1

Introduction to the region .....2

**PRIORITY ISSUES**

1. Water sustainability and storage .....5

2. Soil health management.....9

3. Nutrient management practices ..... 12

4. Management for biodiversity & habitat ..... 15

5. Crop selection for resilience ..... 19

Additional Resources ..... 21

Photo: Foster Richardson

## ACKNOWLEDGEMENTS

### Land Acknowledgement

The Ministry of Agriculture and Food acknowledges the territories of First Nations around B.C. and is grateful to carry out our work on these lands.

### Contributors

Thank you to the producers and industry representatives who participated in our Regional Extension Committee. The time and expertise committed to this work was indispensable.

### Credits

Content prepared by **the B.C. Agriculture Climate Action Research Network.**

Graphic design by **VGN Resources Group**

Front cover photos: Top: Emrys Miller; Bottom: Dieter Geesing

Back cover photos - from top: Ministry of Agriculture and Food; Brenna Schild; Lindsay Benbow; Raúl Cacho Oses/ Unsplash

### Funding

Financial support was provided under the Sustainable Canadian Agricultural Partnership, a federal-provincial-territorial initiative. Additional funding has been provided by CleanBC.

# Introduction to the guide

Agricultural producers are grappling with the impacts of climate change and are on the front lines of developing strategies that maintain economic viability alongside environmental sustainability. Top issues, response strategies, and feasibility of practices differ across British Columbia's diverse ecoregions, highlighting the need for targeted extension and applied research projects. To meet these needs, the B.C. Ministry of Agriculture and Food's new Regional Extension Program aims to increase on-farm adoption of management practices that support producers in making their operations more climate resilient, sustainable, and economically viable.

This regional guide aims to serve as a resource for producers, on-the ground researchers, and consultants to reflect on the climate issues challenging environmental sustainability and local farm businesses and food production.

In this guide, three overarching strategies address the agricultural climate and environment priorities identified by producers across the province:



**Adaptation:** Prepare for and respond to a changing climate. Practices in this guide are largely adaptation focused, reflecting the immediate impacts producers are experiencing.



**Mitigation:** Reduce greenhouse gas emissions and increase carbon sequestration.



**Environment:** Protect and regenerate soil, water, and air quality. Improve biodiversity and protect sensitive habitats.

The priority issues highlighted in this guide were identified by a regional extension committee that represents the climates, soils, and commodity groups in each region, facilitated by the B.C. Ministry of Agriculture and Food. For more information, contact your Regional Agrologist or [AgriServiceBC](#). The content of this document may change with the results of engagement with producers in the region.

Each priority issue described in this guide includes:

- ▶ **An overview of the priority** and why it is important to producers in the region.
- ▶ An **inventory** of past and current applied research and extension projects relevant to the issue. Many of these projects were implemented under the BC Ministry of Agriculture & Food's Climate Change Adaptation Program (2008-2023) with support from government, industry, and research partners.
- ▶ **Beneficial management practices and work that can be built on** to address priority areas.
- ▶ Current **funding programs** associated with each priority area.
- ▶ Current **provincial tools** relevant to each priority area.

# Introduction to the region

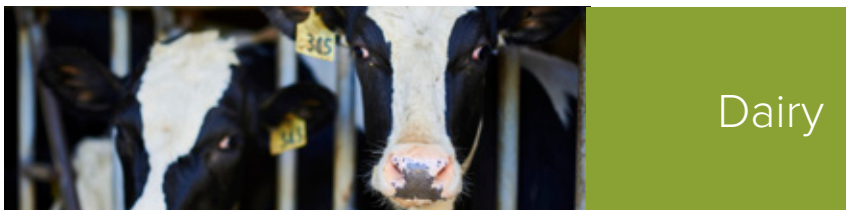
## Regional boundaries

For the purpose of this program, the Islands and South Coast extension region includes Vancouver Island, the southern and northern Gulf Islands, the Discovery Islands, and the Sunshine Coast. This region includes portions of the Vancouver Island-Central Coast census district and the Lower Mainland Southwest census district. The statistics included throughout this document reference the regions that are used to collect the associated data and may not reflect the regional boundaries for this program.





# Agricultural Sector Demographics



## TRENDS IN FARM NUMBERS, FARM TYPE, AND FARMLAND AREA

(Census of Agriculture, 2021)


- ▶ In the Islands and South Coast region, farm numbers decreased by 28% and farmland area decreased by 20% between 2011 and 2021, representing the largest losses in the province.
- ▶ The largest loss of farm numbers was for those with annual revenues under \$10,000.
- ▶ Tree fruit production and horse farming sectors lost the largest number of farms, while vegetable production increased significantly, to represent 25% of the provincial total in 2021.
- ▶ Growth in gross farm receipts for the region was 23.3%, which was substantially below the provincial increase of 63.3 %.

# Regional Climate Change Impacts

Vancouver Island and the South Coast are already experiencing severe impacts of climate change. Increases in the average number of days over 30°C, drier summer conditions, and more frequent extreme rainfall events have become the norm over the past several years.

The changes being observed in this region are consistent with the 2015 Pacific Climate Impacts Consortium (PCIC) 2050 projections. More recent climate models continue to show the same trends.


## PCIC Climate Projections: Vancouver Island, 2050

**TEMPERATURE** 

1.6°C to 3.6°C  
increase  
in annual average temperatures

---

Average of  
36-60 more  
frost free days annually

**PRECIPITATION** 


12% increase  
in average spring precipitation

---

13% decrease  
in average summer precipitation

---

Substantial decrease  
in spring snowfall

**EXTREMES** 

Increase in frequency  
and magnitude  
of extreme rainfall events

---

Increase  
in average number of  
days above 30°C  
annually

Projections provided by the [Pacific Climate Impacts Consortium](#) in 2015. 2050 averages are compared to the baseline historical period of 1961-1990.

Photo: Emrys Miller







# Drought Management

Photo: Emrys Miller



## Adaptation

Changing climatic, regulatory, and farm management conditions are impacting water management needs in the Islands and South Coast region. Water needs for crops and livestock are increasing as the region experiences lower than normal precipitation throughout the summer. Sustainable water management is a priority for producers to maintain productivity and allow water sources to recharge for future use, but implementation of water management strategies requires knowledge and support that are not yet part of the agricultural framework.

Drought conditions have reached levels 3 to 5 (mid to maximum in [Provincial Drought Level](#)) across the region every year for the last five years during summer and/or fall periods, and have reached level 5 consecutively from 2021-2023. In summer 2023, eight watersheds that provide surface water and groundwater to the highest density agricultural areas reached drought level five.

The 2021 agricultural census found that 44% of farms in the region are irrigated. Due to the changing climate, more farmers may implement irrigation systems to adapt to drought, which will further increase water demand in the summer months. The Islands and South Coast region is also positioned to prepare for summer drought by exploring opportunities for water capture during high precipitation events in fall, winter, and spring. Producers in the region are leaders in innovative rainwater capture strategies, employing active capture with tank storage and ponds/dugouts. Producers are also implementing soil management practices that maximize the ability of soil to passively capture, store, and be resilient to excess precipitation.

Concerns around agricultural water have emerged with the processing delays and communication challenges that have occurred with the rollout of the new groundwater licensing requirement in the [2016 Water Sustainability Act](#). Interest in support for increased water storage is high, as drought conditions have resulted in curtailment orders on licensed water users.

## 1.1 Why is drought management a priority?

- ▶ **IRRIGATION EFFICIENCY increases water conservation through targeted application that ensures optimal amount and timing, which can reduce overapplication, evaporation, and greenhouse gas emissions:** Increasing irrigation efficiency requires improved irrigation infrastructure that can be cost prohibitive for some producers.
- ▶ **DEPLETED WATERSHEDS of Chapman Creek (Sunshine Coast Regional District) and the Koksilah, Cowichan, and Tsolum rivers (Vancouver Island) are causing severe water shortages in surrounding high density agricultural areas:** Producers that rely on surface water and groundwater from these rivers have been subject to conservation measures such as voluntary water use reductions, orders to cease water use, and other water management actions. Depleted watersheds are a new reality of climate change in the province that cannot be directly remedied, and all sectors will need to adapt to reduced water availability.
- ▶ **SOIL WATER RETENTION is limited in many areas of the Islands and South Coast due to coarse soil texture:** Irrigating more frequently is often necessary in soils with poor water retention to compensate for rapid drainage and low water storage capacity. Soil management practices that support water retention are particularly important in agricultural areas with coarse textured soils.
- ▶ **RAINWATER CAPTURE during annual high precipitation periods may be an underutilized emergency water strategy in the Islands and South Coast region:** At the farm level, challenges of implementation include cost of storage infrastructure (tanks, dugouts) and volume of storage infrastructure relative to water demand.
- ▶ **GRAZING SYSTEMS: Insufficient feed for livestock due to drought reducing forage crop yields:** In dryland operations, reduced precipitation has led to significant declines in pasture, hay, and forage yields (particularly in summer 2023), forcing some operators to buy feed they would normally grow themselves at demand-surge costs. The implementation of curtailment orders that results in the temporary suspension of water licences used for forage irrigation (e.g., in the Koksilah and Tsolum watersheds) reduces feed supplies from irrigated crops as well. Livestock producers across the province have faced difficult decisions (e.g. reduction of herd size, feeding winter stock early, having pasture not available late in the grazing season) and have needed to rely on additional support programs.

## 1.2 What drought management work has been done?

\* Links in green are producer-oriented resources and tools

Project	Project Resources*	Location	Year
<b>IRRIGATION EFFICIENCY</b>			
Koksilah irrigation management	<i>In progress, Agriculture and Agri-Food Canada</i>	Vancouver Island	2023
Improving irrigation efficiency for managing during dry conditions	<a href="#">Factsheet series</a> <a href="#">Webinar</a>	Okanagan/Provincial	2023



Project	Project Resources*	Location	Year
Farm water fix: climate resilient irrigation systems and management	<a href="#">Video series</a>	Kootenay/Boundary, Provincial	2022
Regional agriculture water demand models	<a href="#">Sunshine Coast report</a> <a href="#">gathet report</a> <a href="#">Capital report</a> <a href="#">Saltspring Island report</a> <a href="#">Nanaimo report</a> <a href="#">Comox Valley report</a> <a href="#">Cowichan report</a>	Islands and Sunshine Coast	2013-2020
Irrigate better: anatomy, pipe design, emission design, scheduling and monitoring	<a href="#">Webinar series</a>	Provincial	2018
Maximizing forage yield by optimizing irrigation	<a href="#">Project report</a>	Fraser Valley	2018
Vineyard water use efficiency, cost in vineyards, and how to measure water use	<a href="#">Factsheet: Vineyard establishment and maintenance practices for water use efficiency</a> <a href="#">Factsheet: Tools to validate</a> <a href="#">Factsheet: The full cost of water</a> <a href="#">Tool: irrigation efficiency calculator</a> <a href="#">Full project report</a>	Okanagan	2018
Water management resources and knowledge transfer of water best management practices for agriculture in B.C.	<a href="#">Resource summary</a> <a href="#">Webinar series</a> <a href="#">Full project report</a>	Provincial, Bulkley-Nechako	2021
<b>DEPLETED WATERSHEDS</b>			
Council for agricultural water supply and producer led watershed data collection project	<a href="#">Full project report</a>	Central Vancouver Island	2023
Tsolum river agricultural watershed plan	<a href="#">Project report Phase 1</a> <a href="#">Project report Phase 2</a>	Mid Vancouver Island	2019-2021
Agriculture sector communications plan for drought in the Cowichan Valley Regional District	<a href="#">Extension brochure: drought alert for agriculture</a> <a href="#">Full project report</a>	Southern Vancouver Island	2017
Cowichan agricultural water storage and management knowledge transfer	<a href="#">Full project report</a>	Southern Vancouver Island	2016
<b>SOIL WATER RETENTION</b>			
Too much water or too little: climate resilient vegetable farming	<a href="#">Research summary</a> <a href="#">Factsheet: Soil water dynamics</a> <a href="#">Factsheet: Soil N dynamics</a> <a href="#">Project Webpage</a>	Southern Vancouver Island	2023
B.C. Climate Agri-Solutions Fund: Cover cropping projects	<a href="#">Extension resources</a>	Provincial	2023

Project	Project Resources*	Location	Year
Using mulches to reduce water use	<a href="#">Grab and go template for on-farm research</a>	Provincial, Kootenay-Boundary	2021
Keyline water management: field research and education in the Capital region	<a href="#">Soil Indicators Monitoring Program:</a> <a href="#">Full project report</a>	Southern Vancouver Island	2018-2019
<b>RAINWATER CAPTURE</b>			
Guidance on farm water storage	<a href="#">Factsheet</a>	Provincial	2021
British Columbia farm water dugouts	<a href="#">Guide</a>	Provincial	2016
<b>GRAZING SYSTEMS</b>			
Modular silvopasture workshop resources	<i>In progress, Ministry of Agriculture and Food</i> <i>Forthcoming workshop modules:</i> <ul style="list-style-type: none"> <li>• 4 core units (Introduction, Science, BMPs, Planning)</li> <li>• Case studies (regional)</li> <li>• Supplemental units (History, Light &amp; Microclimate, Hydrology, Managing Damage)</li> </ul>	Provincial	2023
B.C. Climate Agri-Solutions Fund: Rotational grazing projects	<a href="#">Extension resources</a>	Vancouver Island, Lillooet	2023
Targeted knowledge transfer and development of producer-experience case studies in silvopasture	<i>In progress, Ministry of Agriculture and Food</i>	Thompson-Okanagan	2023
Resiliency: forage, water, and climate change risk assessment pilots	<i>In progress, B.C. Cattlemen’s Association, Ministry of Agriculture and Food, Ministry of Forests</i>  <i>Forthcoming tool: Landscape and range resiliency planning tool for Crown forage, surface water risk and climate change modelling</i>  <i>Forthcoming factsheets:</i> <ul style="list-style-type: none"> <li>• Forage and Water Resiliency Overview: Managing water and forage resources in a changing climate</li> <li>• Reference Evaporation</li> <li>• Calculating Carrying Capacity</li> <li>• Flow Accumulation</li> </ul>	Interior North, Central, South, Kootenays	2019-2022
Pilot use of landscape and range resiliency planning tool	<i>In progress, B.C. Cattlemen’s Association, Ministry of Agriculture and Food, Ministry of Forests</i>  <i>Forthcoming factsheets:</i> <ul style="list-style-type: none"> <li>• Climate change mitigation and adaptation case studies</li> </ul>	Cariboo, Highway 16 North, Kootenay	2023
Silvopasture producer demonstrations – private land planning	<a href="#">Factsheet</a>	Cariboo	2017



## 1.3 What's next: Looking ahead

Sustainable agricultural water management is shaped by regulatory requirements, regional conditions, and farm level practices. Field-level water conservation and soil management practices are primary adaptation strategies for producers as they respond to reduced water supply associated with climate impacts. Robust extension, knowledge transfer, and support for producers are equally critical to promote adoption of drought resilient practices.

### On-Farm Management Practices

In the Islands and South Coast region, drought management includes both water and soil-based strategies:

**Field-level water conservation** is concerned with balancing increased water demands for crops and livestock with reduced water supply. Increasing water use efficiency is primarily achieved through targeted irrigation or watering systems that reduce overapplication, evaporation, and greenhouse gas emissions. As the Islands and South Coast have a diverse mix of dryland and irrigated agriculture, all sectors face challenges to implement efficient practices. On-farm management practices to increase water conservation include:

- ▶ Water-efficient irrigation systems
- ▶ Irrigation scheduling
- ▶ Water quality protection measures (nutrient management, contaminated runoff collection, storage, and disposal, safe pesticide handling and application)
- ▶ Soil moisture meters and evapotranspiration sensors
- ▶ Rainwater collection and storage
- ▶ Dugouts
- ▶ Keyline water management

**Conservation and management of soil organic matter** is critical to climate change adaptation and mitigation. Practices such as cover cropping, retention of crop residues, and reduced tillage can increase soil water retention through preservation of soil structure and organic matter, but success of implementation is site-specific. On-farm management practices include:

- ▶ Cover cropping
- ▶ Interseeding
- ▶ No-till seeding
- ▶ Reduced tillage
- ▶ Retaining crop residues
- ▶ Plowing down green crops (“green manuring”)
- ▶ Integration of perennials (e.g. shelterbelts, woody perennial crops, perennial forages)
- ▶ Nutrient management

**Intensive and well-managed grazing strategies are designed to manage livestock in ways that protect or improve soil properties that enhance forage and pasture production.** On-farm management practices aim to reduce animal impact on soils by managing impact over time and space, which allows pastures to rest long enough for grass and forages to regenerate. As livestock graze, plants redirect energy from above-ground growth to below-ground storage in their roots.

**Funding Programs:  
DROUGHT MANAGEMENT**

The B.C. Ministry of Agriculture and Food, with delivery support from the Investment Agriculture Foundation (IAF), offers the following funding programs that address drought and drought education:

- ▶ [Knowledge and Technology Transfer Program](#)
- ▶ [Environmental Farm Plan Program](#) (EFP)
- ▶ [EFP Beneficial Management Practices Program](#) – *water infrastructure projects*
- ▶ [Agricultural Water Infrastructure Program](#)
- ▶ [AgriStability](#) – agriculture income protection
- ▶ [B.C. Climate Agri-Solutions](#) – *cover cropping and rotational grazing streams (Agriculture and Agri-Food Canada 2022/2023)*
- ▶ [On-Farm Climate Action Fund](#) – *rotational grazing (B.C. Forage Council 2022/2023)\**

\*The On-Farm Climate Action Fund was delivered through both B.C. Climate Agri-Solutions and B.C. Forage Council in 2022-2023.

Rest periods then give time for the plant to use these energy reserves to grow robust roots that maximize water and carbon sequestration and lush grass that provides optimal nutrition. Intensive grazing practices include:

- ▶ Rotational grazing
- ▶ Silvopasture
- ▶ Riparian buffer zones

**Building on Recent Projects**

**Drought:**

- ▶ Improve informational resources and technical support for farm/ranch water storage development
- ▶ Identify water management knowledge transfer priorities; conduct field-based water management demonstration/applied research and knowledge transfer
- ▶ Complete an agricultural productivity and water risk assessment

**Water access and storage:**

- ▶ Re-evaluate needs for agricultural dugout maintenance, upgrades, and knowledge transfer
- ▶ Pilot collaborative improvements of agricultural dugouts
- ▶ Pilot farm-level rainwater catchment and storage for specific commodities

**Recommendations from the Minister’s Advisory Group on Regenerative Agriculture and Agritech:**

- ▶ Identify and share best soil management practices using a producer-centric approach for implementation and knowledge sharing
- ▶ Identify practical indicators of properties that support soil relevant functions; measure and communicate baselines values at farm, regional, and provincial levels; determine realistic improvement goals; measure the impacts of practices



**Provincial  
Toolbox:  
DROUGHT  
MANAGEMENT**

[BC Agriculture Water Calculator](#)

[BC Irrigation Water Use Calculator](#)

[Agricultural Irrigation Scheduling Tool](#)

[BC Drought Information Portal](#)

[B.C. Soil Information Finder Tool](#)

[Farmwest](#)



# Extreme Rainfall Management

Photo: Emrys Miller



## Adaptation

Extreme rainfall events are increasingly frequent and severe across the province, especially in coastal regions. Increased precipitation in spring and fall has resulted in freshet or flood events in the Islands and South Coast region in recent years, particularly around agriculturally significant riversheds (i.e. Cowichan River).

Beyond flooding, there are a range of risks to agricultural operations from extreme precipitation events on the Islands and South Coast depending on the production system. For example, extreme precipitation can create soil erosion that degrades topsoil and/or results in nutrient runoff, break seedlings, or promote disease in perennial and annual crops. Saturated soil can result in specific issues including higher greenhouse gas emissions because of anaerobic conditions, and higher risk of compaction from equipment use and grazing. Reducing traffic on the soil during periods of saturation can create challenges with completing field work including implementation of on-farm management practices.

## 2.1 Why is extreme rainfall management a priority?

- ▶ **FLOODING is an increasing risk in agricultural areas located in river valleys during extreme rainfall events:** Increased precipitation or temperatures causing rapid snowmelt can create unprecedented surges that can devastate agricultural operations.
- ▶ **EROSION is a high risk during extreme rainfall events for degraded or bare soils, and in sloping areas:** Valuable organic matter and nutrients can be lost via extreme precipitation and create risks for nutrient pollution in water resources and siltation impacts on downslope properties. Wet soils are also susceptible to compaction by equipment use or livestock trampling which further increases runoff and erosion risk.
- ▶ **HEALTHY RIPARIAN AREAS provide ecosystem services that may help reduce the risk of flooding:** Healthy riparian areas are more resilient to extreme precipitation events and flooding, which can prevent extreme erosion and costly damage to arable land and infrastructure.

## 2.2 What extreme rainfall work has been done?

\*Links in green are producer-oriented resources and tools

Project	Project Resources*	Location	Year
<b>FLOODING</b>			
Farm flood readiness toolkit	<a href="#">Toolkit</a> <a href="#">Factsheet: Landscape level approaches to mitigate flood impact</a> <a href="#">Video: prepare for flooding</a> <a href="#">Video: protect your farm assets</a>	Provincial	2022
Livestock sector emergency preparedness for flooding	<a href="#">Factsheet</a>	Provincial	2019
Horticulture sector emergency preparedness for flooding	<a href="#">Factsheet</a>	Provincial	2019
Stormwater management planning for agricultural facilities	<a href="#">Factsheet</a>	Provincial	2016
Cowichan agriculture extreme weather event preparedness and mitigation pilot	<a href="#">Project report</a>	Southern Vancouver Island	2015
<b>EROSION</b>			
Improving soil health through enhanced water infiltration	<a href="#">Grab and Go Template for On-Farm Research</a>	Kootenay-Boundary	2021
Agricultural waterways: drainage maintenance and stewardship	<a href="#">Guide</a>	Provincial	2018
<b>HEALTHY RIPARIAN AREAS</b>			
Twinned watersheds project: riparian vegetation assessment in Chemainus and Koksilah watersheds	<a href="#">Project summary</a> <a href="#">Full project report</a>	Southern Vancouver Island	2022
Tsolum river agricultural watershed plan	<a href="#">Project report: Phase 2</a>	Mid Vancouver Island	2021
Riparian management field workbook for streams and small rivers	<a href="#">Field workbook</a>	Provincial	2019
Supporting riparian health on farmland for flood protection	<a href="#">Full project report</a>	Kootenay-Boundary	2023
Agricultural benefits of riparian rehabilitation	<a href="#">Factsheets</a> <a href="#">Full project report</a>	Okanagan	2018



## 2.3 What's next: Looking ahead

Extreme rainfall events can be unpredictable in timing and severity, but producers can take steps to implement management strategies that mitigate risk to crops, soil, and infrastructure. Flood planning resources, diversion, and storage infrastructure as well as soil management practices that maximize soil water infiltration, retention, and drainage can support farm resilience during excess precipitation events.

### On-Farm Management Practices

In the Islands and South Coast region, extreme precipitation management includes physical diversion, field practices, and planning strategies:

**Drainage systems** are designed to manage livestock in ways that support soil health. Ranchers are critical for channeling water from excess precipitation away from crops and livestock as well as preventing waterlogging. Drainage systems can be natural (i.e. watercourses) or engineered (i.e. ditches). Observation of farm level and watershed level topography can indicate areas susceptible to waterlogging and/or flooding. Specific on-farm management practices for drainage include:

- ▶ Dikes
- ▶ Surface drainage (ditches, culverts, waterways)
- ▶ Subsurface drainage systems (tile drains, French drains)
- ▶ Swales
- ▶ Raised/mounded beds (in low-lying areas)
- ▶ Riparian restoration
- ▶ Riparian fencing
- ▶ Bank stabilization and restoration
- ▶ Implementation and restoration of wetlands
- ▶ Alternative livestock watering systems
- ▶ Improved stream crossings

Photo: Stephen Andrews/Unsplash



**Funding Programs:  
EXTREME RAINFALL  
MANAGEMENT**

- ▶ [Extreme Weather Preparedness for Agriculture](#) - *flooding preparedness stream*
- ▶ [AgriStability](#) - *agriculture income protection*
- ▶ [Agricultural Water Infrastructure Program](#)
- ▶ [Farmland Advantage](#) - *payment for ecosystem services: riparian areas*
- ▶ [Environmental Farm Plan Program \(EFP\)](#)
- ▶ [EFP Beneficial Management Practices Program](#) - *water infrastructure projects*
- ▶ [Species At Risk Partnerships on Agricultural Land](#) (B.C. Cattlemen’s Association)
- ▶ [Wetland Restoration](#) (Ducks Unlimited Canada)

**Practices that optimize soil water dynamics** typically have a suite of benefits for soil health, crop productivity, and climate change adaptation and mitigation. On-farm management practices that conserve organic matter, maintain soil structure, and keep roots in the soil are particularly important for water infiltration and retention. Specific practices include:

- ▶ Rotational grazing
- ▶ Cover cropping
- ▶ No-till seeding
- ▶ Reduced tillage
- ▶ Integration of woody perennials

**Farm emergency preparedness** is particularly important for producers with operations in flood risk zones. As shoulder season precipitation increases and the frequency and severity of unexpected events increase, specific planning may include:

- ▶ Emergency flood planning
- ▶ Livestock evacuation planning
- ▶ Monitoring and weather forecasting

**Building on Recent Projects**

**Flooding:**

- ▶ Create flood and erosion vulnerability maps for risk prioritization
- ▶ Demonstration and assessment of low-cost flood mitigation infrastructure and practices

**Erosion, runoff, and drainage:**

- ▶ Demonstration and assessment of run-off and erosion control
- ▶ Conduct trials and demonstration research for field and land management practices to address runoff and drainage concerns

**Riparian areas:**

- ▶ Expand knowledge transfer and professional supports for implementation of riparian enhancement activities in agricultural areas

**Provincial  
Toolbox:  
EXTREME  
RAINFALL  
MANAGEMENT**

[B.C. Flood Study Explorer](#)

[B.C. River Forecast Center](#)

[AgSafe Emergency Planning Resources - Flooding](#)



# 3 Extreme Heat Management

Photo: Emrys Miller



## Adaptation

Extreme heat events have occurred with increasing frequency in recent years, with temperatures in the Islands and South Coast region significantly exceeding seasonal average highs. Because summer heat waves such as those in 2021-2023 are not historical norms in the region, its production systems, workers, and infrastructure may be less equipped to deal with heat related risks. Damage to crops, stress on livestock health, and stress on farmworker health are cited challenges.

Producers are identifying the need for support for cooling infrastructure such as shade, hydration stations, misting systems, augmented refrigeration, and increased ventilation. Additionally, producers have indicated the need for support for electricity consumption related to cooling across livestock barns, greenhouse production systems, and post-harvest storage infrastructure.

Because the impacts of extreme heat on farmworkers and infrastructure have only become apparent in the last three years, there is limited local research and agricultural extension projects addressing this priority area.

## 3.1 Why is extreme heat management a priority?

- ▶ **CROP AND LIVESTOCK health and productivity can be severely impacted by extreme heat:** Lack of shade in outdoor systems and lack of ventilation and/or cooling in indoor systems can cause severe health impacts. In the 2021 heat dome, more than 650,000 farm animals perished and some crops such as berries experienced major crop losses due to scorching. Earlier extreme heat events also put seedlings and transplants at risk, forcing farmers to alter planting times and irrigation or invest in shade cloth.
- ▶ **HEALTH AND SAFETY of farmworkers can be compromised in extreme heat events:** Exposure to extreme heat can create serious health concerns such as dehydration, heat stress, and heatstroke, while significantly lowering productivity and judgment for consequences of error. [WorkSafe claims related to heat stress](#) have increased in the province in recent years.
- ▶ **COOLING INFRASTRUCTURE for livestock, workers, and post-harvest facilities can mitigate extreme heat risks but is limited in the Islands and South Coast region:** Because heat events have been less frequent and severe, producers often lack cooling infrastructure that safeguards their crops, livestock, and workers.



## 3.2 What extreme heat management work has been done?

\*Links in green are producer-oriented resources and tools

Project	Project Resources*	Location	Year
<b>CROP PROTECTION</b>			
Reflective tarps to maintain blueberry quality	<a href="#">Factsheet: fruit quality</a> <a href="#">Factsheet: how to use</a> <a href="#">Full project report</a>	Fraser Valley	2023
Tools for climate resilience in tree fruit: foliar spray to protect fruit quality during heat events	<a href="#">Journal article</a>	Okanagan	2023
Using vented orchard covers for protecting fruit	<a href="#">Project presentation</a> <a href="#">Factsheet</a>	Okanagan	2017
<b>LIVESTOCK HEALTH</b>			
Managing extreme heat on dairy farms	<a href="#">Full project report</a>	Fraser Valley	2023
State of practices and technologies assessment for managing extreme heat impacts (berries, poultry, dairy)	<a href="#">Full project report</a>	Fraser Valley	2019
<b>HEALTH AND SAFETY</b>			
Heat, the workplace, and your health	<a href="#">Guide: Heat, the workplace, and your health</a> <a href="#">Guide: Working outside during heat events</a>	Provincial	2023

## 3.3 What's next: Looking ahead

As extreme heat events become increasingly challenging for agricultural producers in the Islands and South Coast region, proactive management and supportive projects and programs will be vital to resilient production. Altering working conditions, increasing cooling infrastructure, and trialing crop protection measures novel to the region are suggested strategies.

### On-Farm Management Practices

**Crop health** protection can involve field and cultural practices.

- ▶ Adjusted planting and harvest schedules
- ▶ Irrigation management (i.e. overhead for specific crops during extreme heat events, or in anticipation of heat events for perennial crops)
- ▶ Heat resistant varieties/crops
- ▶ Shade cloth

**Livestock health** is concerned with provision of adequate shade and water, which are critical for temperature regulation.

- ▶ Climate resilient watering systems (adequate supply through drought)
- ▶ Shade provision (trees/structures)
- ▶ Barn cooling systems (misting, fans, ventilations, monitoring systems/sensor improvements)

**Farmworker health** is concerned with providing employees resources to cope with extreme heat and confidence that their health be prioritized during extreme heat events.

- ▶ Heat stress training and nutrition
- ▶ Farm housing
- ▶ Altered work hours (i.e. earlier starts or shorter days during extreme heat events)
- ▶ Emergency heat planning
- ▶ Access to potable water
- ▶ Personal protection (clothing, sun protection)

**Cooling infrastructure** supports crop, livestock, and farmworker health, and is also concerned with provision of adequate farm level infrastructure to safeguard harvests.

- ▶ Misting stations
- ▶ Ventilation systems
- ▶ Farm structure design
- ▶ Community level refrigeration access (i.e. food hub)

## Funding Programs: EXTREME HEAT MANAGEMENT

- ▶ [Extreme Weather Preparedness for Agriculture - extreme heat preparedness stream](#)

Photo: Emrys Miller



# 4

## Adaptation to Changing Pests and Pollinators

Photo: Brynn Pedrick/Unsplash



### Adaptation

As climate impacts shift temperature and precipitation patterns, pest and disease presence, population cycles, and severity are changing. Adaptation to pests includes strategies aimed at reducing the impact of pests on crops while minimizing negative outcomes for biodiversity and habitat. This is commonly termed Integrated Pest Management (IPM). In particular, wildlife damage has forced producers to implement creative and sometimes costly infrastructure to protect crops or livestock. Without these strategies, losses can be severe, particularly from ungulates (e.g. elk), waterfowl (e.g. geese), and invasive insects (e.g. Spotted wing drosophila, armyworm).

Natural habitats and biodiversity can provide benefits for agriculture production, including pollination and predation on pests. Agricultural systems that steward ecosystem services, habitat connectivity, native refugia, and riparian area health alongside production may better balance pest management with biodiversity conservation.

### 4.1 Why is adaptation to changing pests and pollinators a priority?

- ▶ **PEST DAMAGE leading to yield losses is increasingly challenging to manage due to shifting climate patterns:** Pests that may not have been a problem previously may now have increasing population numbers due to warming weather, while changing weather patterns can also mean new pests are being introduced to the region. Pests can range from insects and nematodes to birds, rodents, and larger predators, and include agricultural weeds.
- ▶ **DISEASE prevalence, emergence, and severity are increasing with changing climate trends:** Both crop and livestock sectors are at risk of outbreaks or new diseases as climatic conditions create favorable conditions.
- ▶ **WILDLIFE DAMAGE creates tension between agricultural production and biodiversity conservation:** Striking a balance between agricultural and wildlife conservation goals requires multi-faceted strategies and ongoing collaboration between stakeholders. On specific areas of Vancouver Island, elk damage has become increasingly severe and management options for farmers appear prohibitive due to cost or regulations. Likewise, waterfowl damage impacts crop productivity and limits the efficacy of on-farm management practices such as cover cropping.
- ▶ **POLLINATOR AND BIODIVERSITY CONSERVATION are supported by on-farm landscape features:** Landscape elements such as vegetation buffers can provide habitat for diverse insects, plants, animals, and fungi that support farm resilience. For example, conservation of natural insect predators can help keep pest populations in check, and provision of owl habitat can support rodent control. Wild pollinators also make significant contributions to crop pollination, and loss of habitat and food sources (e.g. native flora) can negatively impact farm productivity.



## 4.2 What pest and pollinator adaptation work has been done?

\*Links in green are producer-oriented resources and tools

Project	Project Resources*	Location	Year
<b>PEST DAMAGE</b>			
Island biogeography of invasive insects and their accidentally introduced natural enemies in Coastal British Columbia	<i>In progress, Agriculture and Agri-Food Canada</i>	Islands and South Coast	2021-2024
Pest and pollinator gaps and opportunities assessment and implementation plan	<a href="#">Webinar: managing changing pest pressures</a> <a href="#">Webinar: supporting pollinator populations</a> <a href="#">Full project report</a> <a href="#">2021 Field report</a> <a href="#">2022 Field report</a>	Vancouver Island	2021-2022
Invasive plant pest management plan for public lands	<a href="#">Full project report</a>	Islands and South Coast	2022
Integrated pest management field guides for field vegetable crops	<a href="#">Factsheet: Carrot rust fly</a> <a href="#">Factsheet: Two spotted spidermite in cucumbers</a> <a href="#">Factsheet: Downy mildew in onions</a> <a href="#">Factsheet: Powdery mildew in cucurbits</a> <a href="#">Factsheet: Caterpillars in cole crops</a> <a href="#">Factsheet: Tuber flea beetle</a> <a href="#">Factsheet: Thrips in potatoes</a> <a href="#">Factsheet: Western corn rootworm</a>	Provincial	2022
Integrated pest management field guides for berry crops	<a href="#">Factsheet: Mummy berry</a> <a href="#">Factsheet: Two spotted spidermite</a> <a href="#">Factsheet: Weevils</a> <a href="#">Factsheet: Spotted wing drosophila</a> <a href="#">Factsheet: Caterpillars</a> <a href="#">Factsheet: Powdery mildew in strawberries</a> <a href="#">Factsheet: Blueberry scorch virus</a>	Fraser Valley	2022
British Columbia plant health guide for agriculture	<a href="#">Guide</a>	Provincial	2021
Inventory of pests: activities, gaps, and priorities	<a href="#">Full project report</a>	Fraser Valley	2017
The role of insect community composition in predicting pest control rates and organic matter decomposition	<i>In progress, Delta Farmland and Wildlife Trust/UBC</i>	Fraser Valley	2023
<b>DISEASE</b>			
British Columbia plant health guide for agriculture	<a href="#">Guide</a>	Provincial	2021

Project	Project Resources*	Location	Year
Animal health emergency management	<a href="#">Producer workbook</a>	Provincial	2021
Livestock health emergency management handbooks: B.C.	<a href="#">Beef cattle</a> <a href="#">Dairy cattle</a> <a href="#">Sheep/goats</a> <a href="#">Pigs</a> <a href="#">Equine</a> <a href="#">Bison</a> <a href="#">Avian</a>	Provincial	2021
<b>WILDLIFE DAMAGE</b>			
Elk exclusion fencing	<i>In progress, Ministry of Agriculture and Food</i> <a href="#">Factsheet: Elk exclusion fencing</a> <a href="#">Factsheet: 3D fencing</a>	Provincial	2015-2023
Comox valley waterfowl management program	<a href="#">Project description: winter cover cropping</a>	Mid Vancouver Island	2014
Best management practices for livestock protection from predation	<a href="#">BMP Guide</a> <a href="#">Loss Prevention Practices for Cattle</a> <a href="#">Loss Prevention Practices for Sheep</a>	Provincial	N/A
<b>POLLINATION &amp; BIODIVERSITY CONSERVATION</b>			
Pest and pollinator gaps and opportunities assessment and implementation plan	<a href="#">Webinar: managing changing pest pressures</a> <a href="#">Webinar: supporting pollinator populations</a> <a href="#">Full project report</a> <a href="#">2021 Field report</a> <a href="#">2022 Field report</a>	Vancouver Island	2021-2022
Planning for biodiversity: guide for B.C. farmers and ranchers	<a href="#">Guide</a>	Provincial	2019

## 4.3 What’s next: Looking ahead

Integrated pest management strategies and robust pest monitoring programs can support producers in managing damage to crops and livestock. Biodiversity-based practices can contribute to climate adaptation, reduction of net greenhouse gas emissions, and environmental stewardship. Implementing on-farm habitat and biodiversity management practices are shown to have positive outcomes for farm resilience and environmental health by fostering healthy soils and ecosystems.

### On-Farm Management Practices

In the Islands and South Coast region, on-farm management practices for pest adaptation generally fall into three strategies:

**Integrated pest management** is a holistic approach that combines various strategies to manage pests while minimizing environmental impact.

- ▶ Scouting and monitoring pest populations
- ▶ Setting economic and environmental thresholds
- ▶ Biocontrol measures
- ▶ Crop rotation
- ▶ Crop cultivar diversity
- ▶ Targeted pesticide application

**Habitat management** integrates areas and landscape features that support biodiversity within or around agricultural lands. Specific habitat management practices include:

- ▶ Shelterbelts/windbreaks/hedgerows/pollinator strips
- ▶ Riparian restoration
- ▶ Conservation set-asides
- ▶ Wildlife corridors
- ▶ Agroforestry/silvopasture

**Wildlife conflict management** aims to reduce negative impacts to wildlife while maintaining agricultural productivity. Specific on-farm management practices include:

- ▶ Elk exclusion fencing (including 3D fencing)
- ▶ Electric fencing
- ▶ Tree fruit netting
- ▶ Crop selection and timing
- ▶ Electronic monitoring systems

### Building on Recent Projects

**Integrated pest management:**

- ▶ Coordinate increased regional pest monitoring and management knowledge transfer

**Pollination:**

- ▶ Undertake collaborative multi-region baseline pollinator health assessments and knowledge transfer
- ▶ Enhance supports for creation/maintenance of pollinator and beneficial insect habitat

**Wildlife conflict:**

- ▶ Initiate ungulate agricultural conflict study and provide management recommendations and fencing demonstrations

### Funding Programs: ADAPTING TO CHANGING PESTS AND POLLINATORS

- ▶ [Bee BC](#)
- ▶ [Agriculture Wildlife Program](#)
- ▶ [Environmental Farm Plan Program \(EFP\)](#)
- ▶ [EFP Beneficial Management Practices Program](#) - *pest management projects, biodiversity projects*

### Provincial Toolbox: PESTS AND POLLINATORS



[Habitat and Biodiversity Assessment Tool](#) - *forthcoming from CFGA (2023 update)*

[Plant Health Laboratory](#) - *provides diagnoses for plant health problems*



# 5

## Crop Selection for Resilience

Photo: Emrys Miller



### Adaptation

As the seasons become more variable, specific varieties of key crops that have historically been productive may underperform or become unreliable. Rising temperatures and increasing variability in temperature, frost, and precipitation patterns can reduce crop yields as well as create conditions for increased pest and disease pressures. Regionally adapted cultivars can be bred within the region of intended production to ensure crop traits function well in the local area.



### Environment

As the impacts of climate change accelerate, producers are seeking crop varieties that produce well in periods of increased water stress, disease, or pest pressure. Varieties that can endure a broader range of temperatures and precipitation levels are important. Plant breeding and cultivar development is a slow process; upwards of 10 years may be needed to develop a new variety. This long timeline makes on-farm variety trials an important part of adaptation, so that farmers can better understand how existing varieties perform locally and share farmer-to-farmer knowledge of region-specific data and observations.

### 5.1 Why is crop selection for resilience a priority?

- ▶ **CHANGING TEMPERATURES and extreme weather events can cause staple crops and varieties to underperform:** Drought conditions and extreme events, such as the 2021 Western North America heat dome, have drastically reduced yield in staple varieties across commodities (notably forage, berries, tree fruits). Crops and varieties that are more heat resilient or that are able to withstand prolonged cold temperatures are being explored by producers across the province. Crops that are new to the region are also being explored as they may be more suited to shifting temperature and precipitation patterns.
- ▶ **CHANGING PRECIPITATION patterns cause seeding and harvest timing and frequency to change:** As precipitation load shifts into spring and fall, producers may need to shift seeding and harvest times and frequency. Some commodities may increase harvest frequency, others (i.e. hay) may be reduced.
- ▶ **PEST & DISEASE PRESSURE may increase due to changing climatic conditions:** As temperature and precipitation shifts across the province, some regions may become more susceptible to pests and diseases of concern.

## 5.2 Crop selection for resilience projects

\*Links in green are producer-oriented resources and tools

Project	Project Resources*	Location	Year
<b>TEMPERATURE, PRECIPITATION</b>			
Vancouver Island winter vegetable variety trials	<a href="#">Factsheet: chicory</a> <a href="#">Video: chicory</a> <a href="#">Factsheet: spinach</a> <a href="#">Video: spinach</a> <a href="#">Full project report</a>	Vancouver Island	2023
Vancouver Island annual silage crops demonstration	<a href="#">Full project report</a>	Vancouver Island	2023
Crop trial and crop suitability assessment for climate resilience	<a href="#">Full project report</a>	Vancouver Island	2022
Farmer-led research for innovative corn production practices	<a href="#">Podcast episode</a> <a href="#">Factsheet: interseeding</a> <a href="#">Factsheet: strip tillage</a> <a href="#">Factsheet: variable rate</a> <a href="#">Research summary</a> <a href="#">Full project report</a>	Okanagan	2022
Investigating crop suitability for changing climate conditions	<a href="#">Webinar</a>	Provincial	2021
Forage variety trials	<a href="#">Factsheet</a>	Cariboo-Chilcotin	2009-2012
<b>TEMPERATURE, PRECIPITATION, PEST PRESSURE</b>			
Provincial Cover Crop Factsheets (23 cover crop species)	<i>In progress, Ministry of Agriculture and Food</i> <i>Forthcoming tool: digital cover crop selection tool</i>	Provincial	2023
Canadian Organic Vegetable Improvement	<a href="#">Webinar: Breeding carrots</a> <a href="#">Project description and publications list</a>	National with Vancouver Island sites	2018-2023
Forage crop and variety selection for dryland farms	<a href="#">Webinar</a>	Thompson-Okanagan	2021
Testing new crops with on-farm research	<a href="#">Grab and Go Template for On-Farm Research</a>	Kootenay Boundary	2021
Maximizing forage yield and quality in an intercropping system	<a href="#">Full project report</a>	Fraser Valley	2018
B.C. Seed Trials	<a href="#">Variety trial results</a> <a href="#">Variety trial and seed growing resources list</a>	Provincial with Vancouver Island sites	2016-2018
On-farm forage variety trials	A Guide to On-Farm Demonstration Research: <a href="#">Case Studies 1-4</a> <a href="#">Research Guide</a>	Bulkley-Nechako and Fraser-Fort George	2016-2017

**Funding Programs:  
CROP SELECTION  
FOR RESILIENCE**

- ▶ [Perennial Crop Renewal Program](#)
- ▶ [AgriStability](#) - agriculture income protection

**Provincial  
Toolbox:  
CROP  
SELECTION  
FOR RESILIENCE**



[Forage U-Pick \(Species Selection Tool\)](#)

[BC Tree Fruit Production Guide - variety information](#)

[Fruit Tree Varieties and Pollination Guide](#)

## 5.3 What’s next: Looking ahead

The impacts of climate change on crops and associated pests and diseases are causing producers to implement strategies and practices to ensure crops are resilient. On-farm management practices for crop and variety selection for resilience fall into three main strategies.

### On-Farm Management Practices

**Crop diversity and adaptation** focuses on selecting and developing a diverse range of varieties adapted to regional conditions. This strategy requires participation from producers, industry, and research to develop and trial new varieties and crops. Practices include:

- ▶ Diversification of vegetable and fruit crops and varieties
- ▶ Diversification of forage mixes
- ▶ Selection of climate resilient varieties/crops

**Management for pest and disease risks** is achieved through a suite of practices that can help reduce losses associated with changing pest and disease pressures. Practices include:

- ▶ Crop rotation
- ▶ Integrated pest management
- ▶ Cover cropping

**Monitoring and adaptive management** are critical to track the success of new variety trials. Practices include:

- ▶ On-farm research
- ▶ Continuous monitoring/scouting and data collection
- ▶ Real-time crop performance assessments
- ▶ Integration of local and Indigenous knowledge

### Building on recent projects

**Crop diversity and adaptation:**

- ▶ Coordinate local crop trials and farm practice research and demonstration with opportunities for farmer-to-farmer data sharing
- ▶ Create and share resources on farm practices, crop selection and low-cost technologies to reduce climate risks

**Monitoring and adaptive management:**

- ▶ Improve regional weather station coverage and related decision support tools
- ▶ Facilitate increased opportunities for farmer to farmer discussion and knowledge sharing
- ▶ Establish and support regional weather network “hubs” to track detailed weather information to provide baseline information for regional crop selection and variety trials



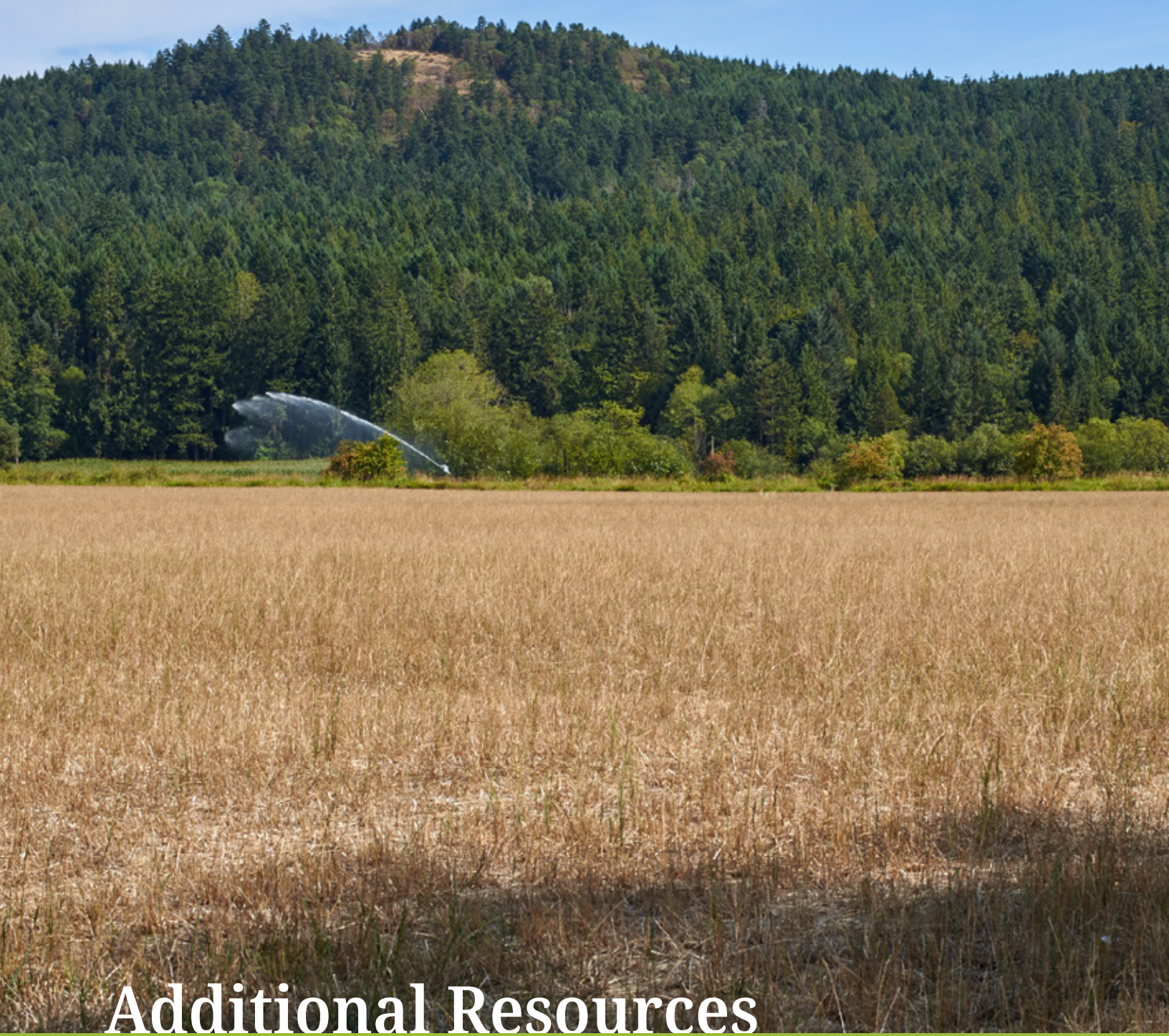


Photo: Emrys Miller

# Additional Resources

## Climate change mitigation

- ▶ [Regenerative Agriculture and Agritech Working Group: Final Report and Recommendations](#) (B.C. Ministry of Agriculture and Food, 2022)
- ▶ [Opportunity Assessment of British Columbia's Agricultural Greenhouse Gas Reductions and Carbon Sinks](#) (Ministry of Agriculture and Food/UBC, 2021)

## Regional adaptation strategies

(B.C. Climate Change Adaptation Program)

- ▶ [Vancouver Island Adaptation Strategies](#) (2020)

## Organic BC

- ▶ [Podcast series](#)
- ▶ [Organic Innovation video series](#)





For more information, visit our [website](#).



Or email us:  
[AgriServiceBC@gov.bc.ca](mailto:AgriServiceBC@gov.bc.ca)