Regional Extension Program

Environment and Climate REGIONAL GUIDEBOOK Okanagan

Central Okanagan, Okanagan-Similkameen

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Contents

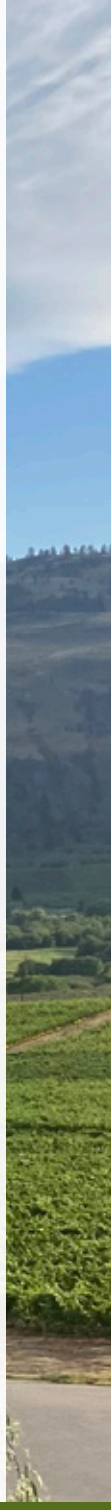

Photo: Nicole Pressey

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Contributors

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Credits

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Sustainable Canadian Agricultural Partnership

cleanBC

British Columbia

Canada

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 Okanagan region includes the Central Okanagan and Okanagan-Similkameen regional districts. Census data is drawn from the Thompson-Okanagan agricultural census area. 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

Tree Fruits

Photo: Hanaa Sheikh

Wine Grapes

Photo: Emrys Miller

Hay

Photo: Karen Tabe

Field Vegetables

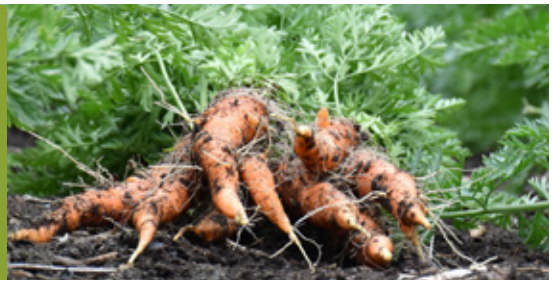

Photo: Dieter Geesing

Mixed Livestock

Photo: Nicole Pressey

TRENDS IN FARM NUMBERS, FARM TYPE, AND FARMLAND AREA

(Census of Agriculture, 2021)

- Decrease in total farmland area in the Okanagan was the smallest in the province (1.2%) between 2011 and 2021, but the number of farms decreased by 19.5%.
- In 2021, the Okanagan contained 48% of provincial fruit and tree nut operations. As of 2021, it also included 23% of vegetable (except potato) production, and 29% of horse and other equine operations.
- In 2021, 40% of Okanagan farms earned under $10,000, similar to the provincial share. Just 1.5% of farms earned over $2,000,000, while provincially 3% of farms are in this top income category.
- The growth of farm receipts across the region was 70% between 2011 and 2021, which was slightly greater than the provincial increase of 63%.

Regional Climate Change Impacts

The Okanagan is already experiencing severe impacts from climate change. Increases in the average number of days over 30°C, drier summer conditions, more intense wildfires, and warmer winter temperatures 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: Okanagan, 2050

TEMPERATURE

2.1°C to 4.4°C increase
in annual average temperatures

Average of
49 more
frost free days annually

PRECIPITATION

11% increase
in average spring precipitation
(+3% to +22%)

14% decrease
in average summer precipitation
(-41% to +2%)

25% decrease
in precipitation falling as snow
(-31% to -21%)

EXTREMES

Increase in frequency and magnitude
of extreme rainfall events

Increase
in average number of
days over 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: Nicole Pressey

1 Nutrient Management

Photo: Shutterstock

Mitigation

Environment

Nutrient management is an essential step in maintaining soil functions and optimizing crop yield and quality. Nutrient management involves applying the **right type of nutrient sources,** such as manure, fertilizer, or compost in the **right amount,** in the **right place** and at the **right time** for the specific crops being grown. Soil analysis and understanding crop nutrient requirements are important for informing nutrient application decisions.

A major reason for soil testing is to evaluate soil fertility, the ability of the soil to supply crops with nutrients. Effective nutrient amendment maximizes crop productivity and saves producers unnecessary costs. Nutrient management is also crucial for environmental health. Proper management for nutrient containment, storage, and application is important to prevent pollution of surrounding waterways and greenhouse gas emissions. B.C. has regulations surrounding nutrient management that are outlined in the Code of Practice for Agricultural Environmental Management.

1.1 Why is nutrient management a priority?

- **OPTIMAL CROP PRODUCTIVITY can be achieved through precise nutrient management:** Crop yields and crop quality depend on optimal nutrient availability and uptake. Producers need soil test results and knowledge of crop nutrient requirements to make informed management decisions. Crops have different fertility needs and require commodity specific nutrient management to optimize productivity.
- **COST EFFICIENCY is achieved when producers don't bear the costs of unnecessary nutrient supply:** Farmers can save on input costs when nutrient use efficiency is optimized.
- **NUTRIENT LOSS poses an environmental risk to water resources:** Excess nitrogen and phosphorus that are not used by crops can get into surrounding waterways or aquifers. Nutrients and pathogens from manure can pose health risks to humans and animals when they are consumed in drinking water. Nutrients (most commonly phosphorus) can cause algae blooms that damage aquatic ecosystems.
- **NUTRIENT USE EFFICIENCY** in agriculture is the efficient extraction and reuse of essential nutrients like nitrogen and phosphorus that is in organic residuals like manure and organic matter or excess fertilizer. It can include field level practices (like cover cropping) or regional approaches that aim to better use regionally generated nutrients (e.g., from manure) within the region. Nutrient recovery can improve soil function and reduce environmental pollution.

1.2 What nutrient management work has been done?

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

Project	Project Resources*	Location	Year
OPTIMAL CROP PRODUCTIVITY			
Nitrogen management in viticulture and enology; precision N management	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Using GIS and imaging tools to guide precision management for nitrogen	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Water and nutrient management strategies to integrate cover crops into vineyards to enhance sustainability and productivity	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Demonstration of innovative corn production technologies	Research summary Factsheet: interseeding Factsheet: strip tillage Factsheet: variable rate Full project report	North Okanagan	2023
Soil quality for resiliency	Factsheet Factsheet: Using a soil quality test kit [pastures]	Peace, Bulkley-Nechako	2017
NUTRIENT LOSS			
Phosphorus Index	*In progress, Ministry of Agriculture and Food*	Okanagan, Fraser Valley, Vancouver Island	2023 - 2024
Phosphorus recommendations in silage corn systems; agri-environmental indicator for risk of P transfer to water sources	*In progress, Agriculture and Agri-Food Canada*	Okanagan, Fraser Valley	2023
B.C. Climate Agri-Solutions nitrogen management projects	Nitrogen management extension resources	Provincial	2023
Soil sampling guidelines for British Columbia	Guide	Provincial	2023
Ministry of Agriculture soil nutrient study	Project report	Okanagan, Central Interior, Vancouver Island	2020
Too much water or too little: climate resilient vegetable farming	Research summary Factsheet: Soil N dynamics Full project report	Kootenay-Boundary, Fraser Valley, Vancouver Island	2021

Project	Project Resources*	Location	Year
Balancing nitrogen and phosphorus on organic vegetable farms	Podcast: Nutrient loss Podcast: N and P balance Online workshop Field trial results summary	Pemberton, Fraser Valley, Vancouver Island	2021
Innovative nutrient management for forage resiliency	Factsheet: Fertilizer placement, variable rate, and nitrogen losses Factsheet: managing on-farm nutrients to rejuvenate hayland	Peace	2015-2017
NUTRIENT USE EFFICIENCY			
B.C. Living Lab: Tree fruit and wine grape – producer led testing, monitoring, and adoption of interrow cover crops to improve soil health	*In progress* Project overview	Okanagan, Lower Mainland	2023
B.C. Living Lab: Field vegetables – producer led testing, monitoring, and adoption of cover crop and fertilizer management	*In progress* Project overview		2023
Provincial Cover Crop Factsheets (23 cover crop species)	*In progress, Ministry of Agriculture and Food* *Forthcoming tool: digital cover crop selection tool*	Provincial	2023
Okanagan vineyard cover cropping	*In progress, Winegrowing B.C. & Ministry of Agriculture and Food*	Okanagan	2023
B.C. Climate-Agri Solutions cover cropping projects	Cover cropping extension resources	Provincial	2023
Nutrient management in the Okanagan bioregion	Full project report	Okanagan	2021

1.3 What's next: Looking ahead

Nutrient management is a key component of agricultural management for producers, as optimal nutrient efficiency ensures crop quality and yield, cost efficiency, and environmental protection. On-farm management practices for nutrient management can be considered within three main strategies:

On-Farm Management Practices

Nutrient application and sourcing focus on how, when, and which nutrients are applied to support optimal efficiency. Increased efficiencies in nutrient management practices can result in reduced greenhouse gas emissions. Practices include:

- Nutrient management planning
  - Soil testing and analysis
  - 4R nutrient management: right time, right place, right rate, right source
- Variable rate application
- Precision application (e.g., low trajectory manure spreading/injecting)

Funding Programs: NUTRIENT MANAGEMENT

- Environmental Farm PlanProgram (EFP)
- EFP Beneficial Management Practices Program - *nutrient and waste management projects*
- B.C. Climate Agri-Solutions (2022/2023) - *nitrogen management stream*

Provincial Toolbox: NUTRIENT MANAGEMENT

- Nutrient Management Calculator
- Nutrient Management Plan Training
- Application Risk Management Tool
- Manure Nutrient Calculator
- Soil Test Phosphorus Converter
- Post-Harvest Nitrate Test Calculator
- B.C. Tree Fruit Production Guide
- Fruit Tree Nutrition

Soil and crop management is concerned with improving soil function and managing crops to enhance nutrient cycling. Practices can overlap with other priority areas and include:

- Soil testing and analysis
- Crop rotation
- Cover cropping
- Reduced tillage

Reducing risks to the environment from nutrient pollution occurs by reducing nutrient losses from the field to surrounding terrestrial and aquatic areas. Environmental protection is largely supported by effective nutrient, soil, and crop management strategies. Practices include:

- Buffer zones surrounding manure storage areas
- Effluent management (manure and fertilizer)
- Nutrient recovery and recycling
- Riparian protection and restoration
- Appropriate rates of application based on factors above

Building on Recent Projects

B.C. Living Laboratories Project:

- Tree fruit and wine grape: Build on on-farm cover cropping trial sites to increase demonstration sites and extension opportunities
- Field vegetables: Build on on-farm fertilizer management and cover cropping trial sites to increase demonstration sites and extension opportunities

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

2 Reducing Impacts of Extreme Temperature

Photo: Nicole Pressey

Adaptation

Extreme heat and cold events have occurred with increasing frequency in recent years, with temperatures in the Okanagan region exceeding seasonal average highs and lows. Extreme heat waves such as those in 2021-2023 and extreme cold events causing unprecedented and widespread damage to grapevines have highlighted worst-case risks to production systems, farmworkers, and infrastructure. Damage to crops, stress on livestock health, and stress on farmworker health are cited challenges.

Producers are identifying the need for support for crop and livestock protection, as well as for cooling infrastructure such as shade, hydration stations, misting systems, augmented refrigeration, and increased ventilation. Because the impacts of extreme heat on farmworkers and infrastructure have only become major issues in the province in the last three years, there is limited research and extension materials addressing this area.

2.1 Why is soil and nutrient management a priority?

- **CROP PROTECTION measures are becoming crucial to avoid severe impacts of extreme heat:** In the 2021 heat dome, many fruit and berry crops experienced major losses due to scorching. Earlier extreme heat events also put seedlings and transplants at risk, forcing farmers to alter planting times and irrigation scheduling. Long term impacts of extreme heat exposure on perennial crops are emerging, including increased susceptibility to pests and diseases or slowed productivity. An extreme cold event in 2022 caused long-term crop damage to 45% of grapevine acreage across the region, with 29% of acreage requiring replanting.
- **LIVESTOCK HEALTH during and after extreme heat events can be severely compromised:** In the 2021 heat dome, more than 650,000 farm animals perished. Lack of shade in outdoor areas or lack of ventilation and/or cooling in indoor systems creates immediate and longer-term health risks.
- **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.

2.2 What extreme temperature work has been done?

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

Project	Project Resources*	Location	Year
CROP PROTECTION			
Tools for climate resilience in tree fruit: foliar spray to protect fruit quality during heat events	Journal article	Okanagan	2023
Impacts of adverse temperature and water conditions on fruit set in sweet cherry in the early growing season	*In progress*	Okanagan	2018-2023
Modeling winegrape phenology for a warming Okanagan	Factsheet: budbreak Factsheet: flowering Full project report	Okanagan	2022
Forage crop and variety selection for dryland farms	Webinar	Thompson-Okanagan	2021
Using vented orchard covers for protecting cherries	Project presentation Factsheet	Okanagan	2017
LIVESTOCK HEALTH			
Managing extreme heat on dairy farms	Full project report	Fraser Valley	2023
State of practices and technologies assessment for managing extreme heat impacts (berries, poultry, dairy)	Full project report	Fraser Valley	2019
HEALTH AND SAFETY			
Heat, the workplace, and your health	Guide: Heat, the workplace, and your health Guide: Working outside during heat events	Provincial	2023

Photo: Lesley Edwards

2.3 What's next: Looking ahead

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

On-Farm Management Practices

Crop protection can involve field and cultural practices, and often involves providing shade or barriers to prevent sunburn.

- Adjusted planting and harvest schedules
- Irrigation management (e.g., overhead for specific crops during extreme heat events)
- Heat resistant varieties
- Shade treatments
- Foliar protectant sprays, stem white-wash or tree-wrap

Livestock health is concerned with provision of adequate shade, water, and ambient temperature, 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 (e.g., earlier starts or shorter days during extreme heat events)
- Emergency heat planning
- Access to potable water
- Personal protection (clothing, sun protection)
- New technology to reduce labour-intensive tasks (e.g., harvesting and pruning platforms)

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
- Community level refrigeration access

3 Water Availability and Management

Photo: Emrys Miller

Adaptation

Changing climatic, regulatory, and farm management conditions are impacting water availability and management in the Okanagan. Water needs for crops and livestock are increasing as the region experiences lower than normal precipitation in the summer months. Sustainable water management is a priority for producers to maintain productivity and allow water sources to recharge for future use. Drought conditions have reached levels 3-5 (mid to maximum in Provincial Drought Level) across the region in three of the last five years during summer and/or fall periods. By September 2023, many of the areas in this region reached a drought level 5, and curtailment orders were issued in two watersheds (Bessette Creek and Salmon River) to protect fish populations.

The 2021 Agricultural Census found 66% of farms in the Okanagan are irrigated. As summers become warmer, the region is projecting significantly increased water demand on diminishing surface water sources. Irrigation infrastructure is increasingly necessary for all agricultural areas in the Okanagan. 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.

3.1 Why is water availability and management a priority?

- **DROUGHT leading to insufficient forage and winter feed for livestock**: In dryland operations reduced precipitation has led to significant declines in hay (particularly in summer 2023), forcing some ranchers to buy feed they would normally grow themselves at demand-surge costs. The implementation of curtailment orders that resulted in the temporary suspension of water licences used for forage irrigation (e.g., in the Salmon and Bessette watersheds) in summer of 2023 likely reduced feed supplies further. Livestock producers across the province have been challenged with difficult decisions (e.g., reduction of herd size, feeding winter stock early, having pasture not available late in the grazing season) and reliance on various supports and funding programs.
- **IRRIGATION EFFICIENCY increases water conservation through targeted application that ensures optimal amount and timing, reducing overapplication, evaporation, cost, and greenhouse gas emissions**. Increasing irrigation efficiency requires improved irrigation infrastructure that can have high up-front costs but result in cost savings over the long term.
- **DECREASED WATER SUPPLY from changing temperature and precipitation:** Overall trends show that decreased snowpack or warmer spring temperatures can result in earlier peak stream flows that reduce surface water supply. Surface water makes up two-thirds of the Okanagan Basin's total water supply and provides water for 75% of the irrigated agricultural land in the region.
- **ON-FARM WATER STORAGE that collects water during annual high precipitation periods can be an emergency water strategy**. At the farm level, challenges of implementation include cost and maintenance of storage infrastructure (tanks, dugouts) and volume of storage infrastructure relative to water demand.

Photo: Lumin Osity/Unsplash

3.2 What water availability and management work has been done?

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

Project	Project Resources*	Location	Year
DROUGHT			
Identifying water-efficient practices that co-deliver maximum benefits for tree fruit production & climate change mitigation	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2021-2025
Drought stage trigger guidelines for Okanagan mainstem lakes and rivers	Full project report	Okanagan	2021
Climate resilient livestock surface water in the Cariboo	Virtual training series 2022 Fact Sheets and Range Unit Maps Assessment methodology (2017) Site assessment case studies Report on pilot projects (2020)	Cariboo	2017-2022
Resiliency: forage, water, and climate change risk assessment pilots	*In progress, B.C. Cattlemen's Association, Ministry of Agriculture and Food, Ministry of Forests* *Forthcoming tool: Landscape and range resiliency planning tool for Crown forage, surface water risk and climate change modelling* *Forthcoming factsheets:* • *Forage and Water Resiliency Overview: Managing water and forage resources in a changing climate* • *Reference Evaporation* • *Calculating Carrying Capacity* • *Flow Accumulation*	Interior North, Central, South, Kootenays	2019-2022
Pilot use of landscape and range resiliency planning tool	*In progress, B.C. Cattlemen's Association, Ministry of Agriculture and Food, Ministry of Forests* *Forthcoming factsheets:* • *Climate change mitigation and adaptation case studies*	Cariboo, Highway 16 North, Kootenay	2023
Water management resources and knowledge transfer of water best management practices for agriculture in B.C.	Resource summary Webinar series Full project report	Bulkley-Nechako / Fraser Fort George	2021

Project	Project Resources*	Location	Year
IRRIGATION EFFICIENCY			
Improving irrigation efficiency for managing during dry conditions	Factsheet series Webinar	Okanagan	2023
Post-harvest deficit irrigation in cherries	Research Summary Fact sheet Full project report	Okanagan	2019-2023
Vineyard water use efficiency, cost in vineyards, and how to measure water use	Factsheet: Vineyard establishment and maintenance practices for water use efficiency Factsheet: Tools to validate Factsheet: The full cost of water Tool: irrigation efficiency calculator Full project report	Okanagan	2018
Optimization of water use and cost in vineyards in the Okanagan using precision irrigation	Full project report	Okanagan	2018
Farm water fix: climate resilient irrigation systems and management	Video series	Kootenay/Boundary, Provincial	2022
Irrigate better: anatomy, pipe design, emission design, scheduling and monitoring	Webinar series	Kootenay/Boundary Provincial	2018
DECREASED WATER SUPPLY			
Okanagan water supply alerts for agricultural users	Project report: Assessment of Okanagan Water Suppliers Report (2018) Research summary and evaluation (2019) Okanagan Water Board resources for agricultural users	Okanagan	2018-2019
Climate change impact risk assessment tool for livestock water ponds	Full project report	Cariboo, Bulkley-Nechako	2017
ON-FARM WATER STORAGE			
Guidance on farm water storage	Factsheet	Provincial	2021
British Columbia farm water dugouts	Guide	Provincial	2016

Funding Programs: WATER AVAILABILITY AND MANAGEMENT

The B.C. Ministry of Agriculture and Food, with delivery support from the Investment Agriculture Foundation, offers the following funding programs that address water sustainability:

- Environmental Farm PlanProgram (EFP)
- EFP Beneficial Management Practices Program - *water infrastructure projects*
- Agricultural Water Infrastructure Program
- Extreme Weather Preparedness for Agriculture - *flooding preparedness and extreme heat preparedness streams*
- Agricultural Water Infrastructure Program
- AgriStability - *agriculture income protection*

Provincial Toolbox: WATER AVAILABILITY AND MANAGEMENT

- B.C. Agriculture Water Calculator
- B.C. Irrigation Water Use Calculator
- Agricultural Irrigation Scheduling Tool
- B.C. Drought Information Portal
- B.C. Irrigation Management Guide

3.3 What's next: Looking ahead

Sustainable agricultural water management is shaped by regulatory requirements, regional conditions, and farm level practices. Field-level water conservation is a primary adaptation strategy for producers as they respond to reduced water supply associated with climate impacts.

On-Farm Management Practices

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. 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 or evapotranspiration sensors
- Rainwater collection and storage

Building on Recent Projects

Drought response:

- Support commodity-specific pilot projects that develop and implement drought management action plans
- Diversify and promote informational resources and knowledge transfer for water on-farm management and efficiency best practices
- Undertake applied research and demonstration for practices and technologies to improve resilience to hot and dry conditions
- Support field-based water management demonstrations

Excess precipitation:

- Demonstration and assessment of run-off and erosion control
- Demonstration and assessment of low-cost flood mitigation infrastructure and practices
- Expand knowledge transfer and professional supports for implementation of riparian enhancement activities in agricultural areas

Water access and storage:

- Re-evaluate needs for agricultural dam maintenance and upgrades
- Pilot collaborative improvements of agricultural dams
- Expand livestock surface water risk assessment process
- Support demonstration of resilient water developments in high-risk range units

4 Adaptation to Changing Pests and Diseases

Photo: Lindsay Benbow

Adaptation

As climate impacts shift temperature and precipitation patterns, pest and disease distribution, population cycles, and severity are changing. Agricultural commodities in the Okanagan can be impacted by several pests and diseases, and its large number of organic operations face increased management complexity. Adaptation encompasses strategies aimed at reducing the impact of pests and diseases on crops while minimizing negative outcomes for biodiversity and habitat. This is commonly termed integrated pest management (IPM).

Several new and emerging pests are impacting producers in the Okanagan. Spotted wing drosophila (SWD) is an invasive fruit fly that can affect berries, cherries, and soft fruits, especially in years with mild winter/spring conditions. Other emerging insect pests in the Okanagan include Pacific flathead borer, grasshoppers, apple clearwing moth, apple maggot and balsam woolly adelgid.

4.1 Why is adaptation to changing pests 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.
- **DISEASE prevalence, emergence, and severity are increasing with changing climate trends:** In the Okanagan, new and existing diseases are impacting tree fruit and wine grape production. Livestock sectors are also at risk of disease outbreaks or new diseases.
- **PESTICIDE RESISTANCE makes previously useful pesticides ineffective:** Pesticide resistance can be exacerbated by climate change as rising temperatures and altered precipitation patterns can create more favorable conditions for pests, increasing the likelihood of resistance development.

4.2 What pest and disease work has been done?

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

Project	Project Resources*	Location	Year
PEST DAMAGE			
Accelerating the development of sustainable pest management practices to support Indigenous food systems in British Columbia	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2022-2024
Developing molecular genetic tools for optimized biological control of invasive plants in British Columbia	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2021-2024
Development of molecular diagnostics for plant-parasitic nematodes in B.C.	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2021-2023
Hot water treatment as an alternative to fumigation for the control of regulated and non-regulated pests and disease on fruit tree nursery material	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Development of sustainable management practices for leafhoppers on grapes	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Unearthing the impacts of plant-parasitic nematodes on grapevine health and productivity	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Weather monitoring for tree fruit in B.C.: pest management decision aid system	Tool: B.C. Decision Aid System Full project report	Okanagan, Kootenay-Boundary	2022
Integrated pest management field guides for field vegetable crops	Factsheet: Carrot rust fly Factsheet: Two spotted spider mite in cucumbers Factsheet: Downy mildew in onions Factsheet: Powdery mildew in cucurbits Factsheet: Caterpillars in cole crops Factsheet: Tuber flea beetle Factsheet: Thrips in potatoes Factsheet: Western corn rootworm	Provincial	2022
British Columbia plant health guide for agriculture	Guide	Provincial	2021
DISEASE			
Biological control and detection supporting tools of canker diseases of tree fruits and grapevines in Canada	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2022-2024

Project	Project Resources*	Location	Year
From nursery to vineyard: implementation of effective management strategies against grapevine trunk diseases	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Field strategies to mitigate the impact of grapevine viruses in British Columbia	*In progress, Agriculture and Agri-Food Canada*	Okanagan	2018-2023
Producers and interdisciplinary team of researchers find answers on sudden apple decline	Podcast	Okanagan	2022
Agro-thermal heat treatment of grapevines in the Okanagan valley	Research Summary Full project report	Okanagan	2022
British Columbia plant health guide for agriculture	Guide	Provincial	2021
Animal health emergency management	Producer workbook	Provincial	2021
Livestock health emergency management handbooks: B.C.	Beef cattle Dairy cattle Sheep/goats Pigs Equine Poultry	Provincial	2021
Climate change influence on disease control patterns in the Okanagan tree fruit industry	Full project report	Okanagan	2017

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.

On-Farm Management Practices

In the Okanagan region, on-farm management practices for pest and disease adaptation generally falls into two 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

Funding Programs: PESTS AND DISEASES

- Environmental Farm PlanProgram (EFP)
- EFP Beneficial Management Practices Program - *pest management projects*
- AgriStability - *agriculture income protection*

Provincial Toolbox: PESTS AND DISEASES

B.C. Decision Aid System for tree fruit pest and disease management

Okanagan Invasive Species Online

Plant Health Laboratory – *provides diagnoses for plant health problems*

Habitat and Biodiversity Assessment Tool - forthcoming from CFGA (2023 update)

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

- Tree fruit and grapevine netting
- Crop selection and timing
- Electronic monitoring systems

Building on Recent Projects

Integrated pest management:

- Coordinate increased regional pest monitoring and management knowledge transfer
- Enhance, adapt, or develop regional pest and weather data decision-support tools
- Disseminate regionally relevant pest management information and resources

Photo: Waldemar/Unsplash

5 Flood Management

Photo: Shutterstock

Adaptation

Environment

Extreme precipitation events are increasingly frequent and severe across the province. Increased precipitation in spring and fall, and more rapid snowmelt from extreme temperatures can cause freshet or flood events in vulnerable lowland areas of the Okanagan such as the Similkameen river valley. In the 2021 atmospheric river, several areas in the Similkameen and Tulameen river valleys sustained damage from flooding.

Beyond flooding, there are a range of risks to agricultural operations from excess precipitation in the Okanagan depending on the production system. For example, extreme precipitation can create soil erosion that degrades topsoil and/or results in nutrient runoff, damage fruit crops, break seedlings, or promote disease.

5.1 Why is flood management a priority?

- **FLOODING is an increasing risk in agricultural areas located in river valleys:** increased precipitation or temperatures cause rapid snowmelt and can create unprecedented river surges that can devastate agricultural operations.
- **EROSION is a high risk during extreme precipitation and flooding 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.

5.2 What flood management work has been done?

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

Project	Project Resources*	Location	Year
FLOODING			
Farm flood readiness toolkit	Toolkit Factsheet: Okanagan Factsheet: landscape level mitigation Video: prepare for flooding Video: protect your farm assets	Okanagan, Fraser Valley	2022
Flood hazard mapping for the Similkameen river	Full project report	Okanagan-Similkameen	2021
Livestock sector emergency preparedness for flooding	Factsheet	Provincial	2019
Horticulture sector emergency preparedness for flooding	Factsheet	Provincial	2019
Linking farmland to floodplains	Research summary Full project report	Kootenay-Boundary	2022
HEALTHY RIPARIAN AREAS			
Riparian management field workbook for streams and small rivers	Field workbook	Provincial	2019
Agricultural benefits of riparian rehabilitation	Factsheets Full project report	Okanagan	2018
Supporting riparian health on farmland for flood protection	Full project report	Kootenay-Boundary	2023
Riparian restoration: debris barriers reduce effects of livestock grazing	Factsheet: live stakes Factsheet: debris stakes Journal article	Okanagan	2021
EROSION			
Improving soil health through enhanced water infiltration	Grab and Go Template for On-Farm Research	Kootenay/Boundary	2021
Agricultural waterways: drainage maintenance and stewardship	Guide	Provincial	2018

5.3 What's next: Looking ahead

Extreme precipitation events can be unpredictable in timing and severity, but producers can take steps to implement management strategies that reduce risk to crops, soil, and infrastructure. Flood planning resources and diversion 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 Okanagan, excess precipitation management includes physical diversion, field practices, and planning strategies:

Drainage and containment systems are critical for channeling water away from crops and livestock and preventing waterlogging. Drainage systems can be natural (e.g., watercourses) or engineered (e.g., dikes, ditches). Observation of farm level and watershed level topography can indicate areas susceptible to waterlogging and/or flooding. Specific practices for drainage include:

- Dikes
- Riparian restoration
- Surface drainage (ditches, culverts, waterways)
- Riparian fencing
- Bank stabilization and restoration
- Implementation and restoration of wetlands
- Alternative livestock watering systems
- Improved stream crossings
- Habitat structures and enhancement

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

Practices that optimize soil water dynamics typically have a suite of benefits for soil, crop productivity, and climate change adaptation and mitigation. 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 (e.g., shelterbelts)

Funding Programs: FLOOD 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 PlanProgram (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)*

Provincial Toolbox: FLOOD MANAGEMENT

B.C. Flood Study Explorer

B.C. River Forecast Center

AgSafe Emergency Planning Resources - Flooding

Building on Recent Projects

Flooding:

- Update dike infrastructure in vulnerable areas
- Create flood and erosion vulnerability maps for risk prioritization
- Demonstration and assessment of low-cost flood mitigation infrastructure and practices
- Create a green flood infrastructure strategy and endowment for agriculture

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

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6 Wildfire Management

Photo: Emrys Miller

Adaptation

Mitigation

Environment

Wildfires have become increasingly frequent and severe in the Okanagan region; record breaking seasons have been occurring since 2017. Destruction of crops, livestock and infrastructure have created substantial economic losses for farmers. Smoke and ash from wildfires degrade air quality, affecting both agricultural workers' health and crop yields and quality.

In addition to immediate impacts, the increased frequency and intensity of wildfires compound these issues, making long-term planning and risk mitigation strategies essential for agricultural sustainability in fire-prone regions. FireSmart practices and Indigenous fire management are two examples of risk reduction actions taking place in many areas of B.C.

6.1 Why is wildfire management a priority?

- **FUEL MANAGEMENT IN THE AGRICULTURE/WILDLAND INTERFACE is critical in high-risk areas to prevent wildfires spreading to production areas:** Fuel reduction (e.g., removal of highly flammable wood/brush) at fence lines and the farm/range interface is of key importance, as wildfires often start in wildlands or range and are more likely to impact farms with fuel resources at their interface.
- **EMERGENCY PLANNING is a strategy to safeguard farmers, farmworkers, and livestock from the most dangerous risks of wildfire:** Farms and ranches can take steps to reduce wildfire impacts by incorporating FireSmart principles into the design and maintenance of infrastructure and their immediate surroundings. Planning for personnel evacuation and livestock relocation is essential for producers to develop in high-risk wildfire regions.
- **SILVOPASTURE is a grazing management system that integrates livestock and forests and can help reduce wildfire risks through fuel management:** Silvopastures typically have lower tree densities, less ladder fuels, and reduced buildup of fine fuels on the ground layer due to grazing activity. Reduced fuels can reduce wildfire intensity and spread. In B.C., use of silvopasture practices is typically supplementary to conventional forestry, range and pasture management.

6.2 What wildfiremanagement work has been done?

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

Project	Project Information	Location	Year
FUEL MANAGEMENT IN AGRICULTURE/WILDLAND INTERFACE			
Grazing and fine fuels reduction: Practices & tool development	*In progress, B.C. Cattlemen's Association, Ministry of Agriculture and Food, Ministry of Forests, B.C. Wildfire Service* *Forthcoming resources:* • *Site selection Guide* • *Operational Guide* • *Monitoring methods field manual*	Provincial	2023
Grazing and fine fuels reduction: Targeted grazing pilots	*In progress, B.C. Cattlemen's Association, Ministry of Agriculture and Food, Ministry of Forests, B.C. Wildfire Service*	Okanagan; Kootenay	2019-2022
Fuel management pilot in the agricultural wildland interface	Full project report Phase II project report Producer engagement summary	Cariboo-Chilcotin, Bulkley-Nechako	2020
Opportunities and barriers to reducing wildfire risk on ranching properties	Full project report	Cariboo-Chilcotin	2016
EMERGENCY PLANNING & FIRESMART ACTIONS			
Farm and ranch wildfire preparedness guide & workbook	Guide Workbook Webinar A Webinar B Creating an operation map Threat to farm assets	Provincial	2019
Regional District of Okanagan Similkameen wildfire impact reduction communication plan for agriculture	Full project report Communication plan reference guide Discussion document	Okanagan	2018-2021
Emergency management guide for B.C. small mixed farms	Guide	Provincial	N/A
Communicating through wildfire: improving outcomes for agriculture and local governments	Project report	Kootenay Boundary	2023

Project	Project Information	Location	Year
SILVOPASTURE			
Modular silvopasture workshop resources	*In progress, Ministry of Agriculture and Food* *Forthcoming workshop modules:* • *4 core units (Introduction, Science, BMPs, Planning)* • *Case studies (regional)* • *Supplemental units (History, Light & Microclimate, Hydrology, Managing Damage)*	Provincial	2023

6.3 What's next: Looking ahead

Wildfire events are unpredictable in timing and severity, but producers can take steps to implement management strategies that mitigate risk to crops, livestock, and farm infrastructure. Key processes for producers include emergency and evacuation planning and farm site preparedness.

On-Farm Management Practices

Emergency planning and FireSmart actions are critical for reducing the worst risks to farmers, farmworkers, and livestock. Specific practices include:

- Development of evacuation plans
- Development of livestock relocation plans
- Incorporate FireSmart practices into farm infrastructure and zones immediately surrounding infrastructure and equipment

Fuel management in the agriculture/wildland interface is particularly important for producers operating at the interface of wildlands and rangelands, where wildfires can start and spread into agricultural areas. Specific practices include:

- Fuel management at farm/range interface (e.g., removing flammable vegetation)
- Fuel reduction and protection of fence lines
- Establish firebreaks

Building on Recent Projects

- Formalize the Agriculture Wildland Interface (AWI) and complete province-wide AWI risk mapping
- Expand fuel management pilot projects
- Increase farm/ranch wildfire preparedness knowledge transfer activities
- Coordination of communication during extreme events for agriculture (Ministry-led pilot)

Funding Programs: WILDFIRE MANAGEMENT

- Extreme Weather Preparedness for Agriculture - *wildfire stream*
- AgriStability - *agriculture income protection*
- Farmland Advantage - *payment for ecosystem services: wildfire risk reduction pilot*

Provincial Toolbox: WILDFIRE MANAGEMENT

B.C. Wildfire Services Map

Provincial Fire Weather Danger Class Report

AgSafe Emergency Planning Resources - Wildfire

Additional Resources

Photo: Nicole Pressey

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 (B.C. Ministry of Agriculture and Food/UBC, 2021)

Regional adaptation strategies

(B.C. Climate Change Adaptation Program)

- Okanagan Adaptation Strategies Update (2018)
- Okanagan Adaptation Strategies (2016)

Organic BC

- Podcast series
- Organic Innovation video series

Photo: Emrys Miller

For more information, visit our website.

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