PRINCE EDWARD ISLAND FEDERATION OF AGRICULTURE

Building Resilience: Adaptation Plan

Building Resilience for PEI Agriculture:
Adaptation Plan 2025-2030

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Executive summary

Farmers on Prince Edward Island (PEI) are used to weathering storms. From extreme weather events such as post-tropical storm Fiona (2022) to disruptions such as disease outbreaks, regulatory changes, and record-high input prices, the sector has managed to adapt and move forward. On PEI, responding to climate change impacts ("climate change adaptation") within the agriculture sector are taking place at different levels, with leadership coming from different groups. This *Building Resilience for PEI Agriculture: Adaptation Plan 2025-2030* is the province's first ever agriculture sectoral adaptation plan. Its purpose is to:

- **Highlight the shared and unique adaptation needs of commodities at the field and sector levels; and**
- **Address barriers faced by PEI farmers and agriculture sector organizations in proactive adaptation.**

Climate change impacts all commodities on PEI. For example, high winds in extreme weather events cause damage to crops and properties. Intense rainstorms cause soil erosion and lead to nutrient loss through leaching. Warming temperatures increase pest pressures and cause heat stress to crops and livestock. The section *On-Farm Actions* outlines climate change impacts and adaptation responses for beef, sheep, poultry, hogs, dairy, eggs, potatoes, cereals, corn, oilseeds, grapes, highbush blueberries, lowbush blueberries, strawberries, berries, apples, and cranberries.

At the sector level, other factors such as policy changes, consumer behaviour, and workforce development come into play. Since agriculture demands a constant ability to adapt to different pressures, this Plan presents an opportunity to explore how climate change adaptation can also address other challenges the sector faces, and vice-versa. The key adaptation activities are listed within the section *Sectoral Actions.* The eight main sectoral actions are:

1. **Establish producer clubs**
2. **Support co-operatives**
3. **Improve soil health**
4. **Enlarge and upskill workforce**
5. **Apply and demonstrate industry-led research**
6. **Enhance agricultural infrastructure**
7. **Sustain agricultural land**
8. **Support locally-relevant adaptation**

This Plan was co-developed with farmers, with the intention of making adaptation more relevant, approachable, and beneficial. The clear intention of making adaptation work for farmers, and not the other way around, resonated with all participants. As it became clear that there will be larger adaptation actions involving more partners and commodity groups required in the future, actions that "make future adaptation more possible" generated significant interest. These key sectoral actions can begin to address climate risks directly today while laying the foundation for more coordinated adaptation actions in the future, helping to make the agriculture sector on PEI more ready, responsive, and resilient.

Introduction

Farmers (or producers) on Prince Edward Island (PEI) are used to weathering storms. From extreme weather events such as post-tropical storm Fiona (2022) to disruptions such as disease outbreaks, regulatory changes, and record-high input prices, the sector has managed to adapt and move forward. Innovations driven by farmers, researchers, industry associations, governments, and the private sector continue to create new ways to meet these challenges.

On PEI, responding to climate change impacts ("climate change adaptation") within the agriculture sector are taking place at different levels, with leadership coming from different groups.

At the field level, farmers continue to test and innovate new ways to prepare their fields, crops, and livestocks for climate impacts. The main focus of adaptation work at this level has been on best management practices (BMPs).

At the multi-farm level, adaptation actions and innovations have been driven by funding and partnership opportunities. For example, on-field applied research is being led and supported by commodity groups, Agriculture and Agri-Food Canada (AAFC), the Government of Prince Edward Island (GPEI), University of Prince Edward Island (UPEI), private sector, and non-governmental organizations (NGOs) supporting soil, water, and environmental health. At this level, adaptation work includes BMPs, automation, creating new crop varieties, developing machine learning tools, and more.

There have been limited climate change adaptation efforts at the sectoral level that support multiple commodities. A sectoral plan at the national level is being developed by AAFC. This *Building Resilience for PEI Agriculture: Adaptation Plan 2025-2030* is the province's first ever agriculture sectoral adaptation plan. Its purpose is to:

- Highlight the shared and unique adaptation needs of commodities at the field and sector levels; and,
- Address barriers faced by PEI farmers and agriculture sector organizations in proactive adaptation

Building the Plan

Climate change impacts all commodities on PEI. For example, high winds in extreme weather events cause damage to crops and properties. Intense rainstorms create runoff, cause soil erosion, lead to nutrient loss through leaching, and increase the risks of soil compaction and water contamination. Warming temperatures increase weed, disease, and pest pressures, cause heat stress to crops and livestock, and reduce snow cover. How these impacts affect different commodity groups and the adaptation responses available to address them are listed within the section *On-Farm Actions*. The lists were created using existing research and stakeholder input.

At the sector level, other factors such as policy changes, consumer behaviour, and workforce development come into play. Farmers do not make adaptation decisions and plans in isolation. However, how climate change impacts interact with other pressures such as increasing costs of production, low succession planning rates, increased competition, and shortage of labour has not been considered. Since agriculture demands a constant ability to adapt to different pressures, this Plan presents an opportunity to explore how climate change adaptation can also address other challenges the sector faces, and vice-versa. The key adaptation activities are listed within the section *Sectoral Actions.* These were developed through multiple rounds of farmer and stakeholder engagement.

Connections to National and Provincial Plans

Canada's National Adaptation Strategy: Building Resilient Communities and a Strong Economy outlines a "whole-of-society" adaptation approach at the federal level (Government of Canada, 2023). It identifies five interconnected systems that are most impacted by climate change: disaster resilience, health and wellbeing, economy and workers, infrastructure, and nature and biodiversity (see Figure 1). It also lists agriculture as a sector that faces a higher level of risk from climate change impacts and recognizes that this affects health, food security, transportation, the environment, and the long-term economic viability of the sector, farmers, and rural communities (Government of Canada, 2023).

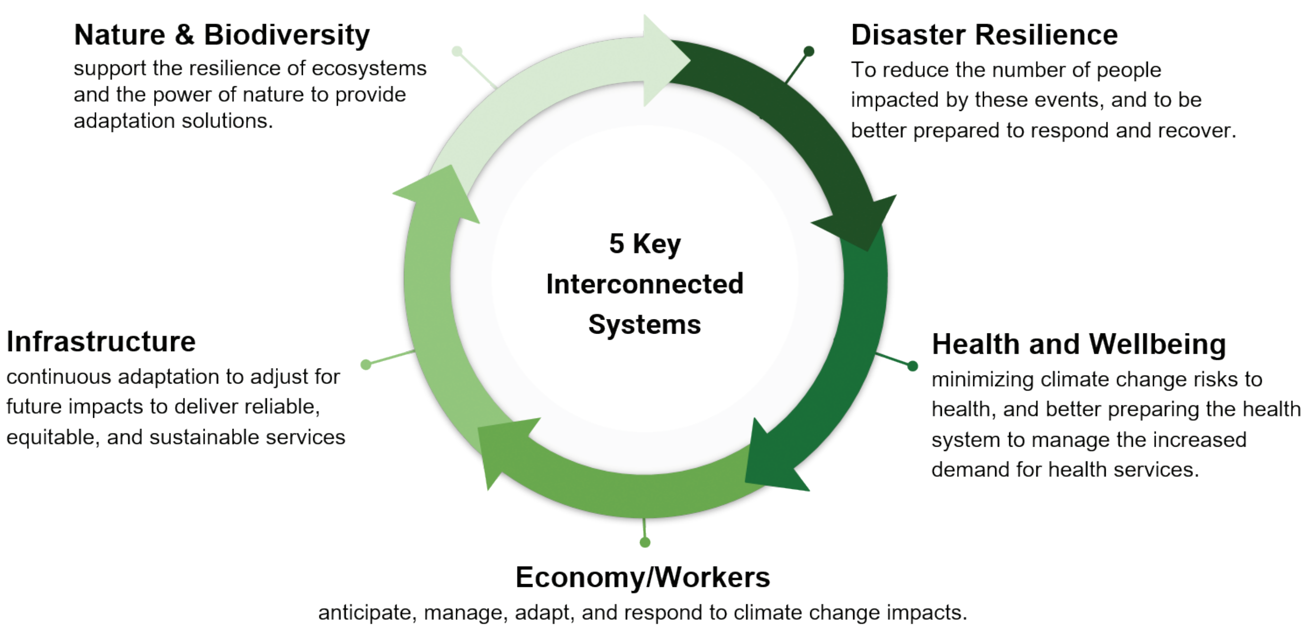


Figure 1: The key systems highlighted in the National Adaptation Strategy (adapted from Government of Canada, 2023).

Throughout the farmer and stakeholder engagement process for this Plan, discussions on impact and adaptation cut across these five key systems. This is reflected in the Plan's sectoral actions and aligns with adaptation work at the national level.

The Provincial Government released the Prince Edward Island Climate Change Risk Assessment in 2021. It assessed potential climate change impacts, scored the risk these impacts posed, and outlined examples of potential consequences for the agriculture sector (see Table 1).

Table 1: The seven climate change impacts identified in the provincial climate change risk assessment, their risk to agriculture, and examples of potential consequences. Consequence ratings are: 1 - Insignificant, 2 - Minor, 3 - Moderate, 4 - Major, and 5 - Catastrophic. ((Data from ICF and Shared Value Solutions, 2021)

Climate Change Impacts	Consequence Rating for Agriculture	Examples of Potential Consequences
Coastal Erosion	2	Agricultural lands nearest to the shoreline may be at risk of losing farmland and suffering from saltwater intrusion
Post-Tropical Storms	4	Reduced yield of crops that are particularly sensitive to wind damage
Heat Wave	3	Heat stress may affect poultry, livestock, worker productivity, and potato yield.
Heavy Precipitation and Inland Flooding	4	Freshwater fish kills resulting from pesticide runoff, washouts and damage to agricultural crops
Severe Ice Storm/Freezing Rain	2	Extreme cold and ice conditions can negatively affect livestock, perennial crops, and forage crops.
Earlier Warmer Springs	3	Earlier and extended growing and harvest season.
Seasonal Drought	4	Potatoes and other water-sensitive crops may face impacts of drought.

In the following year, the Province released the Building Resilience: Climate Adaptation Plan (2022). Its key actions include partnering with industry to respond to climate risks of the agriculture sector and conducting a regional supply chain resilience study.

At the Provincial level, there is a growing recognition that responses to climate and non-climate risks can work together. For example, the province implemented a new Agricultural Resiliency Program that addresses Extreme Weather Preparedness, Resilience Research, and Producer Wellness. Actions that reduce both climate and non-climate risks appeal to farmers because adaptation can help drive the solutions to a wide range of issues, rather than become yet another pressure and responsibility that is downloaded to farms.

Throughout the farmer and stakeholder engagement process for this Plan, discussions on risks and adaptation cut across climate and non-climate themes. This is reflected in the Plan's sectoral actions and aligns with adaptation work at the provincial level.

Laying the Foundation

Although this Plan only covers key activities for the next five years, it builds the foundation for long-term adaptation by:

- Supporting field-level adaptation for all commodity groups;
- Pooling together resources, experiences, and knowledge across commodity groups;
- Bringing together different stakeholders to discuss shared and unique challenges and opportunities; and,
- Identifying sector-level actions that support adaptation work across all commodity groups.

A strong foundation for the sector needs clear steps that connect immediate pressures that hinder adaptation, current climate risks, long-term climate risks, and increasingly complex adaptation needs into the future. These paths forward, sometimes called "adaptation pathways," usually consist of simpler adaptation actions in the short-term and more comprehensive actions in the medium- and long-term to meet greater adaptation needs in the future.

Farmers and sector stakeholders identified short- and medium-term climate risks, adaptation needs, and barriers to adaptation. They also explored what future adaptation pathways become possible for the sector if key sectoral activities are implemented.

Farmer and Stakeholder Engagement

Various engagement sessions were held throughout the development of this Plan. These sessions were often farmer-led. They involved co-creation with others working in the agricultural sector, such as commodity boards, provincial government staff, and other stakeholders working in climate adaptation. The engagement process was iterative, with four rounds of engagement sessions held to share the input gathered and the progression of the Plan.

The first round of engagement took place in Charlottetown from July to September, 2023. Since this was taking place during the growing season, it was originally intended for "non-producers" in the agricultural sector (e.g. members of commodity boards). Since many producers also fill those roles, the sessions ended up being producer-led. These sessions were held based on commodity groups, to understand their unique needs. The groupings were: beef, perennials, dairy and eggs, open/multi-commodity, livestock, cereals and grains, and potatoes. There was also one session for external stakeholders. The outcomes of these sessions included an understanding of different risks facing each commodity, responses to address the risks, strengths and weaknesses of each commodity and the agriculture sector, and the future opportunities that become possible if adaptation responses are successfully implemented. See Appendix A for workshop questions and templates.

The second round of engagement took place in December, 2023. It was intended for farmers only and the sessions were held based on geography to encourage producers from different commodity groups to participate together. The sessions were held in Fortune, Georgetown, Hunter River, O'Leary, and Linkletter. The outcomes of these sessions included sharing an overview of the input gathered during the first round of engagement, discussing if the Plan is on the right track, highlighting what needs to be in place for it to be successful, and identifying constraints the Plan should address.

The third round of engagement took place at PEIFA's Climate Action Day in March, 2024. All participants and stakeholders were invited to attend. The event included various climate topics such as the PEIFA Climate Change Mitigation Project, On-Farm Climate Action Fund 2024 Launch, an address by the Minister of Agriculture, and talks from the PEI Department of Agriculture, East Prince Agri-Environment Association, and UPEI's Climate Smart Research. Then, attendees were divided into smaller groups to review and rank the adaptation responses suggested during the first two rounds of engagement sessions. The outcomes of the session were sharing highest ranked risk themes (severity by likelihood), assigning urgency and feasibility ratings to adaptation responses, and receiving preliminary input on information such as leads, collaborators, costs, etc.

The final round of engagement took place from October to November, 2024. The draft sectoral actions and on-farm actions were shared with commodity groups, interested farmers, and stakeholders. Their feedback was incorporated into the Plan.

What we Heard

Risks

Input on risks were collected from different groups throughout the engagement process. Producers and stakeholders identified the risks, categorized their “likelihood” of occurrence as low, medium, and high, and categorized the “consequences” they cause as low, medium, and high. The project team reviewed this data and three things became clear.

- First, different groups perceived the same risks differently. For example, drought-like periods affect some commodities more than others, affecting how often they perceive these periods happen and the severity of the consequences.
- Second, many of the risks were rated as “high likelihood” and “high consequence,” which makes teasing out the higher priority risks more difficult.
- Third, recent weather events appear to influence the rating of some climate change impacts. For example, extreme storm events have, by definition, a low likelihood of occurrence. Given recent destructive storms, however, these were often rated as “high likelihood.” As a result, the project team made some adjustments to the ranking to utilize available climate modelling data and added more categories to help tease out higher priority risks. The team used five categories each for likelihood and consequence and assigned a score: very low -1, low - 2, medium - 3, high - 4, extreme high - 5.

A total of 144 risks were identified through the engagement sessions. The project team grouped these risks into 17 risk themes (see Table 3). Each risk was given a “risk score” by multiplying the core for its likelihood by the score for its consequence. For example, forest fires were deemed to be low likelihood (score: 2) and medium consequence (score: 3). This gives forest fires a risk score of 6. Then, the risk scores within each risk theme were combined (see Table 3).

TABLE 3: THE NUMBER OF RISKS, NUMBER OF RESPONSES TO THE RISKS, AND TOTAL RISK SCORE FOR EACH OF THE 17 RISK THEMES.

Risk Theme	Risks identified	Responses identified	Total Risk Score
Cost & Finance	19	41	267
High Temperatures	19	11	216
Labour	14	40	126
Moisture & Rain	13	10	144
Policy & Regulation	13	22	131
Variable Weather	11	6	128
Ag Infrastructure	9	14	97
Land	8	9	112
Disease & Pest	8	2	93
Extreme Weather	6	7	60
Drought	5	8	48
Non Ag Infrastructure	4	3	48
Risk Management	4	3	40
Perception & Support	4	6	39
Market Conditions	4	7	35
Supply Chain	2	6	8
Biodiversity	1	11	16

Adaptation Responses

To address the 144 risks, producers and stakeholders also identified 120 unique adaptation responses. Some of these responses can address risks in two or more risk themes. For example, improving animal genetics to handle extreme heat, feed efficiency, and water efficiency helps to reduce risks in three risk themes: high temperature, drought, and costs and finances. After allowing for duplications so the responses can be sorted by risk themes, there were a total of 206 responses. During the engagement sessions, more responses were identified for non-climate risks than climate risks, although this is not the case for all commodity groups (see Figures 2 and 3). This Plan offers additional adaptation responses to climate risks based on existing research (see Section: On-Farm Actions).

"**Cost & Finances**" and "**Labour**" scored highest on business and social risk.
"**High Temperatures**" and "**Moisture & Rain**" scored highest on climate and agronomic risk.

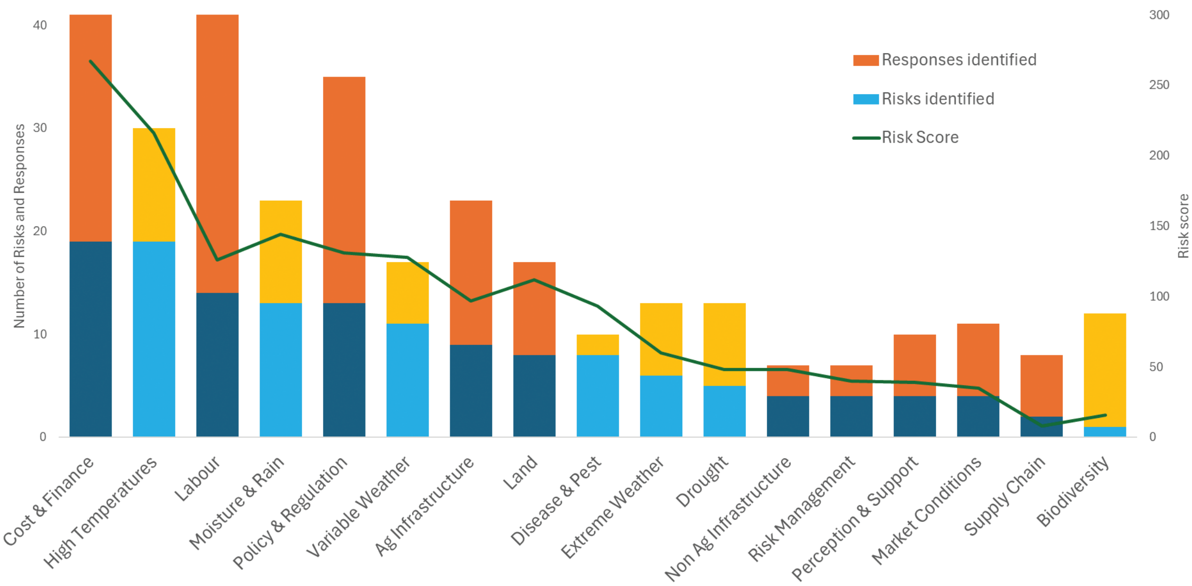


Figure 2: The number of risks and responses identified for each risk theme. The dark blue bars represent non-climate risks and the light blue bars represent climate risks. The dark orange bars represent responses for non-climate risks and the light orange bars represent responses for climate risks. The green line graph represents the total risk score for each risk theme.

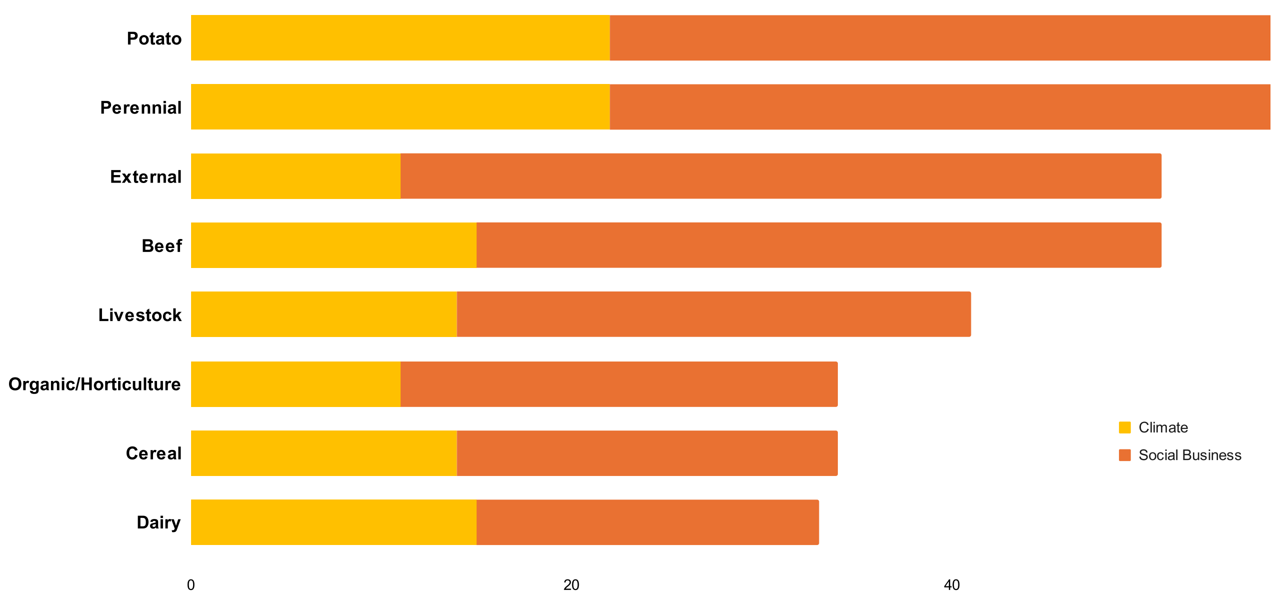


Figure 3: Split of responses to climate and non-climate risks, by commodity group. 35% of responses addressed climate risks and 65% of responses addressed social and business risks.

Looking Ahead

It became clear that there will be larger, more complex adaptation actions involving more partners and commodity groups required in the future. Therefore, actions that “make future adaptation more possible” generated significant interest. Three long-term approaches were often mentioned at the engagement sessions.

Multi-farm Diversification

Historically, PEI farms were mixed-use production systems. Over time, increased mechanization and larger farm sizes saw a shift to monoculture cropping systems. Even so, collaboration with neighbouring farms and diversification at the farm level has been common practice within the sector for many years. There continues to be interest in exploring new ways for multiple farms across different commodities to work together to lower climate and non-climate risks. Outcomes such as improved soil health, increased biodiversity, shared land costs, dispersed climate risks, and increased crop and livestock health, productivity, and profitability were mentioned.

Shared services and capacity

At every engagement session, the lack of time and finances came up as the biggest barriers to adaptation at the farm level. Operational challenges take up so much attention that proactive adaptation planning becomes a luxury. One way to meet these challenges while increasing adaptation capacity is by sharing services. Due to their farm size, commodity-specific realities, and other factors, many farms cannot afford their own agronomist, bookkeeper, and additional help to take on some of the business, operational, and planning responsibilities of their farms. If shared services among 5 to 10 farms were available, it would make the services more affordable for individual farms and take away the burden of recruitment and retention. Farmers are confident in their ability to reduce climate risks. They need help freeing up time and resources to do it well.

Mentorship and Knowledge Transfer

Farmers connect with each other through different networks, sharing information and ideas, helping one another, collaborating on projects, connecting to researchers, and more. These networks rely on the decades-long experience of the farmers. As these networks adapt, grow, or shrink over time, communications and knowledge transfer channels also change. For smaller commodity groups, young farmers, new entrants to the agriculture sector, and others without established networks to rely on, meeting current production challenges and adapting to a changing climate become much more difficult. There is an opportunity to provide support to these networks, by offering on-farm income to experienced farmers who are interested in mentoring others. Over time, this could improve knowledge sharing, peer-to-peer learning, access to research opportunities, and access to support for adaptation.

Sectoral Actions

The engagement sessions brought forward many ideas at the field-, farm-, commodity-, and sector-level. The eight sectoral actions below were chosen using the following criteria:

- The action benefits multiple commodity groups;
- The action supports field-, farm-, and commodity-level adaptation;
- The action does not compete with existing efforts and programs;
- The action was identified as (very) urgent and (very) feasible;
- The action could be implemented within a five-year timeframe;
- The action makes future adaptation actions more possible;
- The action supports overall sectoral resilience goals of systems-based production, sharing of services and capacity, and mentorship and knowledge transfer; and
- Collectively, the actions cover the identified climate and non-climate risk themes.

For each action, key activities for the next five years are outlined. The leads and collaborators listed below were identified in the engagement process but the organizations may not have necessarily committed to the activities (see Next Steps). These actions and activities captured what the farmers and stakeholders shared during the engagement process but they may evolve when they are implemented.

Action 1: Establish Producer Clubs

Desired Outcomes

Producer clubs were often suggested as an approach to address the lack of resources, improve knowledge sharing, and increase collaboration and capacity required for successful adaptation.

There were different types of producers clubs in the past, but most have dissolved. Collaboration and connection now commonly take place through commodity boards and agri-environmental groups. The provincial government used to have staffed regional extension offices where producers would connect with each other and receive extension support but those have also been dissolved.

Many farmers engaged in this process want to see the return of producer clubs and regional extension services to build relationships across commodity groups, share ideas and information, gain knowledge from mentors, and access research findings. These will help build confidence in designing and implementing adaptation actions by learning from each other's experiences, especially when adopting new practices and production systems. Since geography-based clubs provide opportunities for farmers to gather in-person, they can also serve as delivery sites for services such as agronomy support, adaptation planning, and adaptation funding application support. Farmers suggested that clubs could start by providing a needed service, such as emergency management planning sessions, or agronomists holding a talk on a specific subject.

Climate Risks

Establishing producer clubs address climate risks through the three key activities: peer-to-peer learning and mentorship, shared agronomy capacity, and system-based production through relationship building.

Peer-to-peer learning and mentorship will support the sharing and adoption of best management practices, including those that build climate resilience. Having more information about what worked well and unexpected challenges in a hyper-localized context will reduce the risk of adoption, lowering the barrier to adaptation.

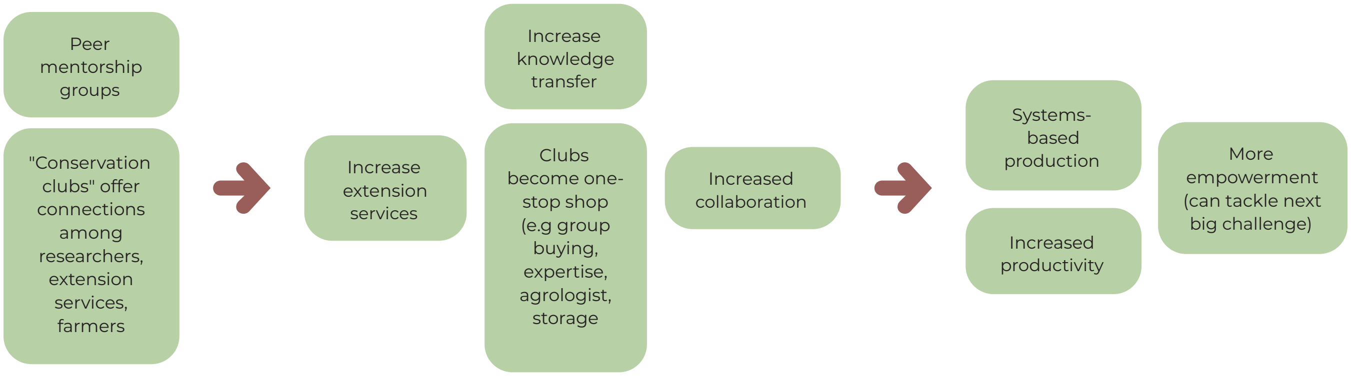
Shared agronomy capacity makes it easier and more affordable for producers to access direct, independent advice for production under a changing climate, such as the selection of varieties, crops, and management practices to increase heat resistance, improve drought tolerance, address increasing pest pressures, and more.

Geography-based, multi-commodity producer clubs also support system-based production through relationship building. By co-creating opportunities to trial new mixed-agricultural land use, such as cattle grazing on fields used for potato production, improvements in soil health, reduction in land costs, increases in profitability, and resilience through redundancies and diversification become possible.

Future Opportunities

In the near-term, increased productivity and profitability through improved knowledge transfer, better access to extension services, and enhanced collaboration become possible. Over time, producers are expected to feel more empowered to take on more challenging adaptation projects as climate change impacts increase in severity and complexity. Producer clubs will also help to expand systems-based production. By building strong networks across commodity groups, innovations and collaboration can take adaptation to new heights that would be impossible for a single farm or single commodity to envision and implement.

FIGURE 4: SAMPLE PATHWAY HIGHLIGHTING HOW ESTABLISHING PRODUCER CLUBS MEETS CURRENT NEEDS AND MAKES FUTURE OPPORTUNITIES POSSIBLE.



Key Activity 1.1 Peer-to-peer learning and mentorship opportunities

Peer-to-peer learning of emerging practices is critical for adaptation in agriculture. Mentorship within the sector will support producers in considering new practices, preparing for transition challenges, and executing adaptation projects from leaders and innovators who have insights and results to share from their adaptation work. Creating opportunities for interested mentors to share their knowledge and experiences will improve knowledge transfer.

Leads: PEI Soil and Crop Improvement Association, PEI Institute of Agrologists

Collaborators: Key mentors, Young Farmers of PEI, commodity associations, Farmers for Climate Solutions

Considerations: Start the club with 1-2 clear goals to highlight farmers' needs, sharpen focus, and generate buy-in. Part-time administrative support will be required to create, grow, and sustain the clubs. Smaller commodities (e.g. blueberry, beekeepers) need to feel represented in the groups.

Startup costs: Stipend for mentor, travel, meeting place

Ongoing costs: Part-time administrative staff

Measures of success:

- Number of active producer clubs
- Number of active mentors
- Number of farmers within each producer club
- Number of farms participating
- Number of peer-to-peer learning and mentoring events

Key Activity 1.2 Shared agronomy capacity

Agronomy capacity will support producers in meeting production challenges arising from current and future climate change impacts. It is difficult to recruit and retain part-time agronomy capacity at the farm-level. By sharing this capacity at the producer club level to offer an agronomist a full-time position, recruitment, retention, and use of this capacity will be more efficient and effective.

Leads: Mentor from Activity 1.1

Collaborators: Farmers sharing agronomist (producer clubs/cooperatives)

Data required: Agronomy needs of producer clubs for current and future production challenges

Considerations: Agronomists must have knowledge and experience in different crop and production types to meet the needs of all members within the producer clubs.

Startup costs: Recruitment costs

Ongoing costs: Shared cost for agronomists hired

Measures of success:

- Percentage of producer clubs with a shared agronomist
- Number of farms benefitting from agronomist

Key Activity 1.3 Support systems-based production via relationship building

There are increasing examples of mixed uses of agricultural land to support soil health, reduce land costs, and diversify operations. Systems-based production is continuing to gain interest among farmers. Since established farmers are likely to remain experts within their current commodities and practices, connecting with other farmers looking to collaborate across commodity groups and production methods will be essential to identify new opportunities to expand systems-based production and benefit additional farms.

Leads: Mentor from Activity 1.1

Collaborators: Farmers

Data required: Baseline production, soil data (before trying mixed use)

Considerations: Clubs could share a summer student (soil testing). Composition of collaborators requires care (e.g., want to avoid grouping direct competitors such as highbush versus lowbush blueberry producers).

Measures of success:

- Number of new clusters of systems-based collaborators
- Number of clusters expanding their diversification
- Number of commodity groups within each cluster
- Number of farms participating in a cluster
- Number and type of activities undertaken to achieve common goals

Action 2: Support Co-Operatives

Desired Outcomes

Developing and supporting cooperatives that provide specific, shared services was frequently suggested to address the lack of labour and capacity required for successful adaptation. This applies to general labour, skilled labour, and administrative capacity (e.g. bookkeeping, funding applications support) at the farm- and sectoral- levels.

Currently, shared services are more commonly provided by commodity groups, such as bulk purchasing, research support, and administrative support. Informally, some farms are already experimenting with shared services. For example, blueberry and potato farms have different labour workloads at different times of the season and have come together to provide longer work terms for seasonal employees.

Many farmers were interested in new cooperatives being formed to provide additional shared services. These could include multiple commodity groups, depending on the service. The services could support on-farm adaptation in several ways. First, they could help recruit the additional labour required to execute adaptation activities at the field level. Second, bulk purchasing of supplies and equipment necessary to execute adaptation activities at the field level will improve the business case for adaptation. Third, extra administrative capacity could improve access to adaptation funding programs by supporting the application process. Fourth, taking the time burden of sourcing lower prices, recruiting staff, and finding additional capacity away from farmers leaves more time for them to experiment with new adaptation practices and proactive adaptation planning.

Climate Risks

Supporting cooperatives address climate risks through the three key activities: shared administrative staff, shared temporary foreign workers support, and shared bookkeeping services.

Shared administrative staff could help address multiple climate risks, depending on the duties they are responsible for. For example, they could help identify adaptation funding opportunities, complete funding applications, and coordinate “demo days” for adaptation trials. They would also provide capacity in addressing short-term, in-season challenges so producers could have more time and energy to focus on longer planning activities such as climate change adaptation and relationship building to expand systems-based production.

Shared temporary foreign workers across commodity groups could help with recruitment and retention for producers and longer work terms for workers. Not only is this capacity needed to meet current production needs, it is likely to become more important when production challenges become more complex and on-farm adaptation initiatives begin in earnest across the sector. Furthermore, maintaining extra labour capacity on the island will support field activities, such as harvesting. As extreme weather events complicate and shorten the window for harvesting, more labour capacity is needed to avoid significant, preventable yield losses.

Bookkeeping and record keeping support is necessary to support a producer’s ability to plan, forecast, and understand adaptation potential and limitations. For example, a better understanding of cash flow, productivity outlook, and the cost and benefits of adaptation will support better adaptation decision-making.

Future Opportunities

In the near-term, increased productivity and better adaptation planning through additional capacity provided by cooperatives become possible. Over time, this is expected to open up better options and increase farm profitability. This will put farms in a better position to take on the next big challenge as climate change impacts increase in severity and complexity. By sharing services and capacities through cooperatives, farmers will have more time and a larger team to support on-farm adaptation actions.

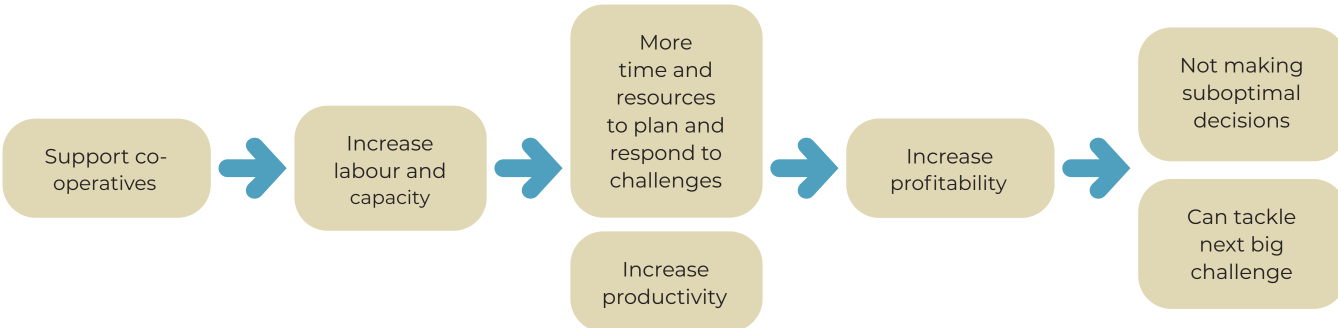


FIGURE 5: SAMPLE PATHWAY HIGHLIGHTING HOW SUPPORTING COOPERATIVES MEETS CURRENT NEEDS AND MAKES FUTURE OPPORTUNITIES POSSIBLE.

Key Activity 2.1 Shared administrative staff

The lack of administrative capacity on farms adds stress, reduces efficiency, and hinders proactive planning. Having shared capacity supports bulk purchases of inputs and equipment, application submissions, sales and marketing activities, event organization, communications with partners and stakeholders, and relationship building for other collaborations.

Collaborators: Participating farmers

Data required: Bulk versus retail cost comparisons

Considerations: Admin person from Activity 2.1 has to be in place in order to support Activities 2.2 and 2.3.

Startup costs: Recruitment costs

Ongoing costs: Staff salary, travel

Measures of success:

- Number of staff positions filled
- Number of farms supported
- Level of farmer satisfaction
- Money saved from bulk purchases
- Number of funding applications supported

Key Activity 2.2 Shared temporary foreign workers support

There have been isolated cases of farms sharing temporary foreign workers to provide extended employment terms for workers and share overhead costs. Administrative capacity is required to match participating farms, ensure all farms meet the necessary criteria, and submit a shared application.

Leads: Administrative staff (see Activity 2.1)

Collaborators: Participating farmers

Startup costs: See Activity 2.1, recruitment costs

Ongoing costs: Administrative costs

Measures of success:

- Number of farms shared temporary foreign workers are supporting
- Number of days worked per temporary foreign worker, per season
- Costs saved from sharing infrastructure such as housing support
- Impact on adaptation implementation

Key Activity 2.3 Shared bookkeeping services

Limited labour availability is impacting administrative duties, not only field operations. The lack of bookkeeping support affects business and adaptation planning. Recruiting and sharing agriculture bookkeeping capacity across farms would enable sustainable adaptation expenditures and investments.

Leads: Administrative staff (see Activity 2.1)

Collaborators: Participating farmers, Holland College, participating bookkeepers (existing small enterprises working within the farm community)

Startup costs: See Activity 2.1, recruitment costs

Ongoing costs: Shared bookkeeper cost

Measures of success:

- Number of farms supported
- Impact on profitability, business planning, and adaptation planning

Action 3: Improve Soil Health

Desired Outcomes

Although there are a variety of soil health projects and activities that have been taking place on Prince Edward Island, improving soil health was identified as an ongoing sector-level priority and action to help producers adapt to climate change.

At the farm-level, soil health projects include long-term monitoring, constructing soil erosion control structures, trialing and comparing different management practices, implementing BMPs to reduce soil and nutrient loss, and putting improvement plans in place. At the sector-level, initiatives include increasing laboratory capacity for soil testing and creating new greenhouse gas sequestration measurement protocols.

Producers identified different opportunities to further support improving soil health at the sector-level by developing data infrastructure, sharing knowledge, and increasing the availability and use of manure. Consolidating data to increase support soil health initiatives, hearing from each other on successes and lessons, and having more access to manure were listed as activities that would support healthier, more biologically active soils on farms at a larger scale. Having access to data, information, and manure were seen as foundational components to supporting ongoing improvements in soil health, adaptation, and systems-based production.

Climate Risks

Improving soil health is a key adaptation action for multiple climate risks, including soil erosion and compaction from heaving rain events, reduced yields during drought-like periods, reduced biodiversity, and increased pest pressures. This plan addresses soil health through the three key activities: develop a consolidated database of soil health data, share knowledge, and increase the availability and use of manure.

Developing a consolidated database of soil health data enables farmers, researchers, and extension service providers to analyze the data across farms and projects at a larger scale. This helps the sector explore which beneficial management practices improve soil health the most and which ones need more work. Any similarities and differences based on farm size, geographic location, and other features can inform future practices and trials.

Sharing knowledge, experiences, and outcomes of trials and practices supports better decision-making. Sharing and discussion of results, challenges, and successes among participating and non-participant farmers helps to make adaptation knowledge more widespread. It also supports uptake and expansion of soil health initiatives, and enables continuous and collective innovation in adaptation.

Increasing the availability and use of manure increases access to a locally-produced fertilizer that adds nutrients, enhances biological activity, and increases organic carbon within the soil. This helps to improve the structure and water holding capacity of the soil, which supports drought and water management.

Future Opportunities

Improving soil health increases crop health, decreases pest pressures, and reduces the long-term effects of run-off and compaction. Healthier soils reduce the use of inputs and increase farm profitability. Healthier soils are also more resilient to both drought and intense rainfall events, increasing the farm's resilience to climate change impacts. Over time, this is expected to open up better options and increase farm profitability, which will put farms in a better position to take on the next big challenge as climate change impacts increase in severity and complexity. Supporting soil health at the sectoral level also encourages expansion of system-based production and increases farm sustainability from a financial, environmental, and climate perspective.

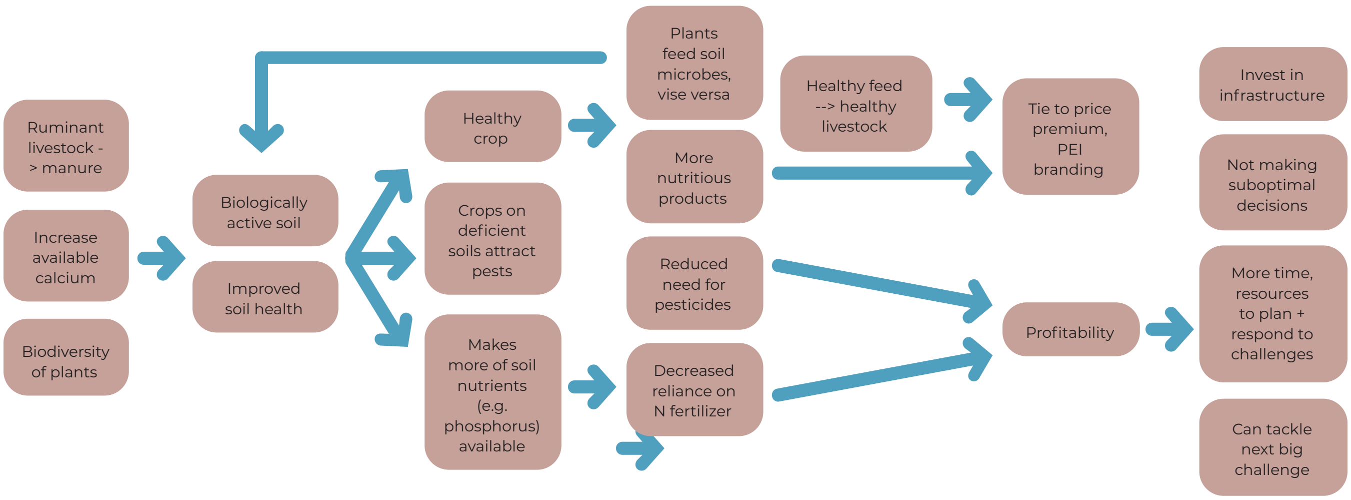


FIGURE 6: SAMPLE PATHWAY HIGHLIGHTING HOW IMPROVING SOIL HEALTH MEETS CURRENT NEEDS AND MAKES FUTURE OPPORTUNITIES POSSIBLE.

Key Activity 3.1 Develop Consolidated database of soil health data

Soil health data is generated by farmers, researchers, project partners, and third-party service providers. Bringing together soil health data will improve the sector's understanding of which best management practices contribute most to soil health, and which need more work. It enables farmers, researchers, and extension service providers to analyze the data across farms and projects at a larger scale.

Lead: PEI Federation of Agriculture (PEIFA)

Collaborators: Participating farmers, Government of PEI, Agriculture & Agri-Food Canada (AAFC), University of PEI (UPEI), third-party service providers

Data required: Baseline carbon sequestration data, existing soil health data

Considerations: The data must be owned/controlled by producers and follow a standardized format. Administrative help to upload the data will be needed.

Startup costs: Database creation

Ongoing costs: Database maintenance, administrative support

Measures of success:
- Number of farms with data in database
- Number of times dataset is used
- Number of new datasets uploaded
- Number of farms using data to create nutrient management plans
- Number of farms using data to create soil health improvement plans

Key Activity 3.2 Share knowledge

There is a wide variety of soil health projects across the province. Sharing the lessons and successes with farmers across all commodities is important in building resilience for the sector. By improving communication and sharing of findings and experiences across farms large and small, the selection and adoption of new management practices that best fit each farm's situation will be easier. Not only will widespread adoption address multiple climate risks at the sectoral level, it also enables continuous, collective innovations and advancements.

Collaborators: Participating farmers, PEI Soil and Crop Improvement Association, PEI Institute of Agrologists, Government of PEI, East Prince Agri-Environmental Association, Holland College, UPEI, Dalhousie University Agricultural Campus, PEIFA, PEI Potato Board, Atlantic Grains Council

Data required: Project details such as trial information and outcomes

Considerations: Farmers and users will require training on how to use the data to improve management and profitability. For example, using trusted mentors to showcase results.

Startup costs: Content creation

Ongoing costs: Content sharing, mentor stipends

Measures of success:

- Number of farms integrating soil health improvement practices into nutrient management plans
- Number of farms adopting BMPs for soil health

Key Activity 3.3 Increase access to manure

The use of manure adds nutrients, enhances biological activity, and increases organic carbon within the soil. This helps to improve the structure and water holding capacity of the soil, which supports drought and water management. However, the comparatively small size of the livestock sector limits the availability and use of manure by the cropping sector. Access to manure varies across the province.

Collaborators: Livestock producers, Government of PEI

Considerations: Current profitability margins make growing herds difficult but there are existing strategies and programs to support this. Access to manure varies across the province. Access to shade structures for livestock will increase with warming temperatures and use of system-based production (e.g., livestock grazing on rotational crops).

Measures of success:

- Number of farms raising livestock
- Number of livestock on PEI
- Total amount of manure produced
- Amount of local manure used off-farm
- Number of fields receiving manure applications (and frequency)

Action 4: Enlarge and Upskill Workforce

Desired Outcomes

Enlarging the workforce by recruiting more on- and off-farm employees and professionals to the sector and enhancing the skills of the current workforce to meet the complexity of farming under a changing climate were often suggested as key ways to grow the workforce and capacity to adapt. This limitation has been identified as a barrier to adaptation and a general risk to the sector.

There are numerous upskilling programs already offered, including microcredentials through Holland College, AGRI Skills through Canadian Agricultural Human Resource Council, Class 3A and forklift training through PEI Agriculture Sector Council, and more. The need to enlarge and upskill labour remains for both on- and off-farm knowledge and skill areas as well as disciplines that directly and indirectly support the agriculture sector.

Many farmers see enlarging and upskilling the workforce as a risk reduction response to address current and future challenges under a changing climate. Upskilling employees and professionals to incorporate adaptation into their day-to-day work will greatly enhance the sector's adaptation capacity. Attracting and "ag-skilling" more employees and professionals to the sector allows more complex issues with multiple climate and non-climate risks interaction to be tackled from a broader knowledge base.

Climate Risks

Recruiting off-farm students and professionals, expanding existing upskilling and ag-skilling initiatives, and increasing agronomy capacity will help build the capacity needed to address current and future adaptation challenges.

Recruiting off-farm students and professionals across multiple disciplines will support different aspects of adaptation planning and action. For example, precision agriculture will become more important in meeting crop needs, as crops will face increasing heat stress, drought stress, water stress, pest pressures, and more. These pressures will have different effects, based on the field or areas of the field. Students and professionals skilled in information technology, computer programming, data analysis, engineering, and more will be needed to support producers in technology adoption.

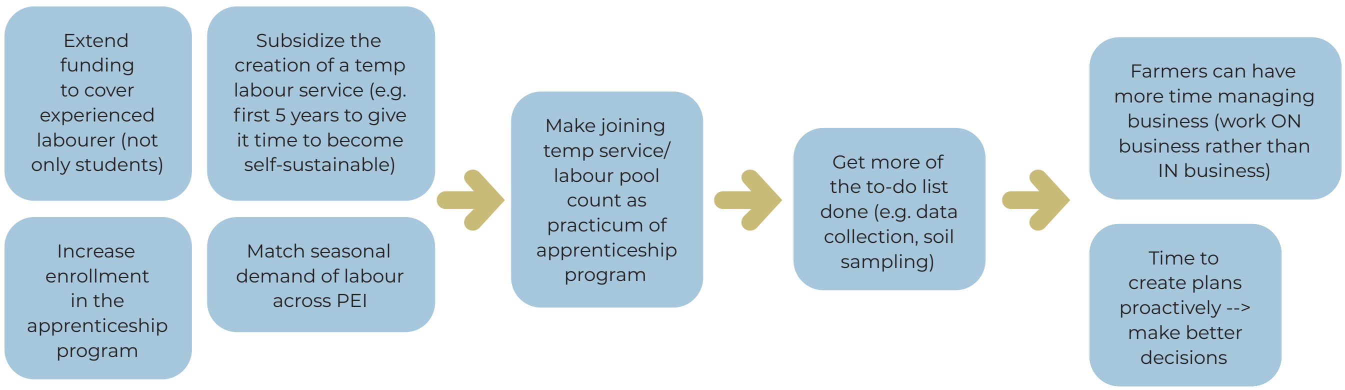
"Ag-skilling" programs will help the newly attracted students and professionals understand the needs of the sector. Upskilling the current workforce to choose, design, and implement on-farm adaptation actions will support farm resilience under a changing climate. Enlarging and training the workforce overall will help alleviate pinch points. For example, extreme events and unfavourable weather conditions often shorten the harvesting window, increasing the likelihood of crop losses if they remain unharvested. With additional capacity, farms can implement adaptation actions to shift or lengthen the window while improving their ability to increase harvesting activities during that window.

Increasing agronomic capacity will provide extra capacity to design and implement adaptation measures on farms, and will help address multiple risks, including moisture and rain, extreme weather, variable weather, drought, high temperatures, and pests and diseases. For example, based on advice from an agronomist, a farmer may trial new crop varieties that can tolerate higher temperatures, adjust nutrient input to minimize losses due to runoff to protect water quality and maximize profitability, and adopt new beneficial management practices to address increasing pest pressures.

Future Opportunities

In the near-term, recruiting more people to the sector and training the existing workforce can support activities such as soil sampling, data collection, establishing trials, and other components of adaptation actions. With better information and capacity to act, more comprehensive adaptation planning and implementation becomes possible, especially with multi-disciplinary support from additional agronomists and off-farm professionals. Over time, this is expected to integrate adaptation planning into business planning and improve proactive decision-making.

FIGURE 7: SAMPLE PATHWAY HIGHLIGHTING HOW ENLARGING AND UPSKILLING THE SECTOR'S WORKFORCE MEETS CURRENT NEEDS AND MAKES FUTURE OPPORTUNITIES POSSIBLE.



Key Activity 4.1 Recruit off-farm students and professionals

While many adaptation actions in the sector require on-farm experience and knowledge of agronomy and animal health, there are significant underlying off-farm needs. From business planning to computer science, communications, environmental stewardship, mechanics, and more, many areas of skills and expertise are needed to support on farm adaptation and resilience.

Leads: PEI Agriculture Sector Council

Collaborators: Holland College, UPEI, commodity boards

Considerations: Connect students, adaptation practitioners, project managers, and other professionals to off-farm opportunities in agriculture. Centralized recruitment efforts may be more effective and efficient. Wages, salaries, and benefits would need to be competitive.

Measures of success:

- % of unfilled off-farm job ads
- Number of off-farm employees in sector
- Number of farms supported by recruited off-farm students and professionals
- Number of commodities supported by recruited off-farm students and professionals

Key Activity 4.2 Expand upskilling and “ag-skilling” programs

Upskilling the sector to support on-farm and sectoral adaptation actions will support their likelihood of sustained success. Similarly, the successful recruitment of off-farm students and professionals (Key Activity #4.1) should be supplemented by “ag-skilling” to support their understanding of sectoral needs and contexts.

Leads: PEI Agriculture Sector Council, SkillsPEI

Collaborators: Holland College, Canadian Agricultural Human Resource Council, equipment suppliers, commodity boards

Considerations: Temporary labour support may be required for smaller farms to send employees to take training opportunities. Intentional connections between upskilling and “ag-skilling” programs and adaptation needs must be made. Training needs arising from implementation of other sectoral actions and key activities need to be communicated to this key activity’s leads and collaborators. Wages, salaries, and benefits would need to be competitive.

Measures of success:

- Number of current farm employees taking upskilling programs
- Number of prospective employees taking upskilling programs
- Number of current off-farm employees taking “ag-skilling” programs
- Number of prospective off-farm employees taking “ag-skilling” programs
- Number of farms participating in upskilling programs
- Number of farms supported by participants taking “ag-skilling” programs
- Number of key activities supported by upskilling programs
- Number of key activities supported by “ag-skilling” programs

Key Activity 4.3 Increase agronomy capacity

Agronomy expertise can support farms in addressing current production challenges, planning for future climate, and designing and implementing adaptation measures such as adjusting on-farm practices, trialing new varieties, and more.

Leads: PEI Institute of Agrologists, Certified Crop Advisors, producer clubs/co-operatives

Collaborators: Dalhousie Agricultural Campus

Considerations: Centralized recruitment efforts may be more effective and efficient.

Measures of success:

- Number of agronomists supporting producers directly
- Number of farms benefiting from increased agronomy capacity
- Number of commodities benefiting from increased agronomy capacity

Action 5: Apply and Demonstrate Industry-led Research

Desired Outcomes

The need to add value to ongoing field-level research by expanding knowledge translation, field demonstrations, and research application were identified by producers as ways to improve industry's capacity to meet adaptation challenges in evidence-based and innovative ways.

Although there are many research projects taking place on farms across PEI, their benefits could expand to the broader sector if supplemental capacity were available. Currently, research trials are more common in larger commodities. They tend to have research administration capacity to help coordinate activities between producers and researchers. Otherwise, participation in trials tends to rely on individual farms' existing relationships with researchers and funders, if any.

Producers are interested in accessing the findings of others' research trials, accessing capacity to implement similar practices on their own farms, and seeing applied research create and validate new adaptation approaches.

Climate Risks

Applying and demonstrating industry-led research addresses climate risks through three key activities: supporting expansion of successful trials, connecting research to extension services, and innovating continuously and responsively.

The expansion of successful trials will increase the reach of new, validated adaptation practices to farms that did not have the opportunities to participate in direct research. Adaptation practices include mitigation of runoff during heavy rain events, crop resilience during heat waves and drought-like periods, supporting biodiversity, and managing increased pest and disease pressures.

Connecting researchers to extension services would shift promising adaptation practices at the research- and field-level to production- and farm-level across the province. Rather than halt the innovation process at field-trials, supporting broad adoption of evidence-based adaptation practices through extensions services will leverage the impact of successful research.

Innovating continuously and responsively will be necessary to meet the challenges posed by increasingly complex and severe climate change impacts. They will eventually overwhelm current adaptation responses, requiring ongoing trialing and adoption of new practices. Furthermore, unexpected interactions among climate and non-climate impacts may arise, so a responsive innovation process is required to continue to meet the needs of producers.

Future Opportunities

In the near term, improved capacity in the application and demonstration of industry-led research is expected to increase access to technical adaptation experts that are relevant to the contexts and needs of producers. Over time, farmers, researchers, and extension service providers will strengthen their relationships to enable them to pursue relevant and innovative adaptation research and practices collaboratively.

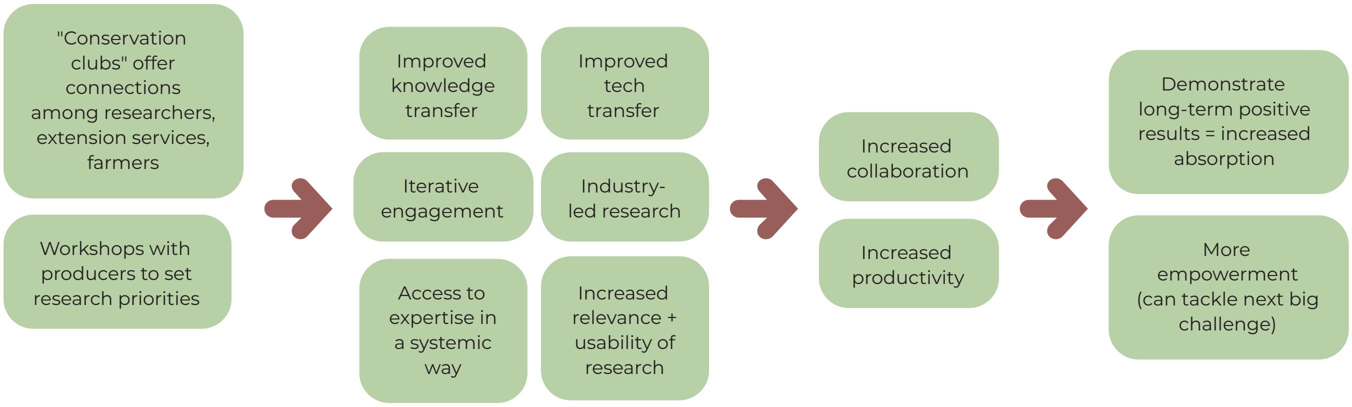


FIGURE 8: SAMPLE PATHWAY HIGHLIGHTING HOW APPLYING AND DEMONSTRATING INDUSTRY-LED RESEARCH MEET CURRENT NEEDS AND MAKE FUTURE OPPORTUNITIES POSSIBLE.

Key Activity 5.1 Support expansion of successful trials

Research trials have a strong presence in the sector. Once the trials conclude, there is an opportunity to share results broadly and increase the adoption of evidence-based management practices on farms across the Island. Improving access to information and support beyond demonstration sites helps more farms connect with promising adaptation practices.

Collaborators: Researchers, UPEI, AAFC, extension service providers, commodity boards, producer clubs/co-operatives

Data required: Trial details and results

Considerations: Analyzing results from expanded trials could improve further research and extension services. Smaller farms and commodity groups require specific attention and inclusion in the original trials and subsequent expansion.

Measures of success:

- Number of farms adopting trial
- Number of commodities covered
- Number of times a trial is repeated and results analyzed by researchers

Key Activity 5.2 Connect research to extension services

When extension services can act as a conduit between research and producers, it supports two-way information sharing. The lack of extension service capacity limits producers' ability to address current and future production challenges, even when field trials produce promising results. Farmers can benefit from applied research findings and researchers can take on meaningful research questions

Collaborators: East Prince Agri-environmental Association, PEI Potato Board, Dalhousie Agriculture Campus, UPEI, Holland College, commodity boards, PEI Institute of Agrologists, PEIFA, PEI Department of Agriculture

Data required: Data supporting benefits of extension services provided

Considerations: Extension service and research connection needs vary by commodity and farm size. Continued adoption is required to show longer-term benefits of BMPs.

Measures of success:
- Number of active extension service providers
- Numbers of farms using extension services
- Number of farms applying research findings
- Number of commodities covered
- Number of research projects converted to extension services

Key Activity 5.3 Innovate continuously and responsively

Climate change will continue to have surprises in store and adaptation innovation will need to keep pace. Ongoing innovation is needed to push the limits of adaptation and respond to farmers' needs.

Leads: AAFC, UPEI, Dalhousie Agricultural Campus, extension service providers

Collaborators: Commodity groups, farmers

Data required: Adaptation thresholds and limits

Considerations: Identification of thresholds and limits require priority setting based on urgency and severity of consequences.

Measures of success:
- Number of climate change impacts covered by research and extension efforts
- Number of adaptation thresholds identified for local impacts
- Number of adaptation limits quantified for local adaptation actions

Action 6: Enhance Agricultural Infrastructure

Desired Outcomes

Enhancing agricultural infrastructure was often suggested by farmers as an approach to support technological adaptation responses, address resilience of sector and farm assets during extreme weather events, and add redundancy and capacity in the supply chain.

Agricultural assets and infrastructure are mainly owned, operated, and maintained at the farm-level, although there are key pieces owned by third parties and cooperatives that serve commodity needs. There are also provincially- and nationally-operated critical infrastructure pieces such as roads, utilities, ferries, and the Confederation Bridge that support the sector.

The engagement process identified gaps in the types of sectoral infrastructure needed to support other adaptation actions, such as adoption of precision agriculture or adding capacity to address supply chain disruptions or disturbances to harvesting windows. It also identified the need for existing agricultural infrastructure to be upgraded and future infrastructure designed to withstand extreme weather events.

Climate Risks

Enhancing infrastructure addresses climate risks by expanding the adoption of technology, upgrading infrastructure to withstand extreme weather events, and increasing climate-controlled storage capacity.

Technological approaches are available to supplement beneficial management practices to support climate resilience. For example, the use of controlled traffic to reduce soil compaction after heavy rain events helps to maintain soil structure and limits the impacts of climate change on field operations. The use of technology to increase the speed of field operations also reduces the risk yield losses from rain events narrowing the harvesting window.

Planned, proactive upgrades to agricultural infrastructure and assets to withstand extreme events reduce the likelihood of significant structural damage and losses. Damage to barns during extreme storms also put livestock, equipment, and inventory at risk.

Climate-controlled storage capacity helps create additional, temporary capacity to manage supply chain disruptions and sudden changes to harvesting windows caused by extreme weather events. This temporary storage capacity would serve different commodity groups in managing sudden, unplanned surges of inventory caused by climatic events to allow time for the rest of the supply chain to resume to normal operations.

Future Opportunities

In the near-term, improved farm practices, greater use of technological adaptation tools, reduced infrastructure damage, and reduced disruptions to supply chain and field operations by extreme weather events are expected. Over time, increased efficiency at the field-level and increased resilience of farm infrastructure will lessen the risks posed by extreme weather events on production and assets.

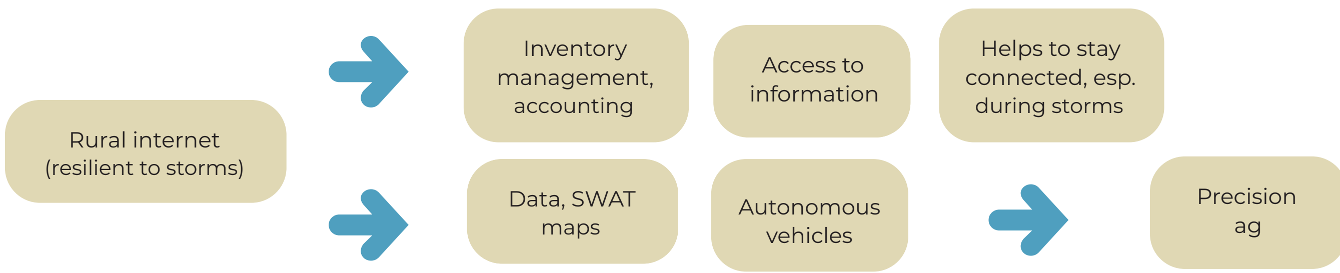


FIGURE 9: SAMPLE PATHWAY HIGHLIGHTING HOW ENHANCING AGRICULTURAL INFRASTRUCTURE MEETS CURRENT NEEDS AND MAKES FUTURE OPPORTUNITIES POSSIBLE

Key Activity 6.1 Expand adoption of technology

The windows for field operations are narrowed by inclement weather, climate change impacts, lack of labour availability, and other factors. The adoption of technology can complete field operations more effectively and efficiently. In addition, precision agriculture has the potential to further improve field operations, such as the use of controlled traffic to reduce soil compaction.

Leads: Government of PEI, AAFC, extension service providers

Collaborators: Equipment suppliers, third-party service providers, processors, commodity boards, Producer clubs/co-operatives, UPEI, Dalhousie Agricultural Campus 34 Building Resilience for PEI Agriculture: Adaptation Plan 2025-2030

Data required: Impact of adoption on profitability

Considerations: Underlying infrastructure such as high speed internet access may be required. Extension services to assist in prioritization, cost-benefit analysis, and adoption may also be required. Ease of adoption, impact on profitability, availability of vendor support and maintenance should be considered. Care must be taken not to shift climate risks to financial risks by increasing debt load or reducing cash flow.

Measures of success:

- $ of loss avoided from unharvested crop
- % of profit margin gained from adoption
- Number of commodity groups adopting new technology

Key Activity 6.2 Upgrade infrastructure to withstand extreme events

Planned, proactive upgrades to agriculture infrastructure and assets to withstand extreme events reduce the likelihood of significant structural damage and losses. Unplanned, reactive rebuilds are likely to be more complex, costly, and disruptive to farm operations.

Leads: Government of PEI

Collaborators: Farmers

Considerations: Upgraded and new infrastructure should be designed for future climate projections, with redundancies, flexibility, and multiple use and users in mind. The priority should be on shared assets that support system-based production. Care must be taken not to shift climate risks to financial risks by increasing debt load or reducing cash flow.

Measures of success:
- Number of upgrades
- Number of farms involved
- $ of loss avoided
- Number of redundancies created

Key Activity 6.3 Increase climate-controlled storage capacity

Additional climate-controlled storage capacity for short-term use supports adaptation to extreme events affecting harvesting and supply chain management.

Leads: Commodity boards

Collaborators: Government of PEI

Data required: Data and information supporting prioritization of storage capacity (e.g., harvest window, climate risk, financial risk), as well as different types of storage needs (timing, duration, storage conditions).

Considerations: Increased storage capacity should be designed for future climate, with flexibility and multiple use and users in mind. Facilities should accommodate different farm sizes and different commodity types for short-term use. Connections to value-add processing may be required for financial sustainability. Care must be taken not to shift climate risks to financial risks by increasing debt load or reducing cash flow.

Measures of success:
- Number of shared temperature-controlled storage facilities
- Number of farms using the extra capacity
- Number of commodities benefitting from the extra capacity
- $ of loss avoided from spoilage and unharvested crop

Action 7: Sustain Agricultural Land

Desired Outcomes

The ongoing loss of agricultural land and the resulting increase in land costs were frequently identified by stakeholders as a risk to a resilient agriculture sector. Adding pressures on production costs and limiting opportunities to increase a farm's land base to expand its capacity have deprioritized on-farm adaptation actions and made them appear out of reach.

With competing land use pressures and lack of succession planning, the loss of agricultural land has been apparent. Once agricultural land is converted to residential, commercial, or industrial use, it is unlikely to return to agricultural use in the future.

Many farmers engaged in this process want to see agricultural land protected, productive, and sustainable. There are wide ranging opportunities to enhance sectoral resilience through system-based production, increase adaptation capacity, and encourage long-term adaptation investments and practices if concerns over land losses are addressed.

Climate Risks

Sustaining agricultural land addresses climate risks through the three key activities: protecting agricultural land through land use planning mechanisms, mixed-use of existing agricultural land, and simplifying succession planning processes.

Protecting agricultural land through land use planning mechanisms would help support the overall viability of the sector. It would also lessen increasing agricultural land costs to ease pressures on the cost of production, leaving cash flow for adaptation upgrades, investments, and projects at the farm-level.

Supporting mixed-land use would help make the most of agricultural land, reduce biodiversity loss, create opportunities for diversified revenue streams, and move toward system-based production.

Simplifying succession planning can help address more complex and severe climate risks as producers will be more inclined to significant, long-term adaptation investments. They will also be more likely to take proactive adaptation approaches if there is a retirement and succession plan in place to help them recover the value and resilience they added to their farms.

Future Opportunities

In the near-term, mixed-land use will create diversified production methods that spread climate risks to improve resilience at the farm level. Easing the worry of cash flow pressures of short-term adaptation expenditures and having mechanisms to justify long-term adaptation investments will lower the barrier of adaptation while making a move towards improved financial and climate resilience. Over time, new, diverse adaptation options can be discovered through expanded system-based production. This will help the sector remain strong, with more farms move toward long-term environmental, climate, and financial sustainability.

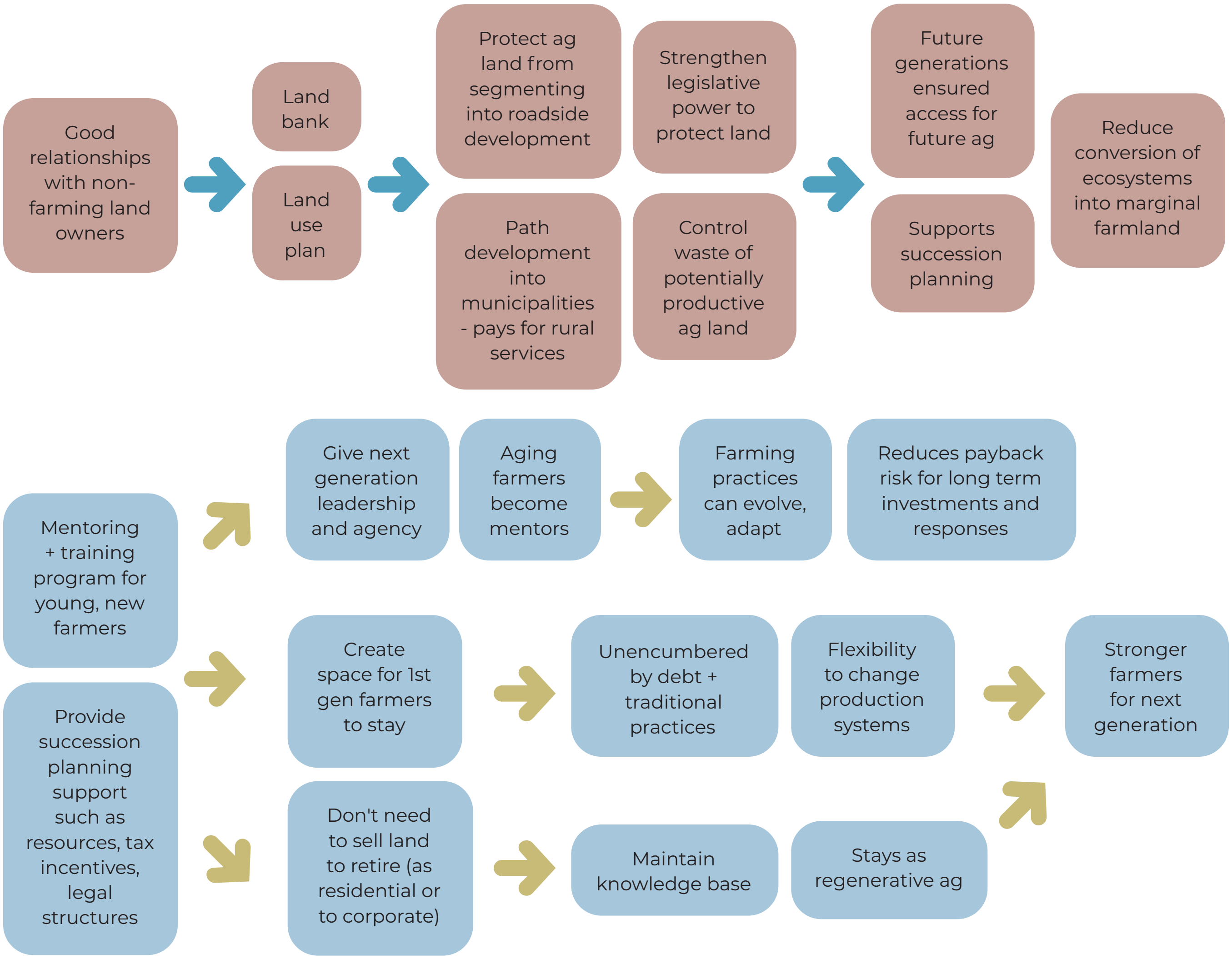


FIGURE 10: SAMPLE PATHWAYS HIGHLIGHTING HOW SUSTAINING AGRICULTURAL LAND MEETS CURRENT NEEDS AND MAKES

Key Activity 7.1 Protect agricultural land through land use planning

Competing land uses (e.g., housing), sale of land by retiring farmers , and other factors have led to significant loss of agricultural land across the province. To support the viability of the sector, opportunities exist to use land use planning policies and mechanisms to protect agricultural land.

Leads: PEIFA

Collaborators: Government of PEI, National Farmers Union (NFU), Federation of PEI Municipalities, Tourism Industry Association of PEI, other sectors

Considerations: Working with other sectors to align goals will help shift from competition to collaboration.

Measures of success:

- Number of agricultural acres lost per year
- Number of acres in production per year

Key Activity 7.2 Mixed-land use

Increasing competition for land has increased land prices and decreased availability of agricultural land. An important approach is to increase mixed-land use across commodity groups and economic sectors (e.g., agri-tourism operations, maintaining pastoral landscapes) to support sustainability at the farm and sector levels.

Leads: Producer clubs/co-operatives, commodity groups

Collaborators: Government of PEI, agronomists, Canadian Forage and Grassland Association, Canadian Food Inspection Agency, PEI Agricultural Insurance Corporation

Considerations: Ecological goods and services can be enhanced if mixed-land use also take ecosystem health and biodiversity into account.

Measures of success:
- Increased profitability per acre for mixed-use fields
- Increased ecological goods and services provided per farm

Key Activity 7.3 Succession planning

Retiring farmers are seeking to recover the investments they put into their farms and establish financial security for their retirement years. The role of social and family dynamics makes succession planning complicated. Some farmers are seeking or receiving interest from successors who are not family members. Interested young farmers do not have the resource base to take over established farms. As farming becomes more capital intensive and faces increasing costs of production, the sale prices continue to increase, adding to the complexity. Creating legal and financial mechanisms to address this challenge will support succession planning, which could encourage farmers to make necessary, longer term adaptation investments.

Leads: Commodity boards

Collaborators: Banks/lenders, PEIFA

Considerations: Individual farms are unlikely to take on the creation of new legal and financial mechanisms on their own. Making different templates for different options available would simplify succession planning.

Startup costs: Legal fees, accounting fees

Measures of success:
- Lower average age of farm owners
- Number of farms with succession mechanisms in place

On-Farm Actions

The sector-level adaptation actions are expected to support on-farm actions at the field level. The tables below were developed through a review of existing research and work on impacts and adaptation options, with input from industry stakeholders.

Whenever possible, multiple adaptation options were provided. Some adaptation options resist change - for example, doing more of the same to preserve current ways of production. Some adaptation options create incremental changes - these are easier to implement but their benefits are limited. Others require fundamental changes - these are more complex to implement but the benefits are broader. Having multiple options also supports producers in exploring which adaptation responses best suit their needs now compared to five, ten, or fifteen years from now.

Livestock

	Risks	Impacts	Thresholds	Adaptation Strategies	Notes
BEEF	**Heat stress**	- Projected increase in HS duration is greatest in temperate & sub-tropical areas, including PEI (see map)[1] - Impacts to cattle: decreased fertility[1] - Decreased weight gain, increased water intake[1]	-Global temps >4°C: over 180 days of HS in temperate regions[1] - Onset of extreme HS in cattle (temperate regions) = THI of 89 AKA 31.6°C and above[1] - Average indicator of HS globally is THI of 68.8 (20.4°C)[1]	- Fans to improve ventilation - Increased access to natural/artificial shade - Seasonal management of calving[1] - Selection of heat-adapted breeds (e.g. taurine to indicine cattle)[1] - Adjusting feed schedule & time[1] - Adjust stocking density[1] - Supplementing diet with fats during periods of HS[1] - Feed during coolest parts of day[1] - Plant-based additives to reduce HS (phenolic compounds & isoflavones)[1] - Metabolizing propionate instead of acetate (produces more heat)[1]	- THI threshold varies between cattle breeds (more research needed)[2] - # of days per year above HS THI threshold projected to increase[1] - Switching to more heat-adapted breeds comes with production trade-offs (temperature changes would have to be significant to ensure farmer profit in changing breeds)[2] - Adjusting feed schedule & time: minimizes metabolic heat production[2]

[1] North, M.A., Franke, J.A., Ouweneel, B., & Trisos, C.H. (2023). Global risk of heat stress to cattle from climate change. Environmental Research Letters, 18(9), 1-14. https://doi.org/10.1088/1748-9326/aceb79
[2] Thornton, P., Nelson, G., Mayberry, D., & Herrero, M. (2021). Increases in extreme heat stress in domesticated livestock species during the twenty-first century. Glob Chang Biol, 27(22), 5762-5772. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9292043/

	Risks	Impacts	Thresholds	Adaptation Strategies	Notes
BEEF	**Cold Stress**	- Cattle can suffocate under snow drifts, experience hypothermia-induced congestive heart failure[3] - Blizzard conditions (bitter cold, strong winds, drifting/blowing snow) can cause stress and/or death[4]	- Hypothermic conditions = (ex.) high winds, freezing rain, & drifting snowbanks over 2.5 days with windchill -12.5°C[3]	- Increased windbreaks/ shelter - Access to unfrozen water - Supplemental bedding - Update farm slurry protocols[6] to account for longer storage	
	Flooding	- Prolonged field submersion prevents grazing + lowers feed quality - Reduced plant productivity & survival due to reduced oxygen in soil profile[5] - Higher risk of soil compaction following heavy rains		- Natural management: restoring peatlands, riparian vegetation - Move livestock to higher, drier ground when extreme precipitation is anticipated - Consider flood-resistant forage types[5] - Sustainable drainage systems6 (to transport surface water, slow runoff, provide storage area)	
	High Winds	- Infrastructure damage: barns, equipment buildings, fences, machines (observed in hurricanes Katrina & Fiona)[4] - Damage to roadways affects transport of goods[4]	- Optimal airflow for windbreaks = 25-30%[7] - 10ft high fence (with 1ft of fence for each cow) will provide protection for 80-100ft (24-30m) behind it[7]	- Agroforestry (hedgerows & silvopasture) - Well-maintained livestock housing - Portable manmade windbreaks can help to determine where herd winters (can pick ideal location)[7]	
	Low Quality Forage	- Higher temps reduce grass nutritive value and may also increase methane production by 0.9% with a 1°C temp rise and 4.5% with a 5°C rise (therefore 'forcing' further climate change)[8] - Quality of forage determines palatability & nutritive value, directly influencing amount consumed, rate of weight gain, quality/volume of milk produced, reproductive success (and methane emissions)[8]	- Beef cattle have longer growing period & require more feed, compared to sheep[9]	- Grazing & cropping in the same field (can increase soil quality if well-managed)[10] - Rotational/advanced multi-paddock grazing to improve forage quality[10] - Nitrogen fertilizer added to forage crops shown to increase nutritive quality[8] - Nitrogen fertilizer complemented by more frequent re-seeding, especially of legumes (ex. Frost seeding clover); improves forage quality[8] - C4 grasses are better heat-adapted than C3 grasses, however they have a lower nutritive value (& are therefore shown to have higher associated methane emissions)[8]	- Different forage types have different tolerances and prime growing seasons[11] - Ruminants consume 80% of all plant material dedicated to livestock; nearly 50% of forage consumed by livestock is grass[8]

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	Risks	Impacts	Thresholds	Adaptation Strategies	Notes
BEEF	**High Winds**	- Infrastructure damage: barns, equipment buildings, fences, machines (observed in hurricanes Katrina & Fiona)[4] - Damage to roadways affects transport of goods[4]	- Optimal airflow for windbreaks = 25-30%[7] - 10ft high fence (with 1ft of fence for each cow) will provide protection for 80-100ft (24-30m) behind it[7]	- Agroforestry (hedgerows & silvopasture) - Well-maintained livestock housing - Portable manmade windbreaks can help to determine where herd winters (can pick ideal location)[7]	
	Low Quality Forage	- Higher temps reduce grass nutritive value and may also increase methane production by 0.9% with a 1°C temp rise and 4.5% with a 5°C rise (therefore 'forcing' further climate change)[8] - Quality of forage determines palatability & nutritive value, directly influencing amount consumed, rate of weight gain, quality/volume of milk produced, reproductive success (and methane emissions)[8]	- Beef cattle have longer growing period & require more feed, compared to sheep[9]	- Grazing & cropping in the same field (can increase soil quality if well-managed)[10] - Rotational/advanced multi-paddock grazing to improve forage quality[10] - Nitrogen fertilizer added to forage crops shown to increase nutritive quality[8] - Nitrogen fertilizer complemented by more frequent re-seeding, especially of legumes (ex. Frost seeding clover); improves forage quality[8] - C4 grasses are better heat-adapted than C3 grasses, however they have a lower nutritive value (& are therefore shown to have higher associated methane emissions)[8]	- Different forage types have different tolerances and prime growing seasons[11] - Ruminants consume 80% of all plant material dedicated to livestock; nearly 50% of forage consumed by livestock is grass[8]
SHEEP	**Heat Stress**	- HS massively destabilizes industry efficiency - Reduced forage intake, increased panting - May not be acute/deadly in most cases, but affects overall performance & increases susceptibility to other health issues - Affects growth, wool, milk & meat production[12]	- Extreme HS experienced >30°C[13]	- Shear wool prior to onset of hot weather[14] - Stall feeding (vs. outside)[14] - Retrofit water system to increase supply of cool freshwater (water demand can increase by 50%)[14] - Place water in shade when possible - Silvopasture (ex. Shade trees, hedgerows)	
	Disease	- Higher incidence of disease/pests in warmer countries = sheep likely to have decreased immunity (in addition to HS & potentially water stress)[14]	- BTV: virus multiplies within midges at 13-35°C[15] - Mortality rate of 2-90%[15] - Clinical signs: 40.5-42°C fever after 4–6-day incubation period[15] - Currently limited in CAN, but is expanding north from U.S. as winters become warmer (midges currently don't survive first hard frost = virus dies with them)[15]	- Developing disease-tolerant breeds (long-term)[14] - Vaccination against common diseases[14] - Effective isolation of sick animals[14]	

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	Risks	Impacts	Thresholds	Adaptation Strategies	Notes
SHEEP	**Disease**	- Higher incidence of disease/pests in warmer countries = sheep likely to have decreased immunity (in addition to HS & potentially water stress)[14]	- BTV: virus multiplies within midges at 13-35°C[15] - Mortality rate of 2-90%[15] - Clinical signs: 40.5-42°C fever after 4–6-day incubation period[15] - Currently limited in CAN, but is expanding north from U.S. as winters become warmer (midges currently don't survive first hard frost = virus dies with them)[15]	- Developing disease-tolerant breeds (long-term)[14] - Vaccination against common diseases[14] - Effective isolation of sick animals[14]	
	Disrupted Forage/Crop Production	- Increased atmospheric CO2 will increase grass growth21 but negatively impact forage type/growth + increase spread of invasives; other researchers disagree with this, arguing that crops will have increased growth[16] - During flooding: nitrogen fertilizers convert to nitrate quickly + are subject to high losses through leaching/ water movement[19]		- Integrating drought-tolerant varieties - Time application of nitrogen fertilizers to ensure peak nitrogen uptake[19] - Delay a portion of the total crops application so that less nitrate is exposed at once[19] - Ensure delayed surface applications are timed to catch late spring rains[19] - Preplant applications of slow-release nitrogen[19] - Fall cover crops - take up residual N from the growing season/fall manure applications (reduces leaching losses + nutrients from cover crops become available to next crop following sod rotation)[17]	- Alternate grazing options; significantly reduces amount of hay required for a flock/herd[18] - Planting more nitrogen efficient cultivars in sensitive areas can prevent nitrate movement to surface & groundwater[19]
	Adequate Animal Maintenance		- Breeding stocks require at least annual hoof trimming & wool shearing[9]	- More frequent shearing[9] - Lowering stocking density during transportation[9]	
POULTRY	**Heat Stress**	- Reduced growth & egg production, reduced egg quality & safety, altered physiological homeostasis[20] - Increased drinking, panting[20] - Reduced reproductive performance[20]	- Persistent HS observed at global temps >1.5°C[2]	- Adequate water supply - Heat acclimation[2] (ex. cyclic increases in incubation temperature) - Upgrade barn ventilation systems[2] and heat recovery	- Access to shade: wooden shelters, etc. in outdoor areas can be used in organic broiler production to attract birds in the outdoor areas[21]
	Disease			- Prompt vaccination - Increasing genetic resistance to common diseases	

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Dairy and Eggs

	Risks	Impacts	Thresholds	Adaptation Strategies
DAIRY	**Heat stress**	- Reduced milk production quantity & value[2] - Altered rumen physiology[2] - Reduced overall animal welfare[2] - Reduced feed intake[22] - Increased susceptibility to diseases & potential for metabolic disorders (indirectly induced by heat stress)[2] - Increased risk of acidosis[2]	- Critical upper ambient temperature is 25-26°C[2] - THI above 72 indicates heat stress[2]	- Improving ventilation systems[2], - Using cooling mechanisms like fans[2] - Managing feeding schedules to cooler periods, reducing roughage in hot periods, adjusting diet composition with higher energy density - Provision of chilled drinking water[2] - Supplementation with niacin and CLA to reduce heat stress effects[23]
	Increased rainfall	- Waterlogging of pastures - Increased risk of foot disease		- Improving drainage systems, rotating pastures more frequently (replacement heifers, cross-bred dairy beef), using better-quality forage, and adapting botanical composition to include species like alfalfa and chicory[1,2.] - Reduce stocking rates[1] - Strategic use of supplementary feed[1]
	Disease prevalence	- Increased incidence of diseases and parasitic infections (e.g., liver fluke)[3] - Potential for increased transmission intensity of highly pathogenic parasites to uncontrollable levels (as per current management strategies)[2]	Increased rate of development of some parasites at temperatures above 15°C[3]	Regular monitoring, vaccination, deworming[3] - Improved pasture management[3] - Careful selection of disease-resistant/resilient breeds[3] - Sustainable disease control programs[24]
EGGS	**Heat stress**	- Reduction in quantity and size of eggs produced[4] - Thinner shells - Increased morbidity & mortality[4] - Increased risk of disease[4] - Decreased efficiency of nutrient digestion[4]	- Thermoneutral zone generally ranges from 19-22°C; heat stress symptoms begin to appear beyond this range[9]	- Ventilation improvements (e.g., cross-ventilation via orientation of housing units)[4] - Use of dietary supplements like vitamin C and E[4] - Adjusting feeding times to ensure that peak metabolic heat production doesn't coincide with warmest part of day[4] - Providing shaded areas (e.g., tree planting around housing units, if not temperature-controlled)[25] - Maintaining proper stocking density to minimize stress[4]
	Disease outbreaks	- Reduced immunity[4] - Increased disease susceptibility (e.g., parasitic infections)	Increased rate of development of some parasites at temperatures above 15°C[3] - Different breeds are likely to have varying levels of susceptibility to parasitic infection[3]	- Using appropriate vaccinations to protect against infection[3] - Dietary adjustments to support immune function[3] - Breeding for selection of disease-resistant varieties[3].

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	Risks	Impacts	Thresholds	Adaptation Strategies
DAIRY AND EGGS	**Increased ambient temperature**	- Reduced feed consumption[4] - Reduced growth rate, egg production	- Broiler chickens able to thermoregulate their body temperature largely irrespective of environmental temperature[4] - Mechanisms for heat loss are triggered in adult broiler chickens above 21.1°C[4]	- Implementing housing modifications for better ventilation - Using evaporative cooling systems[26] - Dietary adjustments (e.g., wet feeding)[4] - Supplementation with antioxidants such as vitamins A, C, and E[4]
	Geographic concentration of livestock feed production	- Vulnerability to extreme weather events can lead to potential impacts to disruption[6] - Potential for reduced output[6]		Diversification of feed sources (e.g., additive supplementation) and improved feed storage practices[2] - Geographic relocation or dispersal of production systems (where possible)[27]
	Water scarcity	Reduced availability of water for drinking, increased competition for water resources[7] - Reduced forage crop quality[7]		- Adoption of water-efficient practices - Use of drought-resistant forage varieties - Improved water management strategies (e.g., rainwater harvesting, recycling)[28]
	Increased ambient temperature and THI	- Significant decrease in milk yield[8] - Reduced feed intake[29] - Increased mortality - Reduced animal performance[8]	- Thermoneutral zone generally ranges from 19-22°C; heat stress symptoms begin to appear beyond this range[30]	Strategic timing of feedings during cooler periods Provided shaded areas
	Decreased forage quality	- Reduced milk production[11] - Poor nutritional value leading to health issues	C4 species have better tolerance to higher temperatures[31]	- Selection of crops that are more tolerant to extreme conditions[32] - Use of alternative forage species (e.g., sorghum for silage)[11]

Potatoes

Risks	Impacts	Thresholds	Adaptation Strategies
Pests/Hotter temperatures	Some potato varieties (e.g. Premier Russet) have decreased defenses against some strains of Potato Virus Y (PVY)[5]		Use virus-free seed coupled with the use of a management plan to control aphids Scheduled spraying of mineral oil & aphicides to control transmission, prioritizing the use of low-risk insecticides (ex. Horticultural oils) Advance efforts to identify aphid species being monitored & main vectors (ex. Green Peach Aphid)

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Potatoes

Risks	Impacts	Thresholds	Adaptation Strategies
Pests/weather variation	Brown center and hollow heart increase with weather variations, quick unexpected changes in temp/precipitation[33]	- Rapidly grown tubers have higher incidences of hollow heart than slower growing tubers[34]	Use precision agriculture to ensure a balanced supply of inputs timed according to crop needs[4], - Maintain uniform soil moisture levels to simulate uniform tuber growth rates[2]
Pests/Hotter temperatures	Colorado potato beetle (CPB) has been on PEI for decades and continues to migrate North as temperatures increase[35, 36] More generations of CPB are occurring annually, increasing feeding damage and enhancing insecticide resistance		Field rotation & isolation, line infected fields with plastic (in organic or extreme scenarios), monitor for CPB every 2-3 days[3,4] Monitor for development for higher-efficacy pesticides
Pests/Hotter temperatures	More susceptible to Verticillium wilt (Fungus causing potato early dying disease)[37] Other pests affected by warmer temperatures include European corn borer, aphids, flea beetle	Verticillium wilt prefers 26-29°C[5]	
Rain & soil erosion	Climate change is bringing more intense rainfall, and worsening erosion by water[38, 39]	Total precipitation is projected to increase the most in winter & spring when the soil is unprotected & most vulnerable to erosion (climatedata.ca)[7,6] Precipitation is projected to be less frequent but more intense & highly unpredictable	Use cover crops after harvest[6] to prevent winter erosion & after fall tillage in the year before potatoes (or use spring tillage) Reduce tillage & maximize surface crop residue after row shaping or hilling[6] Extend crop rotation and include rotational crops[5] that maintain or build soil health; reduces total tillage throughout the rotation & maintains as much growing vegetation as possible
Drought	Warmer temperatures mean more evapotranspiration, bringing the soil moisture content below availability to plants[40]		Mulch reduces evapotranspiration & conserves moisture[41] Deficit irrigation - potatoes need most water during tuber bulking phase[42] and need the least water after maturation[8]
Hotter temperatures	Potatoes are cool season crops, summer temps getting too high, damaging crops/decreasing yield		- Use of heat-resistant varieties - Use of natural or artificial shade[9] (e.g., natural hedgerows on field margins) Dynamically adapt crop calendar to follow changes in weather patterns (ex. Planting earlier/later)

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Risks	Impacts	Thresholds	Adaptation Strategies
Hotter temperatures	Potatoes are more susceptible to disease at high temps, however wild varieties have better resistance, but have cosmetic issues[9]		Increase access to irrigation[9] to increase evaporative cooling Screening & selective breeding for disease-resistant varieties[9] Application of modern genetic & molecular technologies to improve disease resistance[9] Develop educational materials for end-consumers describing the benefits of these techniques in producing safe/affordable food
Variable & Extreme Weather	More hurricanes, wind, unpredictable frost Rainfall expected to be more intense & less frequent Hurricanes flood fields, machines are unable to harvest in fall		Monitor crops & weather closely Plant early/short season varieties to anticipate harvesting Install controlled tile drainage - keeps water & nutrients in the soil[43] Hedgerows for wind reduction

Cereals, Corn and Oilseeds

Risks	Impacts	Thresholds	Adaptation Strategies
High Temperatures	- Heat stress, less pollination, reduced growth & yield, quality impaired = less suitable for food[1]	- Optimal growth at 20-30°C[44]	- Research on breeding corn varieties that withstand heat stress & drought, cover cropping, no till farming, water management, precision agriculture (e.g., drones, sensors)[1]
Pests and Disease	- Higher temp increases rate at which insects can digest food - Pests ranges are migrating north due in part to increased temperatures - An increase in the number of hot days can increase the number of insect generations per year - Insect predators like birds are in danger	- Under 2°C of global warming, global pest-related yield losses from wheat and maize increase by 46% and 31%, respectively, when compared to current levels of loss [45] - Global yield losses from insect pests to increase 10-25% with each additional degree of temperature rise[2]	- Enhanced IPM strategies to conserve effective pesticides - New disease-resistant varieties - Use resistant varieties where possible - Use biocontrols and/or biopesticides - Crop scout and monitor pest thresholds to ensure products are applied in an effective manner - Improve farm biocontrol measures to prevent the movement of pests/ pathogens from field to field
Pests and Disease	- *European corn borer* reduce yield & quality, damage leaves[46] - Interferes w nutrient transfer - Introduce mycotoxins & diseases[3]	- One ECB per plant reduces yield by 3-5%[3]	- Enhanced monitoring and scouting for ECB[3] - Plant resistant varieties, after harvest remove stalks to prevent overwintering[3]
Pests and Disease	- Western bean cutworm expanding north, injury to plant[47] - Increases ear mold infection causing mycotoxin contamination[4]	- Yield loss 3-15 bushels/ac with average infestation of one larva per plant[4] - Monitor egg masses July-Aug - "if the cumulative count of egg masses reaches 5%, then insecticide application is warranted"[4]	- Same as above, monitor + plant resistant varieties

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Risks	Impacts	Thresholds	Adaptation Strategies
Pests and Disease	- *Corn rootworm larvae* feed on roots causing lodging[48] - Reduced harvestability[5] - Root scarring, stops root elongation[5] - Peak in July, lodging risk worsened by wet soils & high winds[5] - Tar spot (fungal) endemic in Ontario/Quebec; likely to reach PEI as temperatures increase		- Don't plant corn 2 years in a row, allows overwintering as eggs, then grow again if crop is still corn[5] - Plant non-host crops like soy or alfalfa[5] - Sandier soils = less eggs[5] - Planting high-quality seeds, using varieties that are more resistant to impacts
High Temps/ Drought	High Temps/Drought - Impacts yield when too hot during grain filling phase[49] - Heat stress impacts photosynthesis, starch conversion and nutrient metabolism[6]		- Adjusting sowing dates, earlier planting/ sowing dates for winter/spring crops and later sowing for summer/fall crops[6] - Less water needed if not growing during hottest periods
Heat/ Drought			- Planting geometry dictates plant density to optimize canopy closure and water demand[6] - Fertilization efficiency (minimizing leaching & volatilization), precision fertilization[6] - Plant breeding and genetic modifications of crops - have traits such as resistance to heat stress, pests, and ability to cope with water logging and salinity[6] - Growing C4 photosynthesis crops instead of C3 photosynthesis crops (less efficient, more water needed)[6] – C4 includes corn, sorghum sudangrass, pearl millet[6] – C3 includes soybean, wheat, barley, oats, forage crops[6]
Extreme Weather		- Sequential cropping yields were higher than that of single cropping systems[6]	- Intercropping increases resilience to unpredictable weather: sowing 2+ cereal crops on same field, at same time or one after the other, increases stability if one crop fails (e.g., canola/peas, mustard/peas)[6] - Diversity of crops per farm (rather than per field); combination of winter and summer crops, shallow root and deep root, annuals and perennials[6]
Soil Erosion	- More storms = more erosion[50] - Impacts yield, especially in eastern Canada[7] - Higher risk of water erosion due to climate[7]	- Highest risk of soil erosion is with long, sloped lengths combined with slopes with a gradient of 2% or higher, and/or areas of concentrated flow of water	- Cover crops[6] - Alley cropping[6] - Strip tillage[7] - Conservation tillage, plant row crops across the slope[7] - Crop rotation with soil-building rotational crops - Inter-seed row crops with other crops[7] - Soil conservation structures
Soil Erosion	- Erosion risk high for corn and soybean crops using conventional tillage[7]	- Soil-landscape restoration can increase yields by 20-50%, and increases crop biomass by up to 95%[7]	- Both corn and soybeans have potential to be grown using no till, minimum till or strip till[7] - Contour tillage instead of going up and down slopes[7] - Soil-landscape restoration: moving rich topsoil from base of hills to higher up areas where erosion has occurred[7]

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Fruit Trees (grapes, berries, apples)

Risks	Impacts	Thresholds	Adaptation Strategies
Increased temperature and heat stress	Affects photosynthesis, causing alterations in sugars, organic acids, flavonoid contents, and firmness of fruits[3] Delayed and poor coloration of fruit skin (e.g., apples, grapes), reducing marketability[2] Increased fruit abscission and reduced quality due to higher temperatures[1]	A temperature rise of 0.7-1.0 °C may shift suitable areas for quality production of certain fruit varieties[3] - Temperatures above 24°C negatively affect skin color in grapes[2]	- Use shading materials to reduce fruit temperature[2] - Develop heat-resistant fruit crop varieties [51], [52] - Implement soil and water conservation techniques [53] - Implement improved agronomic practices and precision farming techniques to manage heat stress[54]
Erratic rainfall patterns and moisture stress (droughts)	- Fluctuations in post-harvest date & quality, timing of flowering and fruit set[7] - Poor pollination due to rain washing away pollen[4] - Inconsistent rainfall can disrupt the water balance, leading to drought stress or waterlogging depending on conditions, affecting overall tree health and productivity	- Most changes to fruit quality are more noticeable in fruits with prolonged development (vs. early development fruits)[2]	- Utilize irrigation techniques, water management strategies, and consider mulching to retain soil moisture[1] - Implement rainwater conservation[5] - Consider advanced soil management practices like using cover crops to improve water infiltration and reduce soil erosion[1] - Adjust irrigation scheduling to manage unpredictable rainfall[55]
Pest and disease incidence due to warmer and more humid conditions	- Increased incidence of pests/diseases like apple scab and fire blight due to higher temperatures and humidity during growth phase[56] - Increased overwintering of pests due to milder winters can lead to higher populations and earlier infestations in the growing season[3]	- Apple scab: higher infection rates when, in April, wet leaves combine with high humidity (>80%) and temperatures above 5°C[6] - Fire blight: higher infection rates when, in April, high humidity combines with temperatures above 18°C[6]	- Development and breeding of pest-resistant varieties[3],[4] - Implementing effective disease forecasting systems[4]
Changes in pollination patterns due to temperature fluctuations	- Cool wet springs can contribute to reduced pollinator efficacy[5] - Potential to damage plant blossoms, impacting fruit set & development[4] - High humidity coupled with high winds can increase the spread of diseases, like scab[3]	- Optimum pollination temperatures for temperate fruits like apple, pear, and cherry are between 20-25 °C[3]	- Introduce low chill cultivars[3] - Manipulate pollination timings through controlled environment conditions (e.g., chilling requirement[3]) - Promote insect biodiversity to support wild pollinator populations[5] - Use of rootstocks tolerant to stress to increase likelihood of effective fruit development [57]

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Risks	Impacts	Thresholds	Adaptation Strategies
Reduced winter chilling affecting dormancy and bud burst	- Insufficient chilling can lead to uneven bud burst, poor fruit set[5], and reduced crop uniformity[3], resulting in lower marketable yields and extended harvest periods	- Apples, cherries, pears have chilling requirements of over 1000 hours[3]	- Implement dormancy avoidance techniques such as defoliation and evaporative cooling to induce bud burst[3] - Develop and introduce low-chill varieties, particularly in areas with warmer winters[3] - Consider the use of chemical rest-breaking agents to compensate for inadequate chilling[3] - Implement site selection practices to optimize microclimates that naturally receive more winter chill[1]
Risk of frost damage during early blooming due to earlier flowering times	- Frost can damage or kill flower buds, leading to reduced harvest or lower fruit quality[2] - Additional risk if warmer winters cause earlier bud break, increasing the exposure to late spring frosts[2]	Late frosts during blooming can cause significant damage with temperatures a few degrees below zero[4]	- Use chemical applications to break rest periods[3] - Misting has been used to delay blooming to avoid frost damage[5] - Consider windbreaks to reduce frost exposure[1] - Implement frost protection techniques such as heaters, wind machines, or overhead irrigation for frost control[4]
High wind speeds combined with elevated temperatures	- Increased occurrence of black spot on fruit skins (e.g., custard apple) and higher rates of fruit drop[1]	- High wind speeds and temperatures lead to greater physiological stress on fruit crops, particularly during sensitive stages like fruit set[4]	- Implement windbreaks and shelterbelts to protect fruit trees from strong winds and reduce moisture loss[4]
Sunburn due to high temperatures	- Sunburn can cause browning of fruit skin, particularly in apples and citrus, reducing fruit quality and marketability[2]	- Fruit sunburn tends to occur at high temperatures, especially on the west side of the fruit exposed to the afternoon sun[2]	- Use shading materials, fruit bags with high shielding performance, and increase irrigation to prevent soil from drying during risk periods[2] - Employ anti-transparents like chitosan to reduce water loss and protect against sunburn[4] - Consider adjusting harvest times to avoid peak sun exposure
Drought and water scarcity	- Reduced fruit size, yield, and overall tree health due to inadequate water supply[7] - Increased susceptibility to other stresses like heatwaves, leading to compromised fruit quality and tree longevity[7]	- Trees with deep root systems have better drought tolerance, but shallow-rooted trees are more vulnerable[7]	- Implement drought-tolerant rootstocks, improve irrigation efficiency[4,7] - Use mulching to reduce evaporation and enhance soil health[4] - Manage canopy architecture to reduce water loss[7] - Consider adopting precision irrigation technologies to optimize water use[4]
Salinity due to reduced precipitation and increased evaporation	- Disruptions to plant metabolism, growth, nutritional disturbances[58] - Toxic accumulation of ions in cell organelles leads to eventual plant death[8] - Critical damage to crop plants, significantly reduces fruit yield[7]	- Most fruit crops are highly sensitive to salinity stress[7]	- Application of organic and natural ameliorants to alleviate salt stress to improve soil health and mineral update (e.g., Si-NPs)[8] - Use salt-tolerant rootstocks, apply adequate potassium fertilization, and manage soil moisture to prevent salt accumulation[7]

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Berries

	Risks	Impacts	Thresholds	Adaptation Strategies	Note
HIGHBUSH BLUEBERRY	**Flooding**	- Timing of precipitation is more impactful than amount; will decrease in wettest months but increase over winter, leading to waterlogged soils at the worst time[59] - Excess precipitation can cause fruit to crack[1]	- (Both high & lowbush) Blueberries more tolerant of waterlogged soils[60]		
	Frost Damage	- Abnormally warm winters cause them to prematurely leave dormancy, causing frost damage[61]	- Winter: In full dormancy, northern highbush genotypes have been found to range in tolerance from −20 to −30°C[3] - Some highbush cultivars shown to reach maximum cold-hardiness by late December, with temps from -22 - -27°C causing 50% lethality[62]	- Genetic manipulation of highbush cultivars and/or switch from high to 'half-high' cultivars[4] (partial genetic mix with wild types, more tolerant of extreme temps) - Some highbush cultivars shown to maintain cold acclimation for a longer period (ex. into late March as opposed to early March) - opt for those types where possible[4] - Closely monitor bud position & stage of flower opening (significantly influences amount of damage sustained)[63]	Ehlenfeldt et al. detail cold hardiness of various cultivar types[4]
	Temperature Extremes	See 'All Berries'	- Highbush chilling requirement is partially satisfied by temps below 1.4°C & above 12.4°C[3] - Optimal temperature (avoiding heat stress) is between 20-25°C[3] -- Temp of 30°C shown to decrease photosynthesis in northern highbush cultivars by 22-51%[3] -- Temps >32°C during fruit maturation can cause smaller, soft fruits[3] - Best yield obtained when avg. temp in growing season is >18°C[6]	- Switch from northern to southern highbush cultivars (more heat tolerant)[3]	
LOWBUSH BLUEBERRY	**Temperature Extremes**	- Flower buds killed during harsh winter conditions + less snow cover will threaten winter survival	*(Both high & lowbush)*[64]: - New stems emerge after 350-400 GDD at soil temps of 12-15°C - High temps of 35-38°C cause damage - Flower buds killed at temps of -28 - -40°C - Best yield obtained when avg. temp in growing season is 18°C		- Management of lowbush blueberry crops recurs on a 2-year cycle (acclimates to cold in fall, high cold tolerance in winter, de-acclimates in spring. Fruit every 2 years)[65] - Lowbush are hardier than highbush blueberries[7]

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	Risks	Impacts	Thresholds	Adaptation Strategies	Note
	Flooding	- Blueberries in Maine shown to be more affected by long-term (>12 months) precipitation & evapotranspiration rates than weather conditions in their current growing season[1]			
	Soil Degradation/ Loss	- Soil pH likely to slightly increase due to higher soil weathering rates & temp increases, could decrease suitability[66]	(Both high & lowbush): - Blueberries require soil pH of 4.5-5.0 (tolerate up to 5.5)[67] -- Soils with pH above 6.5 aren't suitable for blueberry production[9]		
	Drought	-Drought-experiencing crops have been shown to have 14% & 22% lower yields than naturally rainfed control crop[68] - Reduced berry yields as droughts become more frequent[69] - Shallow roots (more susceptible to wind/other damage)[11]	- Lowbush has been shown to be resilient to 4-week long drought periods[70] - Lowbush known to be drought resistant (wild species)[11] but lowbush berries require greater winter chilling than highbush - (Both high & lowbush) lowbush blueberry requires 4-5cm water per week; irrigation common in dry conditions[6]		
STRAWBERRY	**Water Quality & Availability**	See 'All Berries'	- Require min 5.0cm of water per week (sandy soils) - presumably in 'regular' conditions[6] - Irrigation not needed in areas with regular rainfall reaching 70-90cm/yr[6]		
	Flooding	- Strawberry least adapted[2]	- Tolerates submersion for up to 7 days[2]		
	Temperature Extremes	-Abnormally warm winters cause them to prematurely leave dormancy, causing frost damage, death[3]	- Severe winter damage occurs at -9°C, certain cultivars killed at -23°C[6] - Sensitive to late frosts, severe damage between -1 - -3°C[6]		

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	Risks	Impacts	Thresholds	Adaptation Strategies	Note
APPLE ORCHARDS	**Drought**	- Apple production 'notoriously sensitive to climate shocks'[71]		- Zeaxanthin & glutathione (biochemical markers) shown to be the best indicators of drought stress in apple trees[72] ; opt to rely on these (instead of measures of photosynthesis, transpiration, etc.) since relative humidity can affect results - Historically, irrigation not required in Eastern Canada - rainfall is enough (min 50-60cm of water regularly distributed throughout growing season) - this may change due to more frequent droughts/irregular rainfall[6] - Install drip irrigation[6]	- Apple trees naturally biannual - large crop in one season followed by small crop the next season[73] - Biennial bearing nature is managed through thinning[15]
	Temperature Extremes	- In ON 2012 - temp variations preceding the growing season attributed to record yield drops[13] - Extreme climate events in late winter & early spring can drastically reduce yields[13] - New varieties being planted are often on dwarfed rootstock, i.e. roots nearer to surface = more susceptible to frost damage, heat scald/stem cracking[15]	- Winter dormancy of 900-1000hrs at <7.2°C required for floral development[6] - Sensitive to late spring frost (critical thresholds table in article); mature fruits damaged at -2°C[6] - The last spring frost for 2040-2069 could be advanced by 15 days (compared to 1961-1990) + first fall frost delayed by 16 days = longer growing season[13]	- Deeper sandy loams soils allow plant to be more tolerant of dry spells (140cm deep)[6] - Adaptation options that received approval from growers[15]: -- Changing crop varieties & hybrids -- Diversifying crop varieties & types -- Adding irrigation system -- Adding inputs/focus on quality -- Crop insurance -- Income stabilization programs -- Replant Program -- Diversify household income	- "Unlike many other ag commodities that are reference-priced, traded on exchanges and with little quality variations, apples are horizontally differentiated with many varieties selling at the same price, whether one looks at retail prices or import unit values across sources"[13]
CRANBERRY	**Flooding**	Cranberries generally tolerant to flooding, but excessive/winter flooding can surpass their adaptation abilities[1]			
	Temperature Extremes	- Crop failure[16]	- Cranberries susceptible to warmer temps, require minimum of 62 days below 7.2°C to avoid crop failure[74]		- Cranberries are perennial, meaning growers can't easily migrate north/switch to heat-tolerant crops without significant financial losses[16]
	Water Quality & Availability	- Large + small cranberry growth shown to be highly dependent on precipitation-associated variables, could be affected by changing precipitation patterns[75]	- Annual temp & precipitation accounts for >50% of variability in large + small cranberry production[1]		

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	Risks	Impacts	Thresholds	Adaptation Strategies	Note
Grapes	**Flooding**	- Long-term excessive soil moisture is detrimental[6]	- Grapes are more tolerant of waterlogged soils[2]		
	Temperature Extremes		- Spring growth commences when temps hit 10°C[6] -- May - July: ideal avg daily temp of 16-19°C[6] -- Aug - Oct: ideal avg daily temp of 19-23°C (fruit maturation, maximum yield)[6] -- Flower damaged at 0°C & fruits destroyed at -2.2°C[6]	- Grafting cultivars onto hardier rootstocks allows grape development in relatively difficult climates[6]	
ALL BERRIES	**Flooding**	- Field washout[76] - Loss of soil/alteration of soil microbiome[18] - Loss of planted crops[18] - Waterlogging[77] - Soil erosion[19] - Increased disease pressure (more favorable env. for development)[19] - Increased risk of storm surges, rising sea level, saltwater intrusion[78] - Wetter springs leads to delayed planting/seeding operations (waterlogged fields)[20] - Plants that survive summer flooding are more prone to environmental stresses[2] - Timing of precipitation is more impactful than amount; will decrease in wettest months but increase over winter, leading to waterlogged soils at the worst time[1]	- Summer floods cause more root damage than spring floods[2]	- Re: saltwater inundation: transplanting, reseeding, & drainage (Indigenous approaches)[1] - Use of raised beds to discourage root rot[1] - Horizontal/vertical agriculture (for strawberry, raspberry, gooseberry, blueberry)[79],[80],[81] - Field-by-field remediation approach post-flooding event[23]	

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	Risks	Impacts	Thresholds	Adaptation Strategies	Note
ALL BERRIES	**Temperature Extremes**	- Reduced soil productivity level[18] - Crop stress, damage, death[18] - Faster accumulation of growing degree days can lead to altered rate of ripening[19] - Influenced developmental stages (flowering, fruiting, overall growth)[19] - Decreased photosynthetic efficiency, altered plant metabolism[19] - Lower crop yields & fruit quality[19] - Less insulative snow layer in winter[1]		- Climate-resilient crop varieties (in development); e.g., drought-tolerant maize, heat-tolerant tomato cultivars to maintain crop productivity[19] -- ex. Honeyberry production increasing in Canada[21] - Re: less insulative snow layer: promote snow banking/accumulation on berry patches w/ snow fencing or shrubs (Indigenous approaches)[1]	
	Water Quality & Availability	- More surface water evaporation = less water available to irrigate, wash, can, package goods[18] - More blue-green algae, parasites[18] - Extended drought lowers water table level, increasing need for irrigation[20]		- Sustainable water management (ex. rainwater harvesting, precision irrigation) to optimize water use/reduce wastage[19] - Restricted irrigation systems (ex. drop & leach systems)[21] - Recycling more water during harvest[82] - Reduce use of pesticides (especially on highly erodible soils) to lessen impacts on surface water quality[83]	
	Drought	- Disrupted water supply[19] - Reduced growth, yield losses, crop failure[19]		- Drip irrigation is feasible for some berry crops[84]: -- Less frequent tilling -- Timing irrigation during the most sensitive phases of crop development -- Switch to drought-resistant cultivars (has trade-offs) -- Increasing genetic & crop diversity (ex. varying cultivar drought tolerance) across fields to reduce impacts of other stressors (invasives, disease, etc.)	

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	Risks	Impacts	Thresholds	Adaptation Strategies	Note
ALL BERRIES	**Pests & Diseases**	- Misshaped fruit, fruit rot, fruit scarring, altering taste, more difficult harvesting (berries can cling to stem more), ultimately yield loss[85]	- Milder winter temps can increase likelihood of certain pests overwintering[20] - Late blight (Phytophthora) more likely to be present after floodwaters recede from soils, will cause root rot[2] - Preharvest factors that increase yield (ex. adding N & water) are more likely to lead to post-harvest decay/reduced quality[27]	- Soilless agriculture (avoids soil-derived pathogens/nematodes)[21] - Breeding for genetic resistance to disease vectors[27]	- Nearly all pests/diseases impacting berry quality affect the plant pre-harvest[27]
	Soil Degradation/ Loss	- Reduced soil productivity level	- The higher the soil temp, the greater the plant injury following flooding[2]	- Use of microorganisms (vs. chemical sprays) to control grasses, fungi (theory being tested)[86] - Agroforestry integration (introducing fruit trees to crop farming to improve soil fertility, reduce T extremes)[19] - Soilless agriculture (addresses erosion), restorative agriculture[21] - Reduce tillage[87] - Increase use of cover crops[29] - Adding soil organic matter[29] - Low-intensity fires shown to restore berry habitat & increase yields (commonly used by Indigenous Peoples)[1]	
MISC.	**Miscellaneous Risks**			Traditional Indigenous practices[1]: -- Thinning -- Canopy removal (N/A to crops) -- Transplanting (foster more suitable microhabitats)	- Co-management of berry health/abundance with Indigenous groups. Berries have deep cultural & practical importance for Indigenous Peoples[1]

[85] Prange, R.K., & DeEll, J.R. (1997). Preharvest factors affecting postharvest quality of berry crops. HortScience, 32(5), 824-830. https://www.researchgate.net/profile/Robert-Prange/publication/330796956_Preharvest_Factors_Affecting_Postharvest_Quality_of_Berry_Crops/links/5c65701445851582c3e83472/Preharvest-Factors-Affecting-Postharvest-Quality-of-Berry-Crops.pdf

[86] Grant, T. (2023, November 17). Climate change a double-edged sword for N.S. blueberry growers. CBC News. https://www.cbc.ca/news/canada/nova-scotia/wild-blueberry-crop-climate-change-1.7028985

Pork & Hog

Risks	Impacts	Thresholds	Adaptation Strategies
Heat stress (HS)	- Genetically-modified livestock are more susceptible due to higher metabolic production[4] - Reduced voluntary feed intake (directly impacts performance and well-being)[4] - Reduced feed conversion rate[4] - Reduced milk production in lactating sows [88] -- Decreased piglet weaning weight[1] - Prenatal HS shown to impact lean & fat[1] deposition; causes fatter carcasses at slaughter[3] - Reduced piglet survival[89] - Reduced reproduction[2] -- Reduce oocyte growth, quality[2] -- Impaired embryo development[2] -- Lower pregnancy rate[2] -- Associated with lower sperm concentration[2] - Larger pigs have reduced growth & carcass weight[2] - Acute HS alters intestinal morphology; affects nutrient absorption & inflammatory stress for at least 3-6 days following exposure[90] - Increased mycotoxigenic fungi (to which pigs are highly sensitive) occurrence in feed[3] -- Impacts pig immune system; more susceptible to infectious diseases[3] -- Can impair vaccine efficacy[3]	- Upper limits of thermoneutral zone[4]: -- Weaned piglets: 30°C -- Finishing pigs: 24°C -- Sows: 22-24°C - Critical upper limit of core body temperature is 42-45°C[4] - Pigs of larger body mass enter HS sooner (lower critical upper limit)[4] - Lactating sows require temperatures of 20°C, but piglets require 29°C (arguably thermophilic)[4] - Assuming proper ventilation & typical thermal insulation, pig houses withstand dramatic temperature changes with up to 4.5°C increase in outdoor temperatures[4] - Exact temperature of HS is influenced by age, genotype, sex of pig, but also by external factors (feed, housing management, etc.)[3] - HS between 22-32°C shown to[1]: -- Increase respiratory rate by 175% -- Reduce feed intake by 36% -- Reduce milk production by 20%	- Integrate cooling systems involving an air treatment [91] -- Emergency generator to ensure constant ventilation when required (most critical for sows & finishing pigs)[4] - Pig showers to increase latent heat loss[4] - Adjust dietary nutrient density to counteract reduced intake of feed[4] - Modify building/ventilation arrangement to increase sensible heat loss[1] - Ensure separate living areas for lactating sows & piglets to meet individual temperature needs[4] - Explore water-saving irrigation systems to act as buffer in dry years[4]
Drought	- See above impacts - Increased production of tannins, phenols, other compounds in plants, reducing digestibility in pigs[3]	- Physiological changes begin at 12 hours without water[92] - Mortality significantly increases at 24 hours without water[5]	- Explore water-saving irrigation systems to act as buffer in dry years[4]
Variable & Extreme Weather	- Specific impacts to pig production systems have been scarcely researched[3] - Increases risk of pig manure reaching & contaminating nearby crops, water sources[3]	- 'Shelter in place' approach often only option due to biosecurity, confinement, & logistical concerns of moving pigs[5] - Research concludes that vets & government bodies must collaborate to create evacuation procedures where none exist[93]	- Switch from conventional pen-tank storage & crop application of pig manure to anaerobic digestion scenario[94] -- Shown to produce electricity/heat (offsetting costs) while reducing global warming potential of manure by 81%[7] - Evaluate personal flock evacuation protocol[7]

[87] Western University. (2024, June 28). A new trajectory: Climate change rapidly impacting Canadian agriculture. United Nations Office for Disaster Risk Reduction. https://www.preventionweb.net/news/new-trajectory-climate-change-rapidly-impacting-canadian-agriculture

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Risks	Impacts	Thresholds	Adaptation Strategies
Pathogens/ Infectious Diseases	- Reduced performance traits – growth rate, fertility, mortality[4] - Reduced productivity[95] - Trade restrictions[8] - Reduced market value[8] - Food insecurity[8]	- Most important pathogens of swine in North America: PRRS, Salmonella, E. coli, PCV 2, Staphylococcus aureus[8]	- Take actions to anticipate arrival of diseases; implement relevant preventative actions[1]
Biodiversity Loss	- 18% of pig breeds at risk of elimination[2] - Reduced agricultural crop yields, higher year-year variability; price increases for staple livestock crops (wheat, maize, soybeans, etc.)[3]	- Indications that between 2000-2080[96]: -- World crop price levels will increase twofold -- World crop price volatility will increase fivefold - Prices of food-feed crops predicted to increase faster than prices of pig meat between 2022-2050[3]	- Increase awareness of genetic studies; implement genetically well-adapted varieties into flock[2] - Introduce feed production on local land & pursue improved soil health to ensure socio-economic resiliency[4] - Diversify feed products and sources[4] - Pursue feed varieties with increased nutrient density[1]

While some of the research and work came from PEI, the vast majority came from elsewhere in Canada and abroad. To advance locally-relevant adaptation, an eighth sectoral adaptation action is recommended.

Action 8: Support Locally-Relevant Adaptation

Key Activity 8.1 Commodity Adaptation Plans

The engagement and research conducted through this Plan highlights the unique needs of individual commodity groups. While the Plan offers adaptation pathways forward at the sector- and field-levels, it does not address commodity-level adaptation. The commodity adaptation plans are expected to fill that gap, addressing commodity-specific issues, opportunities, and challenges.

Leads: Commodity boards

Collaborators: Government of PEI, AAFC

Considerations: This work can be funded by Sustainable-CAP (Agriculture Resiliency Research) and the PEI Department of Agriculture is building capacity to help support these planning activities.

Startup costs: Legal fees, accounting fees

Measures of success:

- Number of commodity adaptation plans and action frameworks in place
- Number of producers engaged in plan development
- Number of producers participating in commodity plan actions

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Conclusion

This Plan was co-developed with farmers, with the intention of making adaptation more relevant, approachable, and beneficial. The clear intention of making adaptation work for farmers, and not the other way around, resonated with all participants. Farmers shared that they are confident in their ability to adapt to climate risks. However, other pressures they face get in the way. Through the 8 sectoral actions, adaptation will be advanced by coordinating meaningful support to address climate risks directly today and lay the foundation for more comprehensive adaptation actions in the future. It is hopeful that any key activities implemented through this Plan will open up new adaptation opportunities to make the agriculture sector on PEI more ready, responsive, and resilient.

Adaptation is always changing and evolving to respond to new and more complex climate change challenges. This process does not end with the creation of this Plan. It is expected that this process will take place again in five years, engaging producers and stakeholders to understand the risks, needs, and responses necessary to meet the challenges they face and expect to face. The engagement approaches, templates, and data are included in Appendix A to support replication and continuous improvement.

Next Steps

For the actions PEIFA committed to leading - *Key Activity 3.1: Develop consolidated database of soil health data* and *Key Activity 7.1: Protect agricultural land through land use planning* - it will pursue those with partners and find opportunities to support other adaptation actions through these activities.

PEIFA is also committed to continuing its collaborative work with farmers and stakeholders in supporting climate change adaptation in the sector. It will reach out to funders and organizations identified as “leads” and “collaborators” through the engagement process to explore ways to implement the eight sectoral actions.

Collaboration will include a wide range of partners, including commodity boards, research institutions like UPEI and Dalhousie Agricultural College, and organizations such as Farmers for Climate Solutions and the Canadian Agricultural Human Resource Council. This diverse framework emphasizes shared expertise, innovative research, and capacity building to address climate adaptation, workforce development, and sustainable farming practices.

The inclusion of cross-sectoral partners, like the Tourism Industry Association of PEI, highlights opportunities for diversified land use and system-based approaches. Actions like producer clubs, co-operatives, and agronomy capacity rely heavily on mentorship, shared resources, and extension services to connect research with practical applications. Overall, this collaborative structure ensures a unified effort toward resilience, sustainability, and long-term growth for PEI’s agriculture sector.

See full list of suggested leads and collaborators

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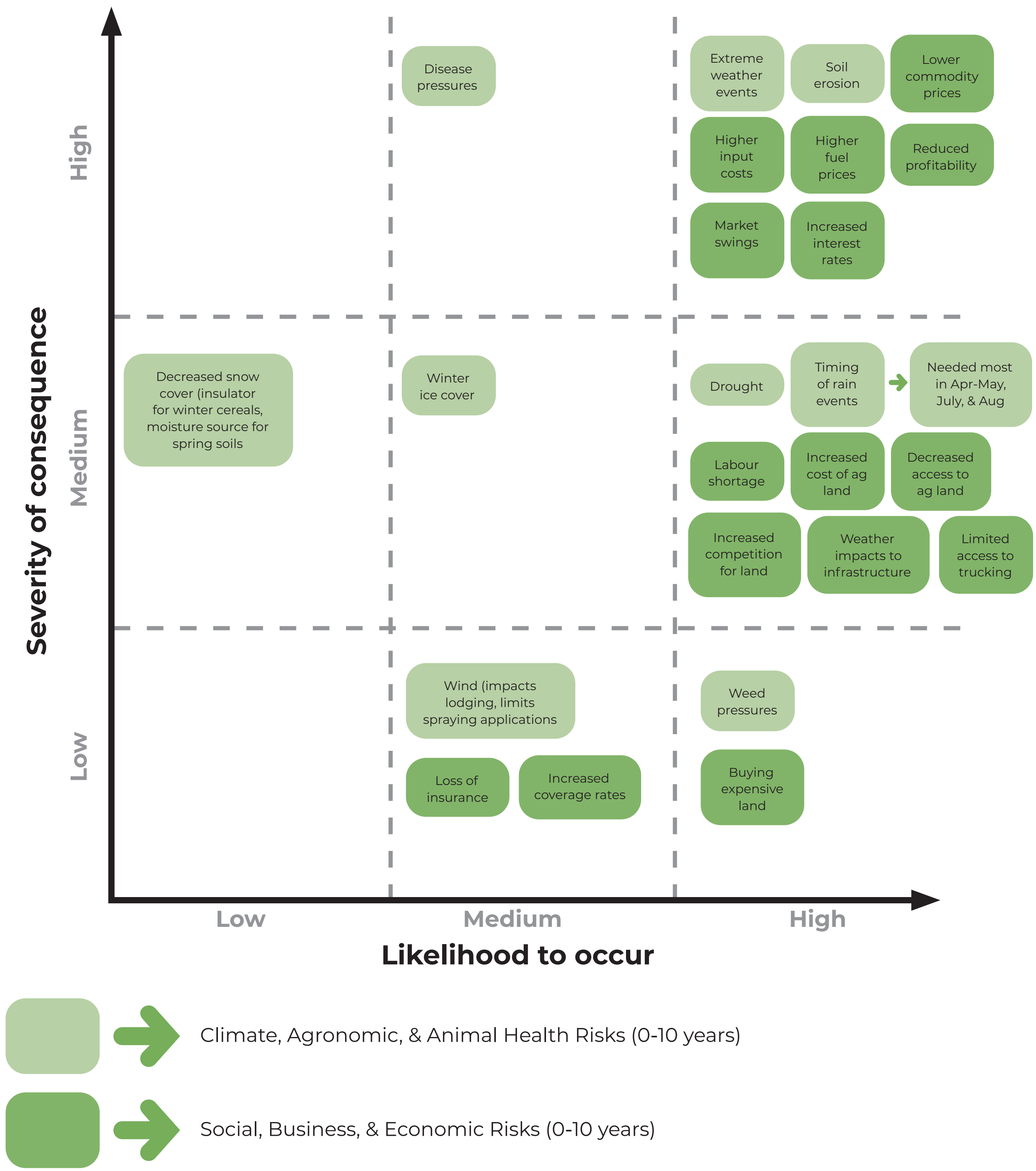
Government of Canada (2023). Canada's National Adaptation Strategy: Building Resilient Communities and a Strong Economy. ISBN: 978-0-660-49133-2

Government of Canada (2024). Adaptation Plan 2024 Update. ISSN: 2818-3436.

ICF and Shared Value Solutions (2021). PEI Climate Change RIsk Assessment. Prepared for the Government of Prince Edward Island. https://www.princeedwardisland.ca/en/publication/pei-climate-change-risk-assessment-2021

Appendix A

EXAMPLE: *Cereals and Grains Commodity Group*

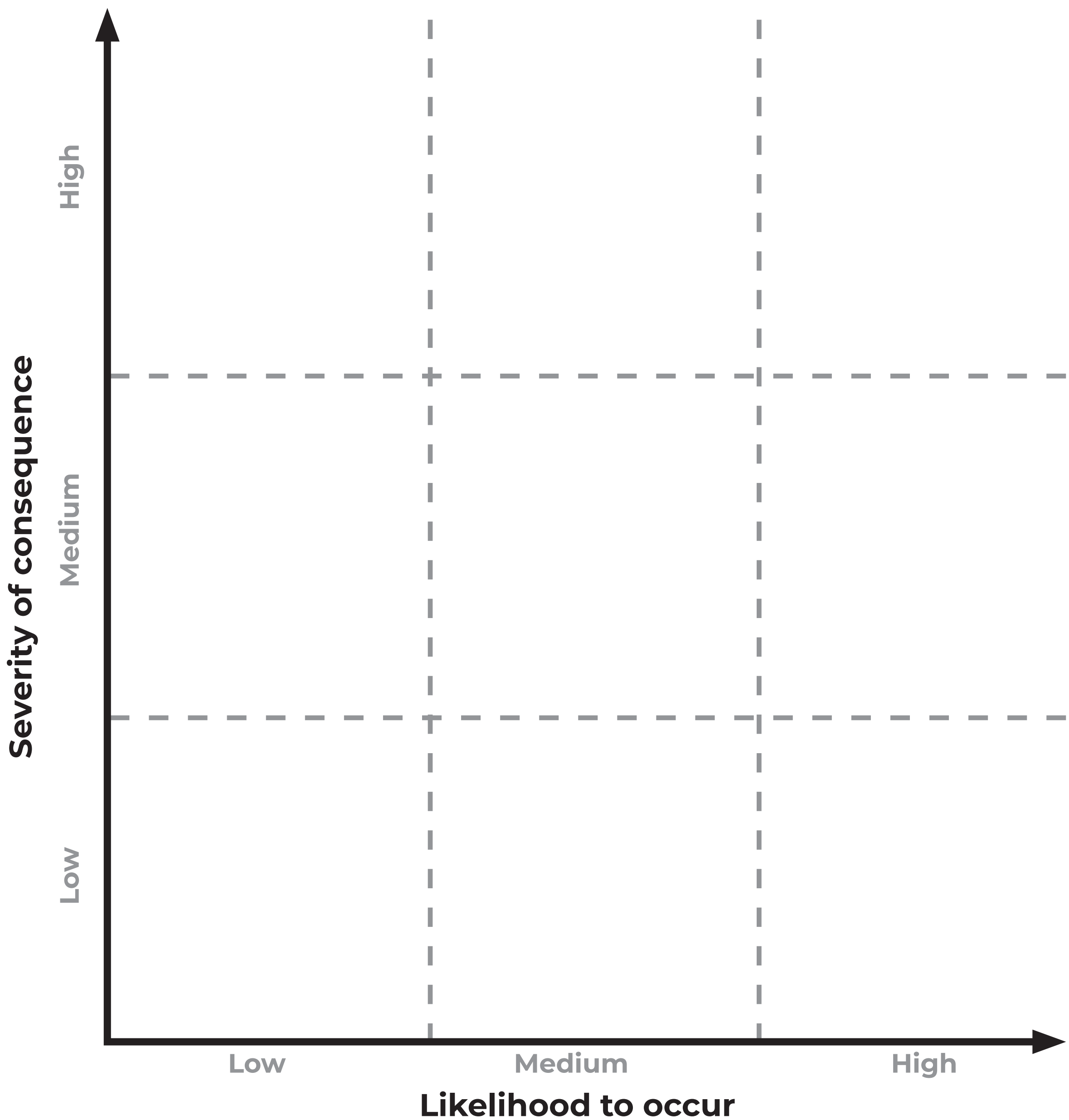


Objective – Risks

Identify and rank the climate and social risks facing the agricultural sector or commodity

Instructions

1. Participants identify risks and facilitator records on sticky note
2. Facilitator categorizes risks as either climate/agronomic/animal health or business/economic/ social risks – use a different colour sticky and matrix for the two categories
3. Participants determine timeline of risk (e.g. 0-10 years, or 10+ years, use different matrix for the timelines)
4. Participants rank risk by likelihood to occur and severity of consequence (low, medium, high)



Objective – Strengths to Leverage

Identify strengths within their commodity or industry that this plan can leverage.

Instructions

1. Participants identify strengths
2. Facilitator records responses on stickey notes of different colours for climate/agronomic/animal health or business/economic/social-related strengths.

EXAMPLE: *Cereals and Grains Commodity Group*

Objective – Weaknesses to Address

Identify weaknesses within the commodity or sector that this adaptation plan can address

Instructions

1. Participants identify weaknesses
2. Facilitator records responses on stickey notes of different colours depending on if climate/agronomic/animal health or business/economic/social-related

EXAMPLE: *Cereals and Grains Commodity Group*

Weakness to Address Climate, Agronomic, & Animal Health Risks

Weakness to Address Social, Business, & Economic Risks

- Lack of local research
- Lack of high-level agronomic expertise
- Soils susceptible to erosion
- Shallow soils

- Limited options for buyers/ suppliers in Atlantic CAN
- Small market size vs. national market
- Increased production costs (due to size and location)
- Aging on-farm infrastructure
- Aging off-farm infrastructure
- Reliance on traditional practices
- Access to capital
- Lack of control over commodity pricing
- Limited crop diversification for small operations

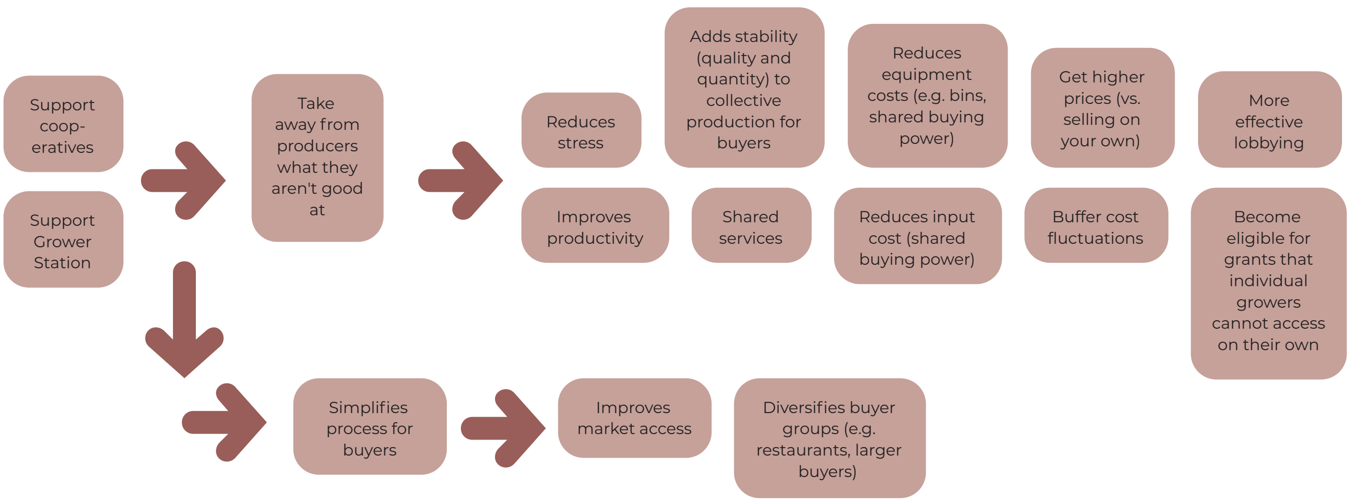
Objective – Adaptation Pathways

Build pathways that show various adaptation opportunities and outcomes that become possible from one or multiple actions.

Instructions

1. Facilitator, with stakeholder participation, identify recurring themes or actions.
2. Facilitator asks "what becomes possible" from the identified action
3. Facilitator uses arrows and stickies to build pathways from stakeholder responses

EXAMPLE: *Perennials Commodity Group*



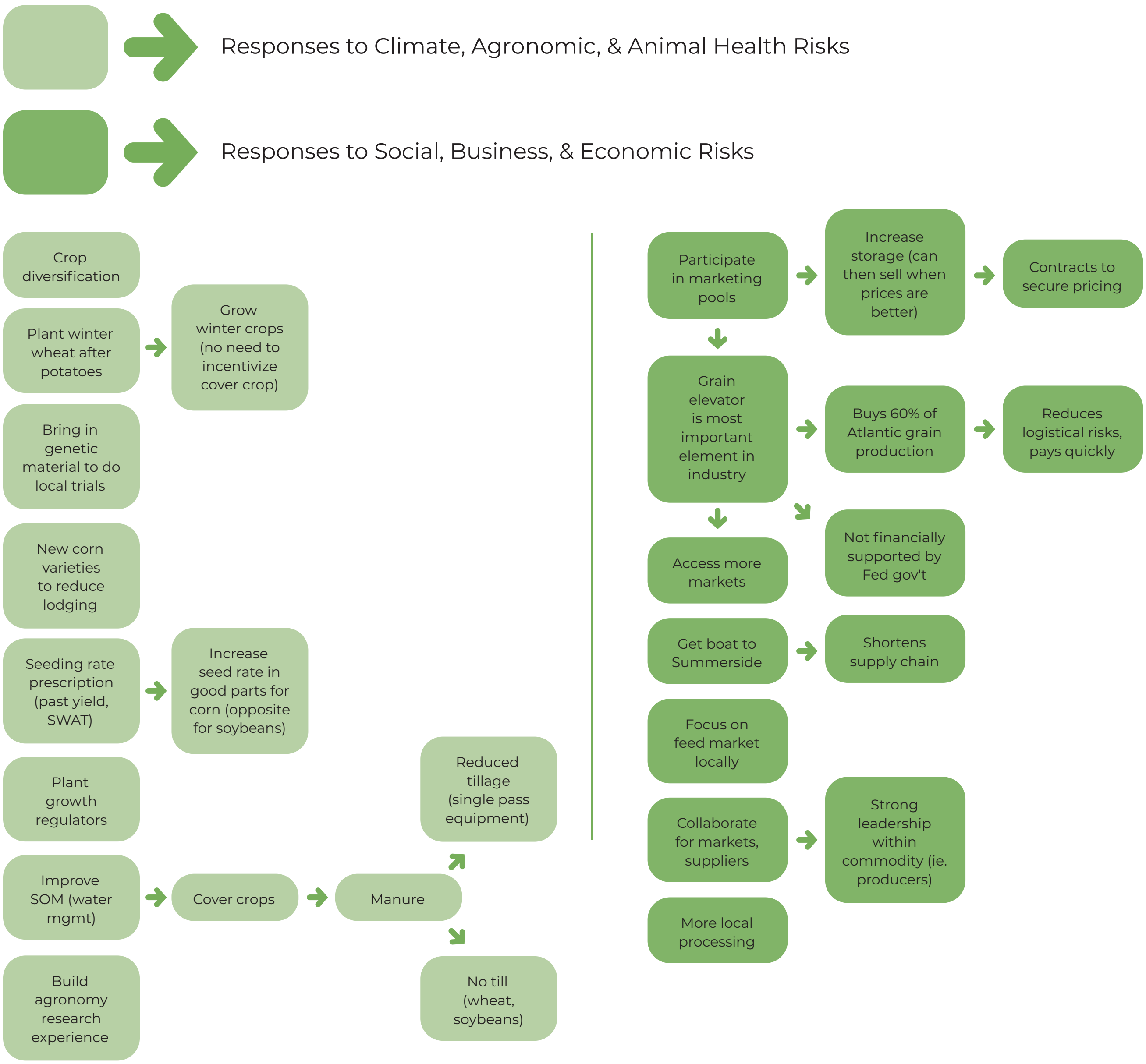
Objective – Responses to risks

Identify adaptation actions for this plan that will help address risks facing the sector.

Instructions

1. Participants identify responses or actions
2. Facilitator records responses on stickey notes of different colours, depending if it addresses a climate/agronomic/animal health risk or a business/economic/social risk.

EXAMPLE: *Cereals & Grains commodity group*



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