

Research Report

“Understanding Wine Industry Sustainability and Resiliency as Concepts and Practices in the Okanagan, Thompson, and Similkameen Valleys” by Morgan King (2023)



Image 1. Vineyard with mountains in background. Own Work. 2020.

Thank you, **British Columbia Grape Growers’ Association**, **British Columbia Wine Grape Council**, and **Sustainable Winegrowing British Columbia**, for taking the time to support this research with your input on the research direction and survey questions as well as sending out the survey information to your email list. Thank you **participants** for taking the time to participate in this research through survey and/or interview. Thank you **readers** for taking the time to learn about this research. Enclosed is the report on the thesis “Understanding Wine Industry Sustainability and Resiliency as Concepts and Practices in the Okanagan, Thompson, and Similkameen Valleys” by Morgan King (2023). If you have any questions or inquiries, please contact me at morgan@morganking.ca, I am happy to go over results in detail at any time. If you would like the full list of literature or survey/interview questions from my thesis, please email me.

Research Report “Understanding Wine Industry Sustainability and Resiliency as Concepts and Practices in the Okanagan, Thompson, and Similkameen Valleys” by Morgan King (2023).

1.0 Introduction

This report is a summary of the thesis “Understanding Wine Industry Sustainability and Resiliency as Concepts and Practices in the Okanagan, Thompson, and Similkameen Valleys” by Morgan King (2023). The purpose of this report is to inform the wine industry, both community groups and wine industry decisionmakers, of the results of the thesis, with an aim to understand the concepts of resiliency and sustainability and the adaptations being used by the wine industry. This study was completed in the Okanagan, Thompson, and Similkameen Valleys of British Columbia, Canada through engagement with the British Columbia Wine Grape Council (BCWGC), Sustainable Winegrowing British Columbia (SWBC), and British Columbia Grape Growers Association (BCGGA).



Image 2. Vineyard with lake and mountains in background. 2019. Own work

2.0 Executive Summary

This research study on the Okanagan, Similkameen, and Thompson Valley wine industries is focused on the concepts and practice of sustainability and resiliency while looking at the adaptative strategies used to combat climatic conditions such as flooding, early frost, smoke, and insects. The study started with a **literature review** of the topics of sustainability, resiliency, and adaptation to risks and vulnerabilities caused by climate change, both generally in wine production and specifically in the study area. The purpose of the literature review is to understand what is **currently known** about sustainability and resiliency in the wine industry which then shows what research is needed. Phase II was an **analysis of eco-certifications**, which are sustainable certifications that inform the public of environmental behaviours by accreditation from an independent company (Berghoef 2020; Corbo, Lamastra, and Capri 2014). This analysis was conducted by creating an inventory of wineries in the study area, researching the eco-certifications of the wineries, and assessing the types of eco-certifications to understand them as an adaptative strategy.

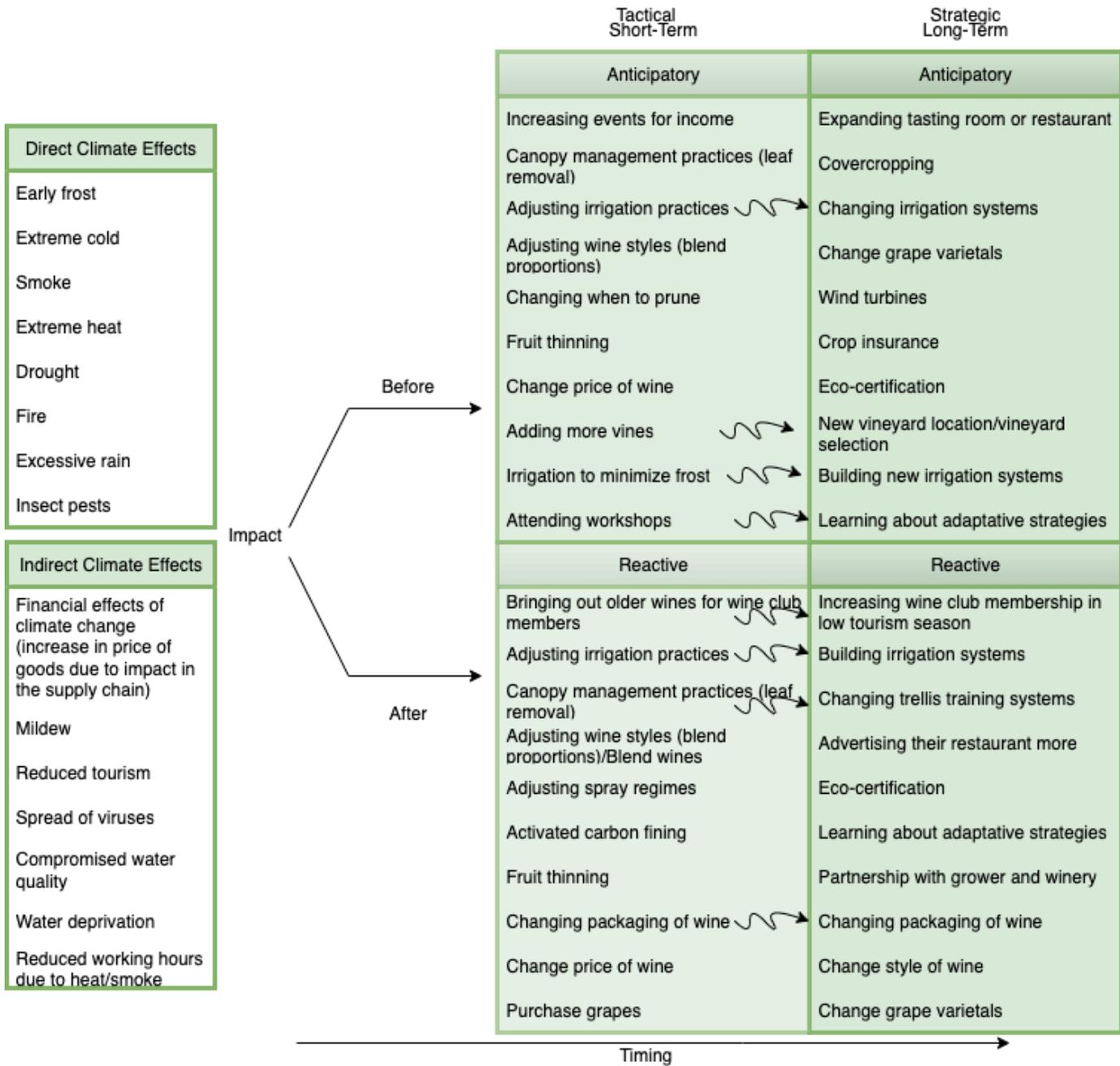
Phase III was an **online survey** of wine industry decisionmaker in the study area to provide information on the wine industry's current adaptative strategies, topics included what adaptative strategies are used and how the decisionmakers decided on adaptative strategies to increase resilience. Phase IV was **semi-structured interviews** with wine industry decisionmakers about sustainability and its connection to resiliency, the creation of resiliency with adaptative strategies, climate change effects, adaptative strategies, barriers and drivers to adaptative strategies, eco-certifications, and cover cropping. The analysis was conducted with NVivo, a software program that helped understand and display patterns in the interview transcripts. The data collection for the research was conducted from September to November 2022 for the survey with 19 completed responses, and from January to March 2023 for interviews with wine industry decisionmakers (King 2023).

The purpose of this study is to learn more about the **sustainability and resiliency of the study area** and the **use of adaptative strategies** because past studies focused on the *effects* of climatic conditions. The focus of the study is on wine industry decisionmakers which are winery and/or vineyard owners, winery and/or vineyard managers, and winemakers. The findings of this study focus on how uniquely wine industry

decisionmakers **define** resiliency and sustainability, the high **barriers** to using adaptative strategies, and the importance of the **social networks** in these wine regions as they can decrease the obstacles to adaptations. In addition, in the findings there is an emphasis on having a sustainable and resilient way of **thinking**. Examples of this include experimenting with adaptative strategies, diversifying the products for sale, and being flexible in using adaptative strategies especially with changing climatic conditions (King 2023).

At the end of this report I use a **matrix** of types of adaptative strategies (Figure 4) to discuss how wine industry decisionmakers choose what adaptative strategies to use and when with real life examples. Additionally, I created a **toolkit** for wine industry decisionmakers that demonstrates climatic effects and the use of short-term and long-term adaptative strategies to create resiliency (see below). Practical implications from the study's conclusions are there is a need for **more connection** between public institutions, wine industry decisionmakers, and wine industry groups as well as more information on how adaptative strategies can be used. Recommendations from this study are for more **community-based** research in the future, with public education institutions providing **access to information**, such as a database of adaptative strategies discussing their efficacy and how to implement them. In addition, it is recommended that wine industry groups and institutions aid in **creating access to equipment** and **funding** needed to implement adaptative strategies.

Figure 1. Sustainability and Resiliency Toolkit. ©Morgan King 2025



3.0 Methods

I came to this research when working in the wine industry, during this time I recognized how important it is and how it needs to evolve. I asked myself; how can we improve the sustainability of this wine industry? Over time this question evolved into the following research questions.

Research questions:

1. How are the Okanagan, Thompson, and Similkameen wine industries adapting to climate change?
 - a. What are the effects of climate change on the Okanagan, Thompson, and Similkameen wine industries?
 - b. What are the current hard and soft adaptative strategies being used to create resiliency to changes in climatic conditions?
 - c. Is cover cropping in vineyards an adaptation tool for resiliency to climate change in the Okanagan, Thompson, and Similkameen wine industries? And if so, how?
 - d. Is eco-certification an adaptation tool for resiliency to climate change in the Okanagan, Thompson, and Similkameen wine industries? And if so, how?
2. Can the Okanagan, Thompson, and Similkameen wine industries create resiliency through adaptation to climate change conditions? If so, how?

(King 2023, 6)

I have used these questions to guide my research, the questions in the survey and interviews, and the conclusions with the goal of helping the wine industry become resilient.

3.1 Phase I

The first phase was a literature review of academic and industry materials of topics in relation to the wine industry such as climate change, risks and vulnerabilities due to climate change, defining sustainability, resiliency and adaptation, and using hard and soft adaptative strategies to create resiliency, specifically eco-certification and cover cropping.

3.2 Phase II: Desktop Analysis

The second phase was an assessment of eco-certifications by creating an inventory of the wineries within the study area and conducting a search of their websites and eco-certification inventories to determine if the winery had any eco-certifications. I assessed the type of eco-certifications, the number of eco-certifications, and the combinations of eco-certifications in the study area.

3.3 Phase III: Survey

Phase III was an online survey that asked wine industry decisionmakers, such as vineyard managers, winemakers, and owners of vineyards/wineries, how they think of resiliency in the wine industry and if they use adaptation tools for climate change and how. Questions were decided using knowledge from the literature, experience in the wine industry, and input from SWBC, BCGGA, and BCWGC.

3.4 Phase IV: Interview

In phase IV, to address the information collected by the desktop analysis and the survey, five interviews were conducted with wine industry decisionmakers to allow for a more in-depth understanding of sustainability and resiliency. I asked questions about the effects of climatic conditions, the barriers to adaptative strategies, and how adaptative strategies are used and thought of such as hard and soft adaptative strategies.

4.0 Results

4.1 Phase I: Literature Review

During the first phase of research, the literature review, I looked at industry and academic materials on the region, winemaking, and climate change such as books, journal articles, newspaper articles, and materials written by the provincial government, federal government, and wine industry community groups. I created a **conceptual framework** to understand how the different topics related; it is a visual understanding of the topics and their connections in the wine industry field (Figure 2 below). At the top of Figure 2 is **terroir = value** since terroir is valued in the wine industry both culturally and monetarily. Connected to terroir below and to the left is **culture**, as cultural practices such as winemaking methods that have been passed down generations, are an important influence on terroir. **Climate** and **soil** are connected below and to the right of terroir, representing how the region winegrapes are grown in and the soil they root in influence the flavour profile of the wine created. They are then connected to the **natural environment** (local soil, direction of the sun, and slope) and the **cultural environment** (grape varieties chosen, pruning methods, and the cover crops grown) as they impact the terroir of the wine.

In the middle is the sign for therefore, \therefore , implying that since what is above is true then what is below is also true: wine sustainability and resiliency is made up of the four pillars of **soil, economic, climate, and culture** since these are the common themes shown throughout the academic and industry literature. These four pillars show up in the discussion of **terroir** since it is valued monetarily and culturally, which with climate and soil are what makes up terroir (Poirier, Plummer, and Pickering 2021; Santos 2020; Cardell, Amenguel, and Romero 2019; Novara et al. 2021; Jones 2012). These four pillars connect to **adaptation**, since throughout the literature and in discussion with wine industry community groups I have found that wine sustainability and resiliency is increased by adaptation strategies. I focused on **hard** and **soft** types of adaptive strategies as they appear to be the most natural categorization in strategies due to how wine industry decisionmakers discuss strategies. This conceptual framework aided in guiding the creation of the survey questions for Phase III and the interview questions for Phase IV.

Figure 2. Wine Sustainability and Resiliency Conceptual Framework. ©Morgan King (King 2023, 28, Figure 6)

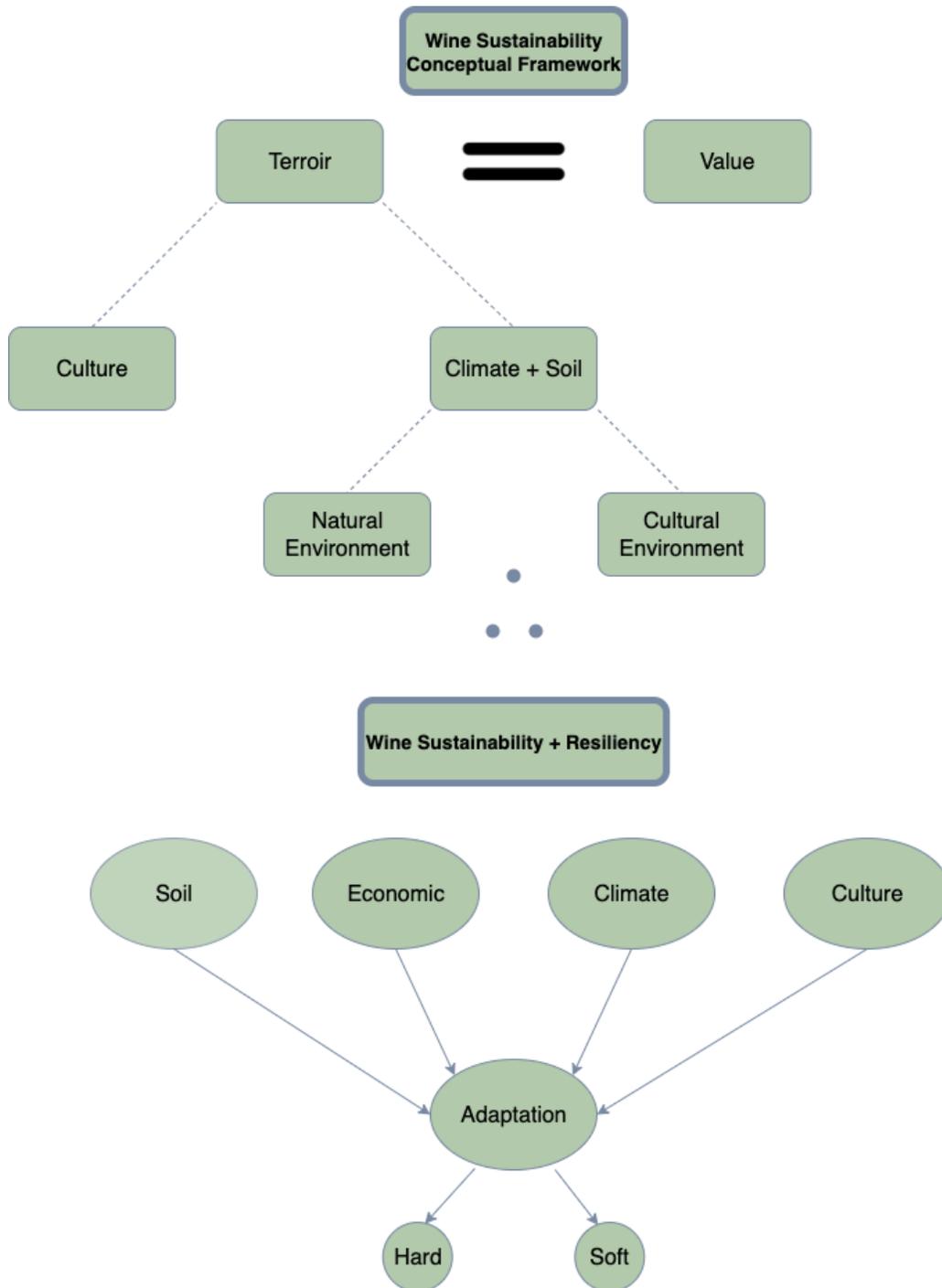
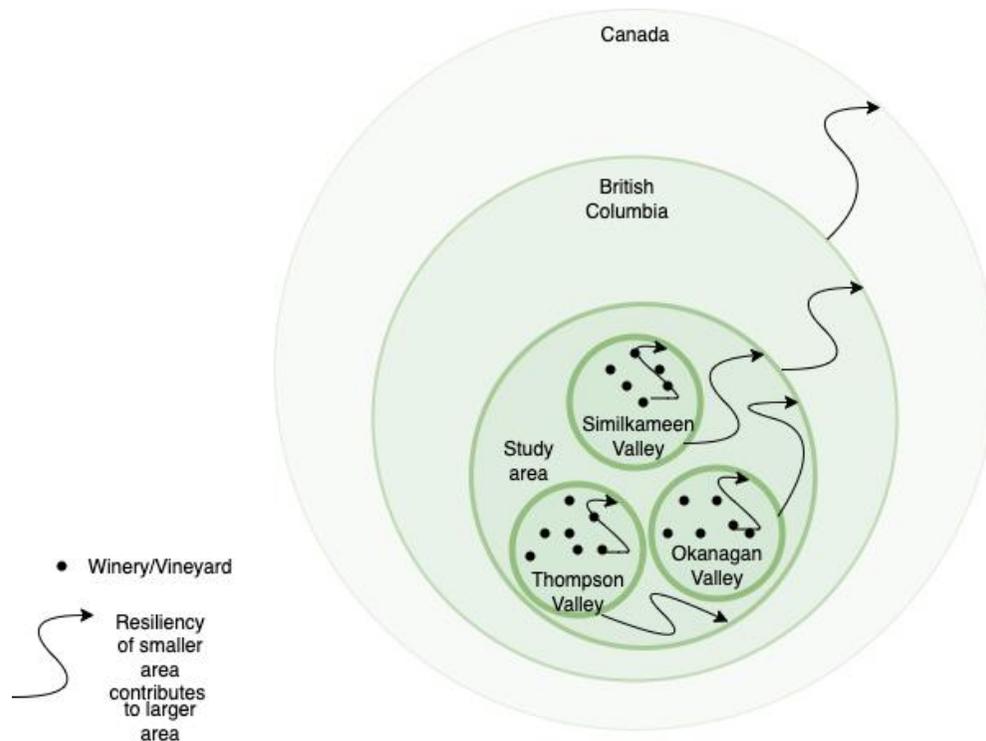


Figure 3. Nested Systems of Resiliency. ©Morgan King 2023 (King 2023, 32, Figure 7)



During the literature review **resiliency** and different scales of resiliency were mentioned numerous times. I created Figure 3 (above) to show the different scales of resiliency, their importance, and how they interacted with each other. This figure demonstrates how the resiliency of wineries and vineyards contribute to the resiliency of the region they are within such as the Similkameen, Thompson, and Okanagan Valleys. And how these smaller areas then contribute to the larger resiliency of the study area, British Columbia, and Canada overall (Conz, Denicolai, and Zucchella 2017; Kenny 2011). These findings resulted in a focus on **organizational resilience** (resiliency at the winery and vineyard scale) and **local community resilience** (wine regions) in the research.

Figure 4. Matrix of Adaptation Strategy Possibilities. ©Morgan King 2023 (King 2023, 36, Figure 8)

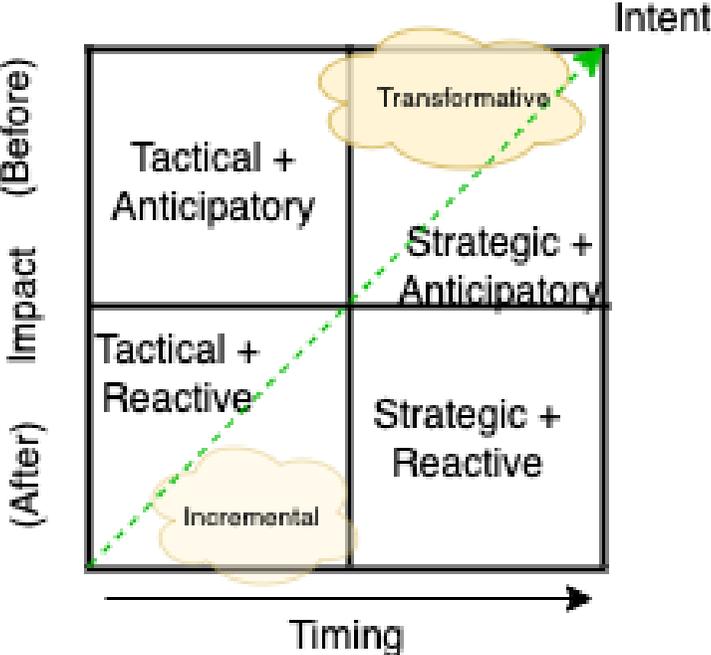
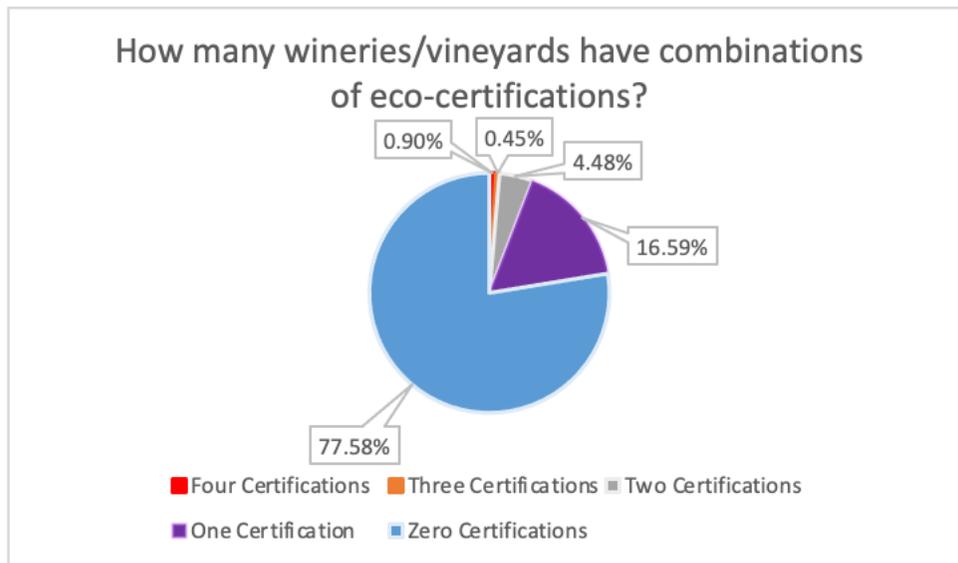


Figure 4 demonstrates how **adaptive strategy** types can be categorized, depending on **timing, intent**, and if it occurs **before** or **after** a climatic condition, such as a flood (Holland and Smith 2014; O’Brien et al. 2012). Understanding these different definitions can be useful since having diverse types of adaptive strategies can increase resilience. **Hard and soft adaptive strategies** were looked at in this research study since they are how adaptive strategies appear to be naturally divided in the wine industry. **Hard** adaptive strategies are less flexible, more expensive, and usually involve a physical tool or infrastructure, an example is cover cropping. Whereas a **soft** adaptive strategy is flexible, less expensive, and can be training, or a program (Sovacool 2011; Hallegate 2009; Heltberg, Gitay, and Prabhu 2012).

4.2 Phase II: Desktop Analysis

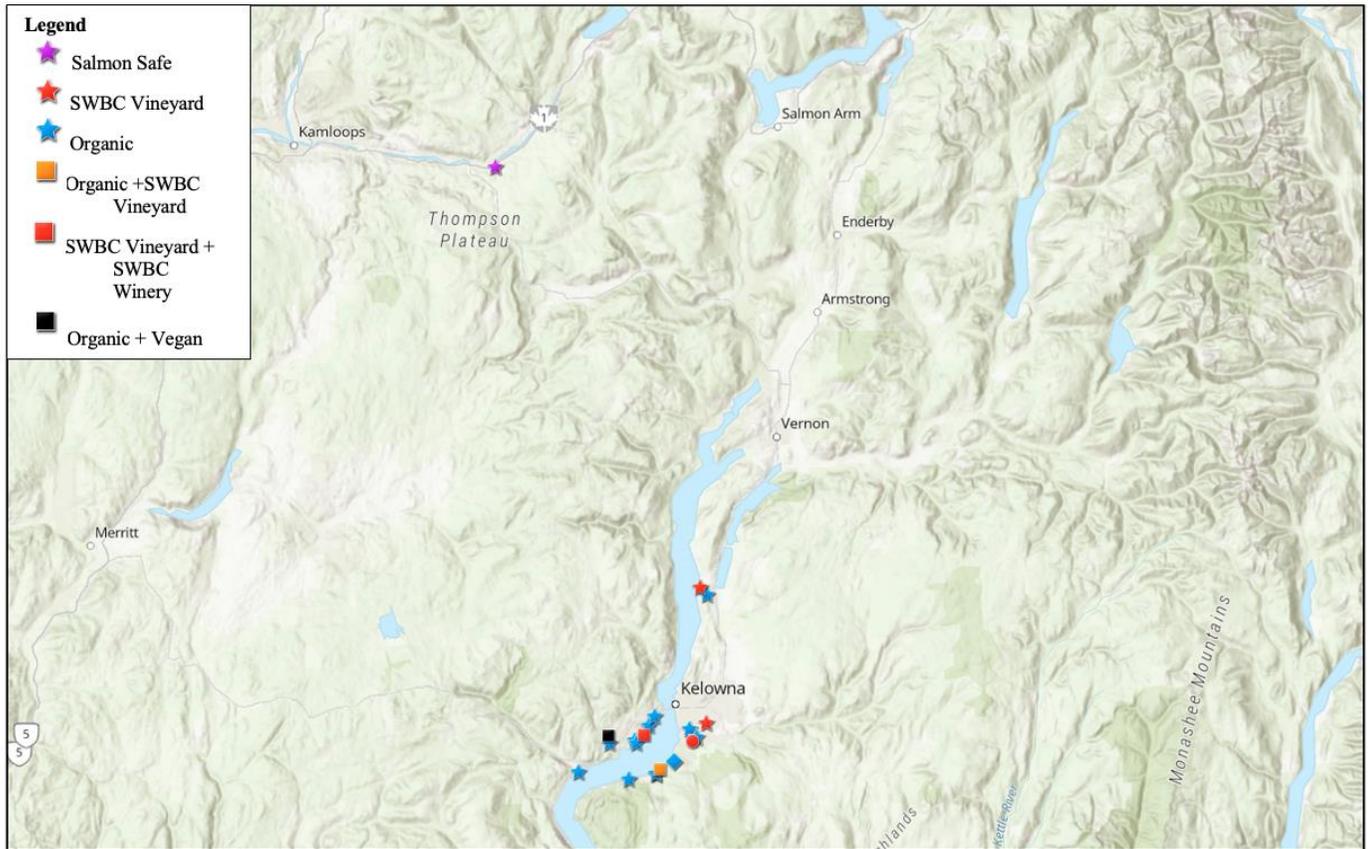
The desktop analysis was limited to the 223 licensed wineries/vineyards, since these met the requirements of being businesses with a liquor licence making wine. This data was gathered from the government BC website (<https://www2.gov.bc.ca/gov/content/employment-business/business/liquor-regulation-licensing/liquor-licence-permits/liquor-resources-information/bc-liquor-licensed-establishment-locations>) on June 23, 2022. Overall of the licensed wineries/vineyards **22.4%** had **one or more eco-certifications** (Figure 5).

Figure 5. Combinations of Eco-Certifications in Study Area (King 2023, 64, Figure 10)

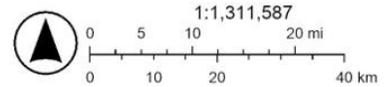


These eco-certifications are shown below on maps of the regional districts in Figure 6, Figure 7, and Figure 8 demonstrating how **far-ranging** this adaptative strategy is. As well, the eco-certifications were “Organic, Biodynamic, SWBC Vineyard, SWBC Winery, Salmon Safe, Vegan, Green Tourism, and Other (Figure 9). Five certifications were in the “Other” category: Radical Climate Smart, Regeneration Canada, LEED Silver, Certified B Corporation, and Canada GAP Food Safety” (King 2023, 63).

Figure 6. Eco-Certification Map – TNRD, RDNO, and RDCO. This map was created using Esri ArcGIS. Powered by Esri. By permission. (King 2023, 161, Figure 31)



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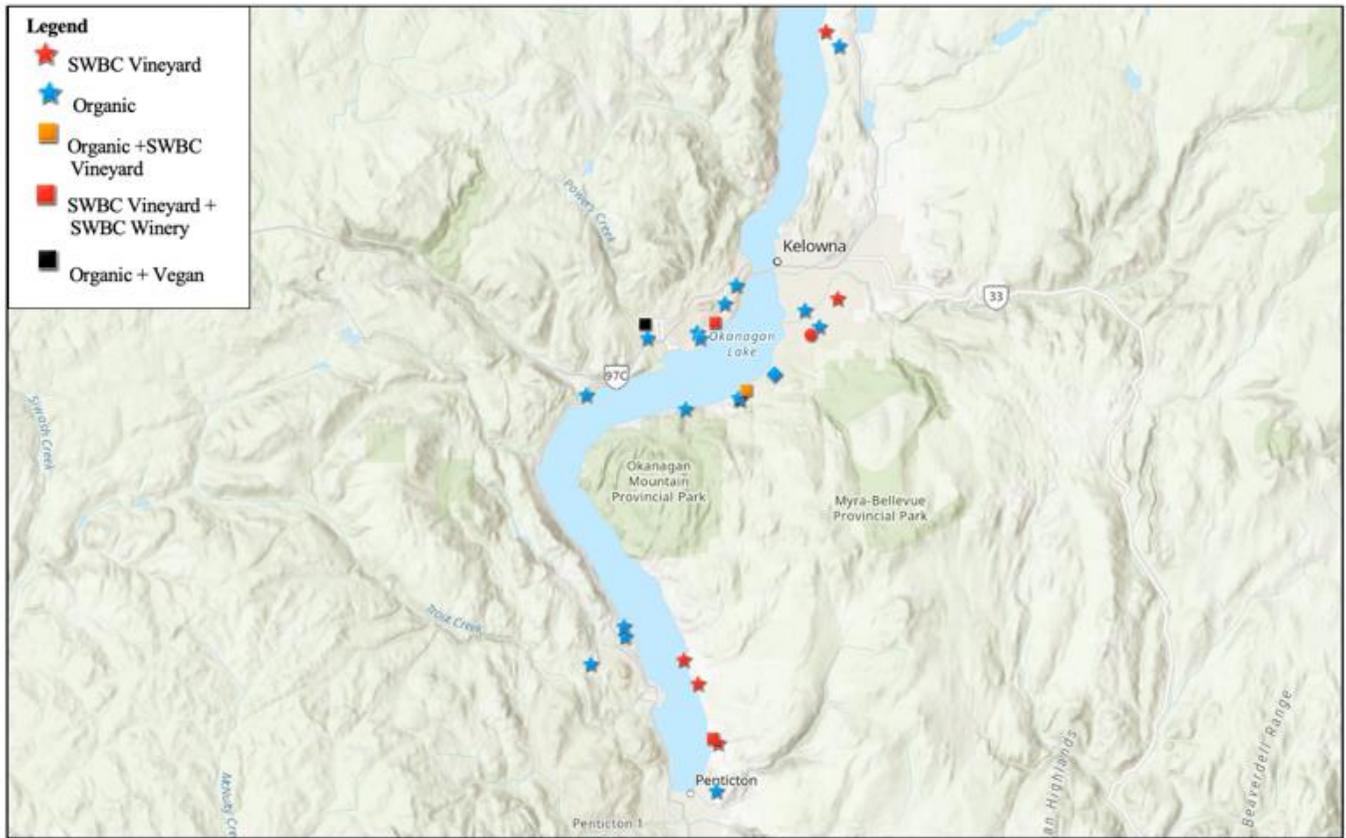


Sources for World Hillside: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatasysteisen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

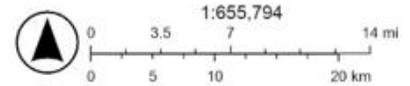
Sources for World Topographic:

Esri Canada, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada, Esri, USGS

Figure 7. Eco-Certification Map – RDOS and RDCO. This map was created using Esri ArcGIS. Powered by Esri. By permission. (King 2023, 162, Figure 32)



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Sources for World Hillside: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatuystrelen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

Sources for World Topographic:

Esri, CGIAR, USGS, Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NRCan, Parks Canada

Figure 8. Eco-Certification Map – RDOS. This map was created using Esri ArcGIS. Powered by Esri. By permission. (King 2023, 163, Figure 33)

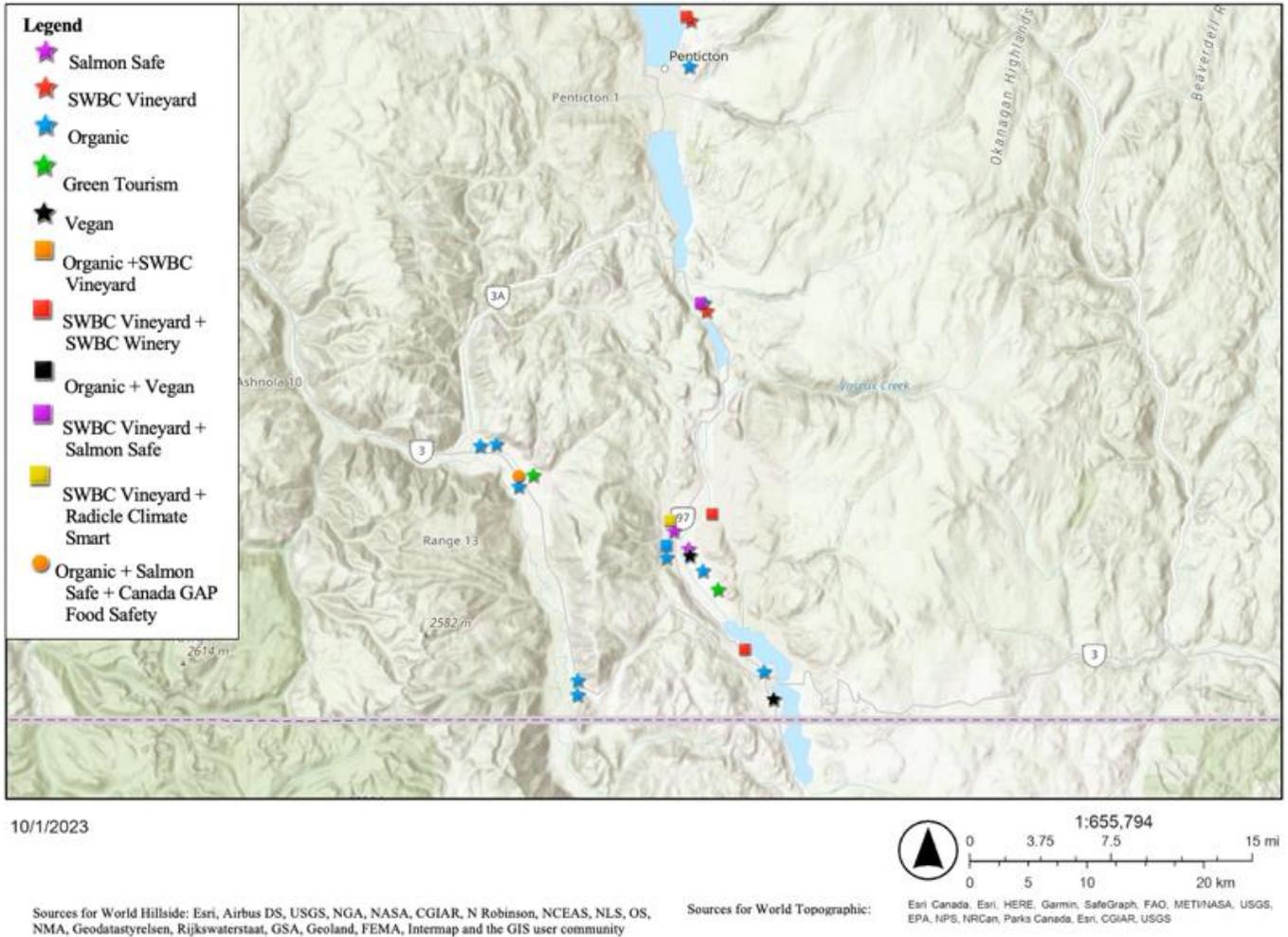


Figure 9. Eco-Certification Types in the Study Area (King 2023, 64, Figure 9)

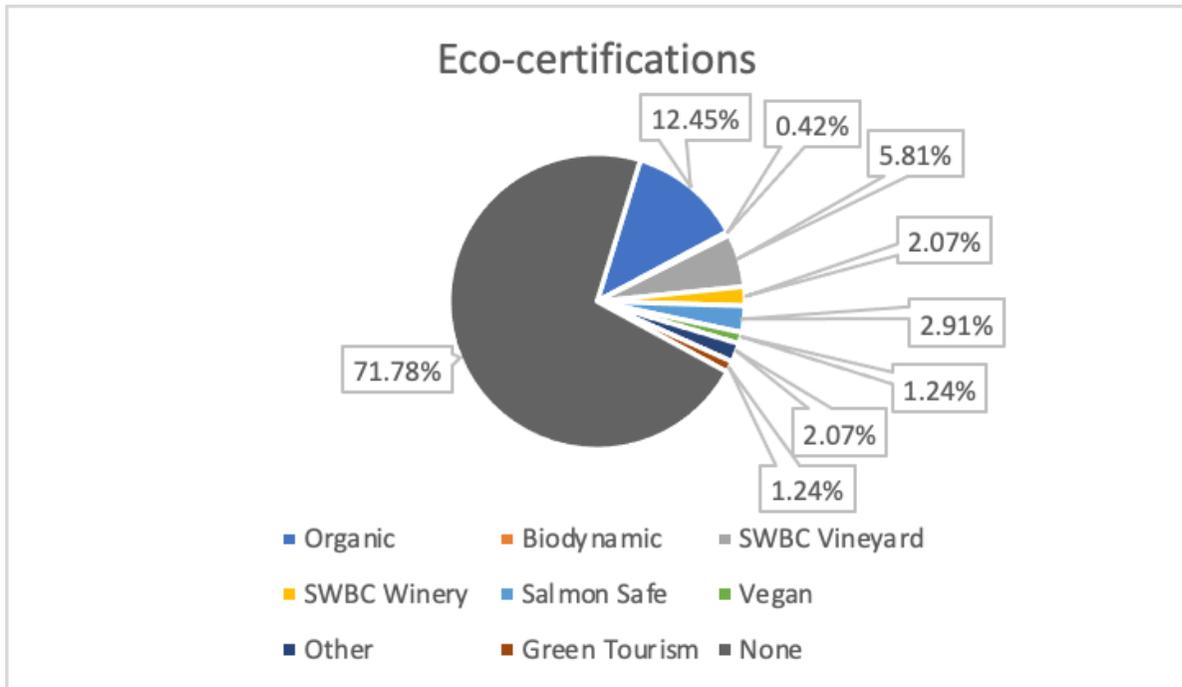


Figure 10 (below) shows the **eco-certification** combinations that were **most frequently** occurring. With Organic most often in combination, meaning many vineyards/wineries have an Organic certification and another eco-certification. The other eco-certifications that show up in combination often are SWBC Vineyard, SWBC Winery, and Salmon Safe with Table 1 (below) demonstrating all the combinations of eco-certifications.

Figure 10. Frequency of Eco-Certifications in Combinations (King 2023, 65, Figure 11)

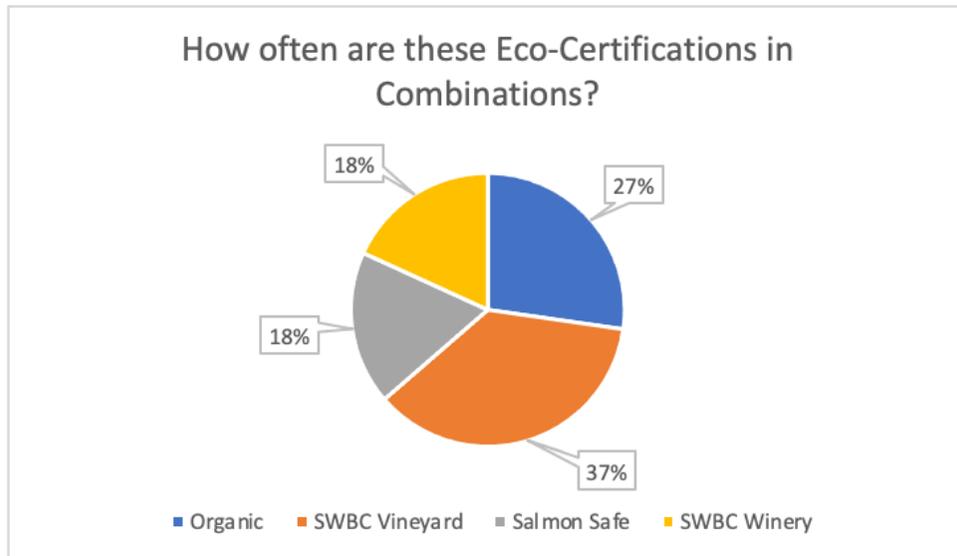


Table 1. Eco-Certification Combinations (King 2023, 66, Table 3)

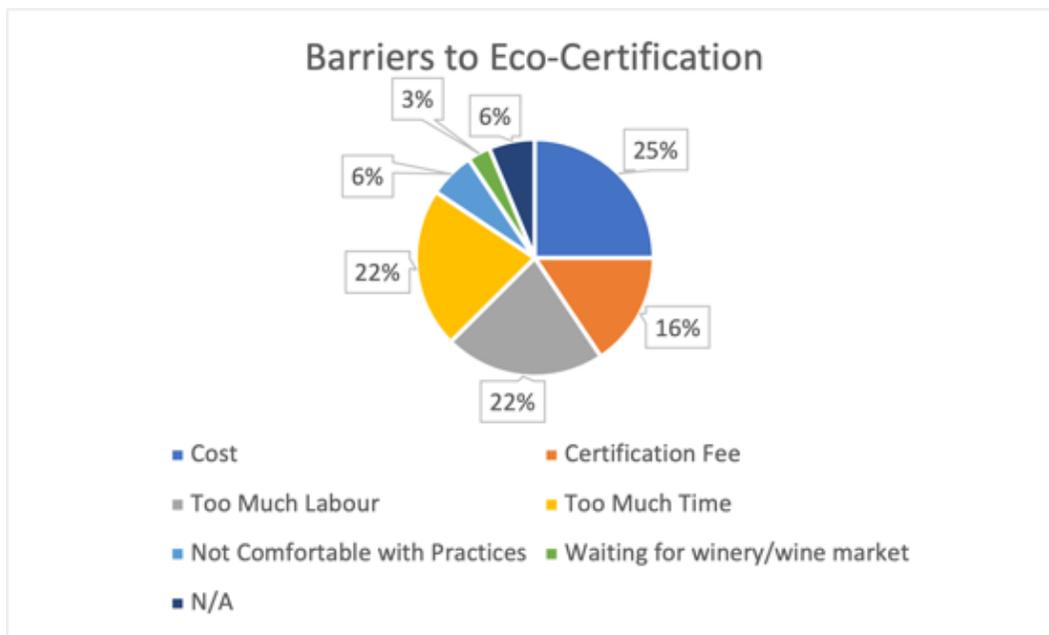
Number of Certifications	Combinations
Two Eco-certifications	Organic and SWBC Vineyard
	Organic and Regeneration Canada
	SWBC Vineyard and Radical Climate Smart
	Organic and Salmon Safe
	Organic and Vegan
	SWBC Vineyard and Salmon Safe
	SWBC Vineyard and SWBC Winery (X4)
Three Eco-certifications	Organic and Salmon Safe and Canada GAP Food
Four Eco-certifications	SWBC Vineyard and SWBC Winery and Salmon Safe and LEED Silver
	Organic and Biodynamic and Green Tourism and Certified B Corporation

4.3 Phase III: Survey Results

For the online survey, participants needed to be able to answer questions, be available, and be representative. These participants were first recruited through the mailing lists of SWBC, BCGGA, and BCWGC then vineyards and wineries were directly emailed, the email described the research and had a link to the online survey. The survey is made of **31 multiple choice questions**, takes 9 minutes to complete, and includes **sustainability, adaptive tools used, eco-certifications, and cover cropping**. Analysis of the results started with removing any partial surveys leaving 19 completed surveys. Then these questions were assessed for significant patterns, which is when **50% or more** of the participants answered with a particular choice. Sixteen questions were kept and displayed visually with bar graphs.

The online survey results show that the main **barriers** to eco-certification as an adaptation tool are **labour constraints, time, and cost** (Figure 11). Whereas considerations for purchasing cover crops are varied and did not have direct conclusions.

Figure 11. Barriers to Eco-Certification (King 2023, 69, Figure 14)



As well, these results determine that significant **direct** risks due to climate change are **extreme heat** and **smoke**, and **indirect** risks are **mildew** and **reduced tourism due to fire** (Figure 12 and Figure 13). In contrast, when assessing for any patterns due to **location** or **size operations**, there was **no regional pattern**; in fact the direct and indirect risks show up in all three districts. Whereas cover cropping did have a **higher rate for larger companies**. In general, the current use of adaptative strategies for all sizes and locations of companies are a mixture of **short-term** (such as fruit thinning) and **long-term** (such as cover cropping) as shown in Table 2 on the next page.

Figure 12. Results of Question 13 of the Online Survey (King 2023, 70, Figure 15)

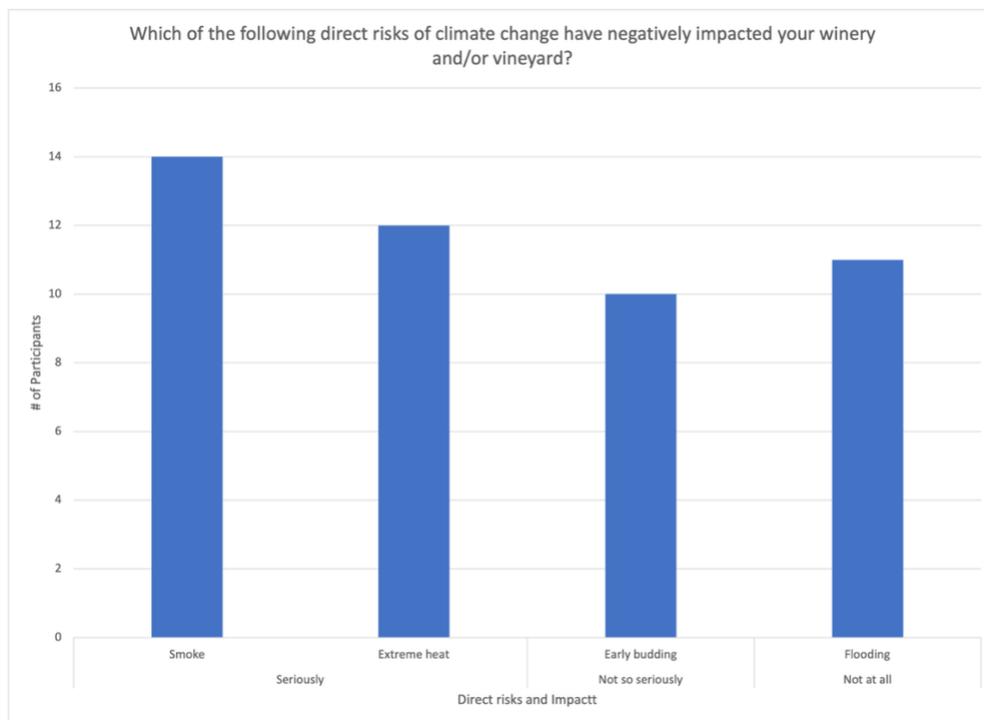


Figure 13. Results of Question 14 of the Online Survey (King 2023, 7, Figure 16)

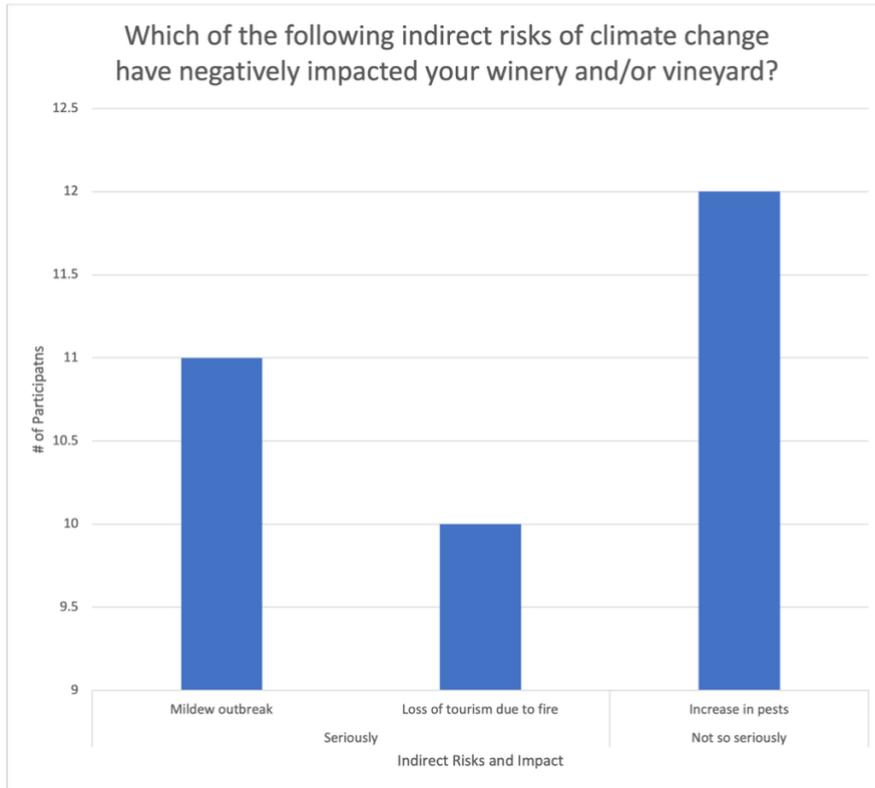


Table 2. Responses to Question 19 of the Survey (King 2023, 76, Table 4)

Current Adaptive Strategies	# Of Responses
Fruit thinning	13
Adjustment of water management	11
Change price of wine	11
Cover cropping	10
Varietal selection	9
Blend wines	8
Change style of wine	8
Purchase grapes	7
Vineyard selection	7
Irrigation to minimize frost	2

The results of the online survey were interesting and useful for the interviews as many questions were **too complex** and needed to be answered in an open-ended manner. Additionally, the survey results, provided interesting information for **future research**, demonstrating how a different way to inventory wineries and vineyards is needed because only those with liquor licences were included.

4.4 Phase IV: Interview Results

For the interview results **regional context** was provided by the results of the desktop analysis and the survey, while the literature review allowed it to be understood in the **larger context** of wine sustainability and resiliency. Participants were selected from the online surveys as well as referred by interview participants. The interviews ranged in **length of 45 to 75 minutes** and had approximately **11 questions** depending on answers. Analysis took several steps, first preparing the transcripts by removing personal information and verifying accuracy. Then reading over the interview transcripts multiple times to familiarise with the data.

With multiple readings patterns started to emerge and were given a **code** which is one or a couple words summing up an idea, are patterns of thoughts, and can be repeated phrases; to be created they need to have either two participants repeat it or one participant multiple times. With closer readings the codes evolved to become more specific with some of them being combined, and sometimes there are **child codes** which are a more specific idea within a code. Eventually, these codes were then grouped together into **themes**, which show central overarching ideas in the data and are more general. The interviews resulted in **fifty-six codes** which were organized into **seven themes** and **two subthemes**, shown in Figure 14 and Table 3. **Subthemes** are created when a grouping of codes can be created within a theme. This coding and theme creation was completed with NVivo a software program that allowed for me to highlight quotes, keep track of ideas, and group quotes together (Creswell and Creswell 2018; Braun and Clarke 2022).

An example is **Theme 2** Current Direct and Indirect Impacts of Climate Change (Table 3), it has the **codes** Extreme heat, Smoke, Financial effects of climate change, Extreme cold, and Insect pests within it. They are connected by a similar thought, as they are all impacts of climate change both indirect and direct and they are separate ideas not repetitive. Some of these themes were **mentioned by the researcher**, most **were identified from the results of the interviews** and **by participants** during the interviews.

Figure 14. Interview Themes. ©Morgan King 2023 (King 2023, Thesis Presentation, Figure 1)

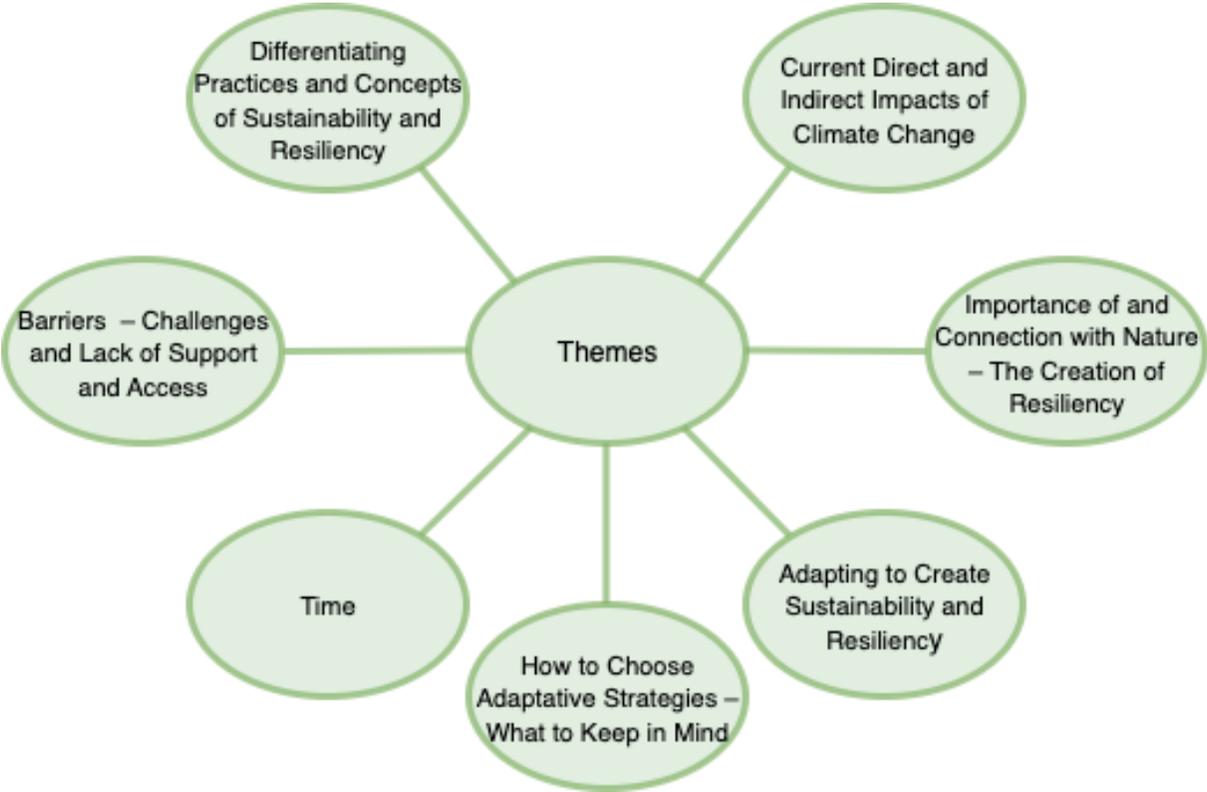


Table 3. Themes, Subthemes, and Codes of Interview Results (King 2023, 93-95, Table 7)

Theme		Code and Child Codes
Differentiating Practices and Concepts of Sustainability and Resiliency		Defining sustainability – how sustainability is thought of
		What is sustainability in practice
		Sustainability as core value of company
		To be resilient and definition of resiliency
		Sustainability and resiliency, once you have one you have the other
		Creation of resiliency
Current Direct and Indirect Impacts of Climate Change		Extreme heat
		Smoke
		Financial effects of climate change
		Extreme cold
		Insect pests
Importance of and Connection with Nature – The Creation of Resiliency		Biodiversity <ul style="list-style-type: none"> • Biodiversity equals healthy plants <ul style="list-style-type: none"> ○ Healthy plants
		Soil <ul style="list-style-type: none"> • Soil health
		Happy vineyard as a wild one
		Better vine health, more resiliency
		Better quality grapes from more resilient vines
		Importance of place in grape growing
Adapting to Create Sustainability and Resiliency		Current adaptative strategies
		Current hard adaptative strategies
		Hard strategies as more frequent
		Current soft adaptative strategies
	Subtheme: Eco-certification	Why certify – reasons to certify
		Certification as strategy
		Consumers’ perception and reaction
		State of thinking created by eco-certification

Theme		Code and Child Codes
	Subtheme: Cover cropping	Cover cropping – as living blanket, protection
		Cover cropping as multi-solution
		Cover cropping use of crops for precise problems and strategies
How to Choose Adaptative Strategies – What to Keep in Mind		Knowledge as a tool and strategy <ul style="list-style-type: none"> • Learning as a strategy • Learning by - self and others
		Financial – optimization of practices to save money
		Minimal use reduction
		Partnership with grower and winery – collaboration, resiliency, sustainability
		Flexibility as resiliency
		Change – change strategies methods
		Diversification of products and packaging as a strategy
		Experimentation as a strategy – changing how making wine
		Balance and balance multiple aspects, inputs, products
		Good strategy as holistic including all important elements
Time		Looking to future – direction of sustainability
		Patterns of climate change or weather
		Time – strategies evolving over time, how much time it takes
Barriers – Challenges and Lack of Support and Access		Barrier to cover cropping Establishment of crop
		Barriers to eco-certification <ul style="list-style-type: none"> • Bureaucracy and paperwork challenges • Lacking brand strength – strategy not enough <ul style="list-style-type: none"> ○ Awareness is needed to create a consumer demand
		Cost – inaccessibility to strategy
		Regulation
		Missing and lack of – access to labs, machinery, and help
		Need for more information – lack of information

Note: The dashes indicate more information, and the bullet points are child codes.

5.0 Key Takeaways

There are several key takeaways from this research study:

- An emphasis on having a sustainable and resilient mindset
- Increased resources such as labour, time, and cost as the main barrier to adaptative strategies
- Inaccessibility of information affecting wine industry decisionmakers implementation of adaptative strategies
- Disconnection of social and professional networks of the wine region

5.1 Mindset

The first key takeaway is that wine industry decisionmakers in the study area focus on using adaptation to meet **current conditions** such as weather, location, and product versus utilizing specific adaptative strategies. There is an emphasis on having a **sustainable and resilient mindset**, thus adaptative strategies are used together to work as a unit to address problems. In the next section I discuss how you can have a sustainable and resilient mindset by using real life examples, my matrix of adaptative strategies, and demonstrating examples of both short-term and long-term adaptative strategies that can be chosen.

5.2 Increased Resources



Image 3. Vineyard with cover crops in alleyways. 2022.
Own work.

Another key takeaway is that a **main barrier** to using adaptative strategies are the **increased resources** that are needed to access the strategy such as labour, time, and cost. In this case it is recommended that community associations aid by helping wine industry decisionmakers access equipment and money thus reducing barriers. This could include buying equipment and renting it out or helping groups of growers to pool resources for purchasing equipment or lending it out. As well, they can help wine industry decisionmakers access government funding since cost is a higher barrier for adaptative strategies especially cover cropping.

5.3 Knowledge Mobilization

An additional barrier to implementing adaptative strategies is **knowledge mobilization**, since wine industry decisionmakers who need access to information about adaptative strategies may not have it. In this case, public education institutions need to provide more access to information for the wine industry such as adaptative strategies, how to implement them, and their effectiveness. An example would be a public database that would allow people to look up common problems in the vineyard/winery and find solutions or look up adaptative strategies and see information on how to implement them and potential problems with using them.

5.4 Networks

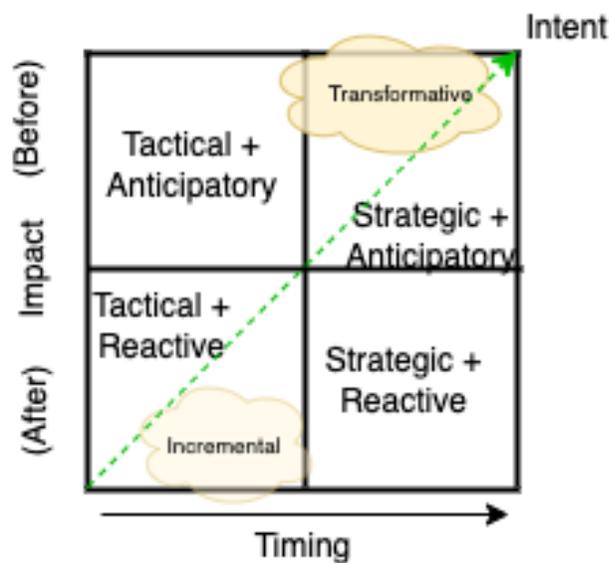
With this research wine industry decisionmakers have indicated that **social and professional networks** of the wine study region are not functioning and there needs to be more connection and communication between groups. For this to occur, **social capital** needs to be increased by individuals and community associations to mend these networks, this can be done by providing information and help with those you would like to depend on. Thus allowing for a more group-based approach to increasing sustainability and resiliency by public institutions and community associations especially with future research.

Other suggestions for future research from this research study would be to use **door-to-door** and **phone call surveys** to increase response. As well, to have **group workshops** since this would facilitate discussion between wine industry decisionmakers and allow for more connection and knowledge transferral between them.

6.0 How to Implement Adaptative Strategies?

During this report I discuss the more common adaptative strategies used and how wine industry decisionmakers currently use adaptative strategies in the study area. Throughout the last five years there have been major climate change events that have affected the wine industry, I will discuss different events and how wine industry decisionmakers have reacted to them with the use of the Matrix of Adaptation Strategy Possibilities (Figure 15). By using the Matrix I hope to clarify how using a diverse array of adaptative strategies can be useful in increasing the overall sustainability and resilience of a winery/vineyard.

Figure 15. Matrix of Adaptation Strategy Possibilities. ©Morgan King 2023 (King 2023, 36, Figure 8)



6.1 Before and After Impact

The first is the early frost and freeze that occurred in the winter/early fall of 2024 and the wildfire smoke of 2023, the frost and smoke are the **impact** which is on the left side of the diagram. Any adaptative strategies that had already been in place (**Before Impact**) are considered **anticipatory**, since they have anticipated events that could occur (Holland and Smith 2014). If a vineyard had had problems with early frost in the past they may have changed their pruning to occur later in the fall thus allowing buds more protection as well as more buds to compensate if some died, this would be an **anticipatory** adaptative strategy. Adaptative strategies that occur after the early frost (**After Impact**) are considered **reactive**, since the wine industry decisionmaker is reacting to the situation that has occurred such as using motorized windmills to blow out cold spots or using activated carbon fining to remove smoke taint from wine (Holland and Smith 2014).

6.2 Timing

Another example is the **lack of tourism** that occurred in both the summer of 2023 due to smoke from wildfires and the summer of 2024 because of the lack of crops. Some wineries then utilized other methods of gaining income, such as increasing the number of events that occurred at their winery or focusing on their short-term rentals. These strategies could be **strategic** strategies, which look at the **long term**, so they are further along on the **timing** axis which is at the bottom of the matrix (Belliveau, Smit, and Bradshaw 2006; Poirier, Plummer, and Pickering 2021; Holland and Smit 2014; Gbejewoh, Keesstra, and Blancquaert 2021). Longer term strategies can occur over the course of years or may take multiple months to implement. These may be increasing space for customers in their restaurants or keeping the interest of their wine club, which allows for a steady stream of income, by using older sometimes more exclusive wines. **Tactical** strategies are **short-term** strategies, so they are to the left of the **timing** axis, an example is increasing the number of events for a year or season since there are less grapes to focus on or make wine with (Belliveau, Smit, and Bradshaw 2006; Poirier, Plummer, and Pickering 2021; Holland and Smit 2014; Gbejewoh, Keesstra, and Blancquaert 2021).

6.3 Intent

The third access of the matrix is **intent**; it focuses on what is the intent of your adaptative strategies and what purpose do you have for them. Do you want this adaptative strategy to be **incremental** so over time it will incrementally help you to become more sustainable and resilient as a winery and/or vineyard? Or do you want this adaptative strategy to be **transformative** such that to increase resiliency the whole system, in this case the winery and/or vineyard, will change to achieve this (Holland and Smit 2014; O'Brien et al. 2012)? What these adaptative strategies are is dependent on the company, the decisionmaker, and what future they are aiming for. For example, with the frost event of 2024 in the Okanagan, Similkameen, and Thompson wine regions an adaptative strategy that can be chosen is using crop insurance to replace the grapevines. This can be done such that it is **incremental**, so the replacement grapevines are similar with maybe a slightly better rootstock that is less susceptible to cold but is still a popular European varietal. Or it is **transformative** since the winery is focusing on how the climate in their region is predicted to change and the grape varietal chosen is a less popular hybrid but is shown to be more cold-tolerant. This choice may seem small, but it can affect the winegrape growing and winemaking process, the product, marketing, and how the winery thinks of resiliency and the future.

7.0 Conclusion

Since this research was published in November 2023 several climate change events have occurred locally in the Interior BC wine industry. This includes an **early frost and deep freeze event** in the winter of 2024 that decimated the industry's crops and grapevines. As well as the resulting **decrease in wine tourism** in the summer of 2024. **Increases in tariffs** in 2025 have made supplies from the United States more unstable, resulting in the wine industry having to find new suppliers. These events demonstrate the importance of creating sustainability and resiliency on the organizational scale and regional scale. There has been an **increase in discussion and collaboration** between wine industry community groups in these last few years, demonstrating the importance of a strong community for increasing the resiliency and sustainability of the wine industry overall. This touches on the main conclusions of my research, the need for more effective networks and knowledge mobilization.

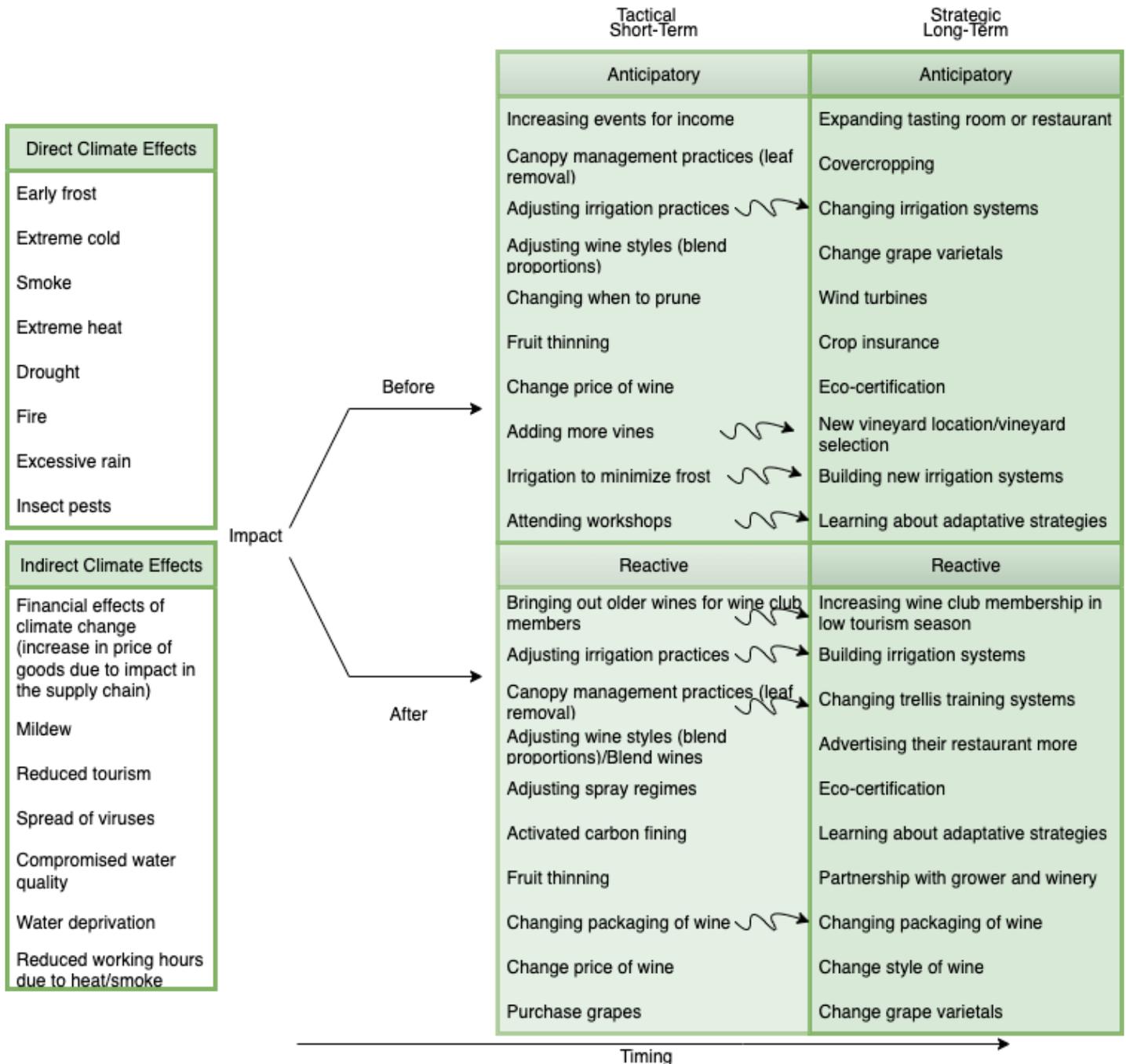


Image 4. Vineyard in Osoyoos in winter. 2020. Own work.

These disasters demonstrate how wine industry members need **tools of resilience**, below is a toolkit that demonstrates how indirect and direct climate effects can be reacted to both before and after the impact as well as for the short term and the long term. This toolkit can be used by wine industry decisionmakers to understand how to use adaptative strategies, examples of adaptative strategies, and when these adaptative strategies can be used. It is a starting point for understanding the complex decision-making behind choosing adaptative strategies.

8.0 Toolkit: Adaptation Strategy Possibilities

Figure 16. Resiliency and Sustainability Toolkit. ©Morgan King 2025



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Glossary of terms

Codes: “Codes describe repeated meanings or phrases within the dataset by labeling them with a description, and they are created when the pattern is repeated by two participants or multiple times by one participant. Codes demonstrate how the interview participants think of the interview topics and are the consistent patterns of thoughts the participants have, whereas themes capture overarching ideas that consist of multiple codes grouped” (King 2023, 92).

Cover cropping: Planting different crops between the rows of the main crop, in this case grapes. This can be edible crops or crops used to add biomass to the soil, this adaptative strategy also increases organic matter and soil fertility and reduces water and soil loss. (Novara et al. 2021; Dunn et al. 2016; Poirier, Plummer, and Pickering 2021; De Steur et al. 2019; Santos et al. 2020)

Eco-certification: A sustainable certification that involves helping the environment, increasing sustainable practices, and informs the consumers of this information, given through an accredited and recognized independent body. (Corbo, Lamastra, and Capri 2014; Delmas and Lessem 2015)

Themes: “Themes have a central organizing concept with multi-facets of meaning from a qualitative dataset, and they are made up of codes (Braun and Clark 2022)” (King 2023, 92).