

TERROIR CONSULTING

# Grape Gap Analysis

Prepared for the British Columbia Ministry of Agriculture and Food

July, 2024



Ministry of  
Agriculture  
and Food

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Prepared July, 2024 by

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## TERROIR CONSULTING

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## *Executive Summary*

This Grape Gap Analysis report, commissioned by the British Columbia Ministry of Agriculture and Food and conducted by Terroir Consulting, addresses the urgent need for replanting in the BC wine grape industry following significant crop losses due to environmental factors and disease. The primary objective of this report is to address knowledge gaps from a previous 2023 report, and secondarily, to support science and market-based guidelines for the forthcoming 2024 Enhanced Replant Program, detailed in the subsequent Re-Planting Guidelines and Recommendations report.

Extensive stakeholder engagement, including detailed interviews with industry stakeholders and committee members, as well as a comprehensive survey of BC grape growers, informed the findings and recommendations. A broad range of perspectives was represented and provided valuable insights into the current state of the industry. Additionally, anonymized aggregated data from secondary sources was utilised, ensuring recommendations were grounded in the current realities of grape growing in BC, and providing a holistic understanding of the industry's challenges and needs.

The estimated percentage of vineyards currently in need of replanting ranges from 43% to 79% of the province-wide acreage, translating to between 5,579 and 10,233 acres.

The report highlights the widespread prevalence of grapevine trunk diseases and viruses, which have affected substantial portions of vineyards, underscoring the need for timely intervention and replanting efforts. Severe cold in December 2022 and January 2024 resulted in additional vine and crop losses. It is important to encourage grape growers to adopt resilient farming practices to improve vineyard resilience.

This report details the BC wine grape industry's unique climatic and viticultural constraints. Although replanting efforts must be suitable for each varied vineyard location, grape varieties have not yet been matched with sub-regional climates: this is work for a subsequent project. Replanting efforts must also align with market demands for wine grapes' value-added products. This report reviews the market for BC wine, and suggests possible grape varieties to meet top marketable wine styles and consumer preferences.

This Grape Gap Analysis report is a crucial step in understanding the unique challenges faced by the BC wine grape industry and ensuring its long-term sustainability and success. The findings and recommendations provided will guide the Ministry of Agriculture and Food in effectively implementing the Enhanced Replant Program and supporting grape growers in BC.

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# Grape Gap Analysis

## *Background*

The Perennial Crop Renewal Program was launched in 2023, to “remove unproductive, diseased, or unmarketable cultivars and to adopt growing systems that are better suited to environmental conditions and market demands”. In response to the first Sector Development Project stage, a 2023 report entitled, “An Opportunities Assessment for the BC Grape and Wine Industry”, sought to address the challenges the BC wine grape industry was facing and identify solutions.

With the additional crop losses from severe cold in the winter of 2024 and the launch of the Enhanced Replant Program in March 2024, the Ministry of Agriculture and Food identified the need to address gaps from the 2023 report, and to provide science and market-based guidelines for the delivery of replanting funding.

The Enhanced Replant Program in BC is for the wine grape, tree fruit, and berry industries; however, the wine grape industry has unique needs and considerations for effective support. Specifically, the BC wine grape industry is a supportive market for value-added products. Due to complex quality, style, and pricing factors for wine, as well as very specific, complex consumer demands in the context of a global market, wine grapes do not function as an interchangeable commodity. Therefore, any planting decisions must take into account climatic constraints and farming decisions, as much as market viability for the end products.

Thirteen one-hour, detailed interviews were conducted by Terroir Consulting with industry stakeholders, and members of the Enhanced Replant Program committee, representing BC Grapegrowers’ Association (BCGG), the BC Wine Grape Council (BCWGC), Wine Growers British Columbia (WGBC), and the Wine Islands Growers Association (WIGA). This ensured many varied perspectives from the wine grape industry were represented in the findings and conclusions. An additional feedback group meeting was held for industry stakeholders, which relayed the draft recommendations for replant funding distribution.

In order to provide the Ministry of Agriculture and Food with a holistic and detailed understanding of the unique aspects of the wine grape industry, anonymized, aggregated data from the BC Wine Grape Council’s crop report, the Business Risk Management Branch’s production insurance, and sales figures from the BC Liquor Distribution Branch were accessed and informed the outcomes of this report. Additional data collected included a thorough literature review, unpublished disease data from the Summerland Research Centre, and advice from industry experts.

To address the remaining gaps in the 2023 report, as well as develop guidelines for the delivery of replanting funding, a survey of BC grape growers was conducted. Terroir Consulting developed nineteen questions that would address the gaps in analysis and inform the recommendations for replant funding. The online quantitative survey was launched in partnership with the BCWGC and the BCGG to help researchers and industry associations understand the extent of climate, disease, and virus-related impacts to wine grape crops in BC, as well as the current market distribution and situation for BC wines.

The open-link online survey was scripted in SurveyMonkey and sent out by WGBC in their weekly newsletter to industry on June 6, 2024. The BCWGC and BCGA sent the survey to their respective members on June 11th, 2024.

Both wineries and grape growers were encouraged to contribute and answer a series of questions on wine production, crop production, mitigation practices, and vine health. The results of the survey and all resulting data is owned by the BCWGC. The average response time for the 142 respondents was 10:42 minutes. On June 17th, 2024, the results of the nineteen questions relevant to this report were aggregated and anonymized for analysis by Terroir Consulting to use in the Enhanced Replant Program (ERP) and for work being conducted by the Wine Grape Industry Task Force. The survey was left active beyond this date to continue collecting information for the BCWGC and BCGG; however, any responses collected after June 17th 2024 are not included in this report.

The results of this Grapevine Impact Study have been integrated into the relevant sections of the Grape Gap Analysis as well as the Re-Planting Guidelines and Recommendations. For each result, the full question seen by respondents is included, as well as the reporting base size as responses for each question were optional and vary. The results included in both reports represent the full reporting and analysis conducted by Terroir Consulting for the ERP and there is no stand-alone report.

SECTION 1

# BC Wine Grape Acreage

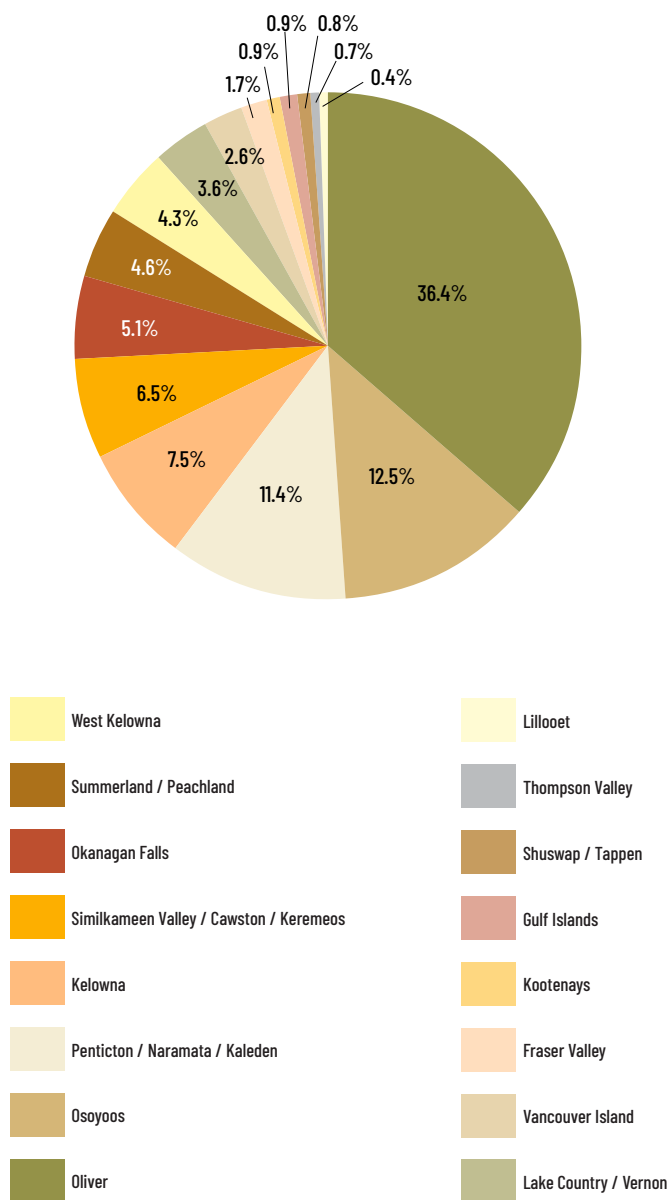




# Acreage

In 2023, there were 12,929 acres of wine grape vines planted in British Columbia (BCWGC). The southern Okanagan Valley, including vineyards surrounding Oliver and Osoyoos, account for almost half of the province’s plantings. The remaining half of the province’s vineyards are spread throughout different climatic zones, including the semi arid desert of the Okanagan, Similkameen, and Thompson Valleys, the verdant Shuswap and Fraser Valley, the maritime Vancouver and Gulf Island, and the high elevation Kootenays and Lillooet regions.

FIGURE 1: VINE ACRES PLANTED BY REGION IN 2023 (ACRES)



Source: BCWGC, 2023

The broad diversity of the climatic, soil, biomes, and cultural practices have been recognized as 10 distinct geographical indications (GI), each having unique terroir, the conditions which affect the grapes and resulting wines. Additionally, 12 sub-geographical indications (sub-GI) have been established and recognized. This includes 11 specific site considerations within the largest geographical indication, the Okanagan Valley, as well as one sub-GI on Vancouver Island.

TABLE 1: OVERVIEW OF GEOGRAPHICAL INDICATIONS AND SUB-GEOGRAPHICAL INDICATIONS

GEOGRAPHICAL INDICATIONS	
Vancouver Island	
<i>Vancouver Island Sub-GI</i>	Cowichan Valley
Okanagan Valley	
<i>Okanagan Valley Sub-GI</i>	Lake Country
	East Kelowna Slopes
	South Kelowna Slopes
	Summerland Valleys
	Summerland Lakefront
	Summerland Bench
	Naramata Bench
	Skaha Bench
	Okanagan Falls
	Golden Miles Bench
	Golden Mile Slopes
Kootenays	
Lillooet	
Gulf Islands	
Thompson Valley	
Similkameen Valley	
Shuswap	
Fraser Valley	

## Wine Grape Varieties

### GRAPEVINE DIVERSITY

In 2023, British Columbia had 102 distinct wine grape varieties planted across 12,930 acres of vineyard (BCWGC, 2023). This is a remarkable diversity of varieties given the relatively small acreage of vineyard that exists in BC. For comparison, Ontario has 18,000 acres of wine grapes in production, with around 50 varieties planted (Grape Growers of Ontario, 2024). Although both provinces have a wide range of possible Growing Degree Days and latitude in growing regions (Wine Country Ontario, 2015), British Columbia's variety of plantings reflect the added complexity of maritime, to extreme continental, to alpine biomes in which viticulture takes place.

The top five red varieties planted by acreage in British Columbia, making up 48% of total plantings, include Merlot, Pinot Noir, Cabernet Sauvignon, Cabernet Franc, and Syrah. The top five white varieties planted by acreage, making up 30% of total plantings, include Pinot Gris, Chardonnay, Riesling, Gewurztraminer, and Sauvignon Blanc.

The 92 remaining varieties planted make up a total of 22% of total plantings. Substantial (more than 100 acres) plantings of Gamay Noir, Viognier, Pinot Blanc, Malbec, Marechal Foch, Muscat, and Petit Verdot make up 1,268 acres or 45% of this diverse list of remaining varieties.

TABLE 2: WINE GRAPE VARIETIES PLANTED IN BC - 2023

VARIETIES	ACRES IN BC
Merlot	1,874.32
Pinot Noir	1,714.08
Pinot Gris	1,319.40
Chardonnay	1,260.35
Cabernet Sauvignon	1,006.92
Cabernet Franc	978.31
Syrah	669.73
Riesling	664.30
Gewürztraminer	659.96
Sauvignon Blanc	445.68
Gamay Noir	267.54

Viognier	244.88
Pinot Blanc	243.87
Malbec	159.21
Maréchal Foch	131.22
Muscat	112.45
Petit Verdot	108.54
Ehrenfelser	62.82
Sémillon	61.34
Siegerrebe	56.85
Bacchus	52.96
Ortega	49.16
Auxerrois	46.22
Vidal	45.95
Zweigelt	43.59
Chenin Blanc	38.44
Pinot Meunier	34.28
Roussanne	31.85
Kerner	31.75
Schönburger	31.36
Chasselas	25.78
Petit Milo	23.90
Tempranillo	23.13
Zinfandel	23.06
Pinotage	18.94
Grenache	18.09
Marquette	16.50
Carmenere	15.89
Madeleine Angevine	15.62
Grüner Veltliner	15.55
Frontenac Blanc/Gris	14.94
Sangiovese	14.30
Blattner Cabernet Foch	13.81
La Crescent	12.57
Sovereign Opal	12.41
Baco Noir	12.30

Müller Thurgau	11.53
Marsanne	9.98
Sylvaner	9.90
Optima	9.56
Frontenac Noir	9.55
Blattner Brickett Red	9.48
Lemberger	8.40
Blattner Cabernet Libre	7.29
Zengo	7.00
Albarino	6.75
Chancellor	6.60
Léon Millot	6.38
Mourvedre	6.15
Castel	5.97
Tannat	5.63
Dunkelfelder	5.04
Reichensteiner	5.00
Oraniensteiner	4.96
Madeleine Sylvaner	4.50
L'Acadie Blanc	4.38
Barbera	4.32
Dolcetto	4.25
Traminer	3.56
Orange Muskat	3.18
Dornfelder	3.17
Petit Sirah	3.07
Trebbiano	3.03
Malvasia	3.00
Concord	3.00
Rotberger	2.80
Teroldego	2.61
Nebbiolo	2.57
Touriga Nacional	2.50
Verdejo Verdelho	2.30
Rosette	2.00

Verdelet	1.80
Regent	1.66
Chambourcin	1.63
Montepulciano	1.40
Perle of C'saba	1.02
Gamay Fréaux	1.00
Gamay de Bouze	1.00
Alicante	0.94
Agria	0.84
Lucie Kuhlman	0.67
St. Laurent	0.60
Seyval Blanc	0.60
Savagnin	0.59
Petite Arvine	0.58
Epicure	0.40
Cinsault	0.40
Aglianico	0.40
Refosco	0.39
Rkatsiteli	0.04
Siegfriedrebe	0.01
<b>GRAND TOTAL</b>	<b>12,929.48</b>

Source: BCWGC, 2023

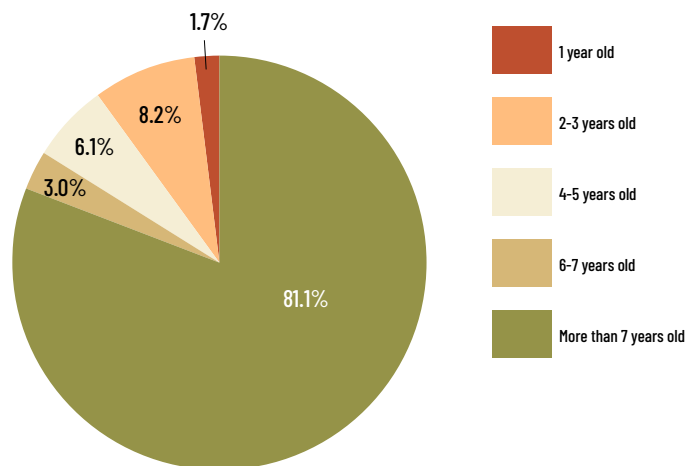
## Age and Productivity

The lifespan of a grapevine depends on where and how it is grown. While wild grape species can grow for hundreds of years, commercially produced *Vitis vinifera* grape varieties are generally grown for up to 50 years before they are replaced (Riffle, 2021). Although wine grapes will fruit in the second and third year after planting, grapevines are not considered commercially productive until they are 3-5 years old. Although there is no legal definition of an old vine, a grapevine is considered mature and commercially productive from 3-5 years until 25-30 years.

Vines are considered “old vines” by most after 30 years in production (Old Vines Registry). The decreased capacity to set fruit and mature phenological characteristics is the commonality between old vines (Riffle, 2021). The two benefits of old vines are quality and sustainability. Wine made from old vine grapes is noted for its complexity. Additionally, old vines are deep reservoirs of biomass and carbon; interacting with stable hydrological cycles and mycorrhizal systems (Currin, 2021).

The BC Wine Grape Council began tracking the age of grape vine plantings in 2017, which is why the age of plantings beyond 7 years of age are aggregated.

FIGURE 2: AGE OF VINES IN BC (PERCENTAGE OF 2023 BC PLANTINGS)



Source: BCWGC, 2023

## REGIONAL DISTRIBUTION

TABLE 3: AGE OF VINES BY REGION (PERCENTAGE OF 2023 PLANTINGS)

SUM OF ACRES	MORE THAN 7 YEARS OLD	6-7 YEARS OLD	4-5 YEARS OLD	2-3 YEARS OLD	1 YEAR OLD
Shuswap / Tappen	97.6%	2.4%	0.0%	0.0%	0.0%
Thompson Valley	93.8%	1.9%	4.3%	0.0%	0.0%
Oliver	89.3%	2.2%	3.4%	4.2%	0.9%
Penticton / Naramata / Kaleden	85.6%	1.9%	6.3%	5.2%	1.1%
Okanagan Falls	76.5%	8.6%	11.7%	2.2%	1.1%
Osoyoos	75.9%	1.7%	7.5%	12.4%	2.5%
West Kelowna	75.2%	2.9%	7.1%	13.4%	1.5%
Summerland / Peachland	75.0%	6.8%	10.9%	5.5%	1.8%
Fraser Valley	74.0%	0.0%	6.8%	12.9%	6.2%
Kelowna	73.8%	1.9%	5.0%	16.8%	2.5%
Lake Country / Vernon	73.5%	3.1%	1.0%	20.9%	1.5%
Vancouver Island	73.0%	9.2%	1.0%	13.8%	2.9%
Gulf Islands	71.2%	0.0%	0.0%	28.8%	0.0%

SUM OF ACRES	MORE THAN 7 YEARS OLD	6-7 YEARS OLD	4-5 YEARS OLD	2-3 YEARS OLD	1 YEAR OLD
Similkameen Valley / Cawston / Keremeos	69.0%	3.5%	13.7%	9.7%	4.1%
Kootenays	60.9%	3.8%	25.0%	10.3%	0.0%
Lillooet	56.1%	29.2%	14.8%	0.0%	0.0%

Source: BCWGC, 2023

TABLE 4: AGE OF VINES BY REGION IN 2023 (ACRES)

SUM OF ACRES	PRE 2017	2017	2018	2019	2020	2021	2022	2023	TOTAL ACRES
Oliver	4198.9	45.6	58.6	64.6	96.0	180.3	15.7	42.7	4702.3
Osoyoos	1227.6		27.1	90.2	31.9	177.1	22.8	41.0	1617.6
Penticton / Naramata / Kaleden	1266.0	6.2	21.7	47.7	45.0	52.3	24.6	16.0	1479.5
Kelowna	720.1		18.7	39.9	8.9	143.9	19.8	24.3	975.6
Similkameen Valley / Cawston / Keremeos	579.6		29.2	90.6	24.6	15.3	65.9	34.5	839.6
Okanagan Falls	501.0	19.2	37.2	55.7	20.7	14.2		7.2	655.3
Summerland / Peachland	445.1	4.2	36.2	25.9	38.6	21.0	11.5	10.6	593.1
West Kelowna	421.8		16.3	32.9	6.8	42.1	32.8	8.5	561.2
Lake Country / Vernon	346.7		14.5	1.0	3.8	93.9	4.6	7.1	471.5
Vancouver Island	243.8	27.9	2.8	2.5	0.8	33.7	12.5	9.8	333.7
Fraser Valley	161.6	0.1		0.5	14.4	11.1	17.1	13.5	218.3
Kootenays	73.0		4.5		30.0	9.3	3.1		119.9
Gulf Islands	78.6					31.8			110.4
Shuswap / Tappen	104.6	0.5	2.1						107.2
Thompson Valley	87.6		1.8	1.0	3.0				93.4
Lillooet	28.5	6.0	8.8	7.5					50.9

Source: BCWGC, 2023

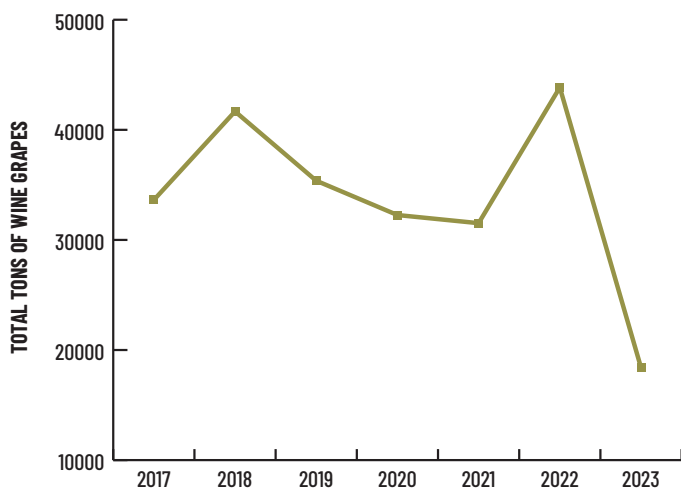
## OLD VINES

Although current crop data for British Columbia aggregates the data for any grapevines planted before 2017, there exist old, surviving blocks of grapes worthy of note. The global Old Vines Registry, a verified register of international old vineyards (30+ years) has five listings for British Columbia, including 101 acres planted in 1968/69, 46 acres planted in 1978, and 79 acres planted between 1983-86. This is not a comprehensive list of older BC vines; however, a sample based on self-reporting and auditing.

The oldest reported 56 year old block at Hester Creek (West Kelowna) contains Pinot Blanc, Merlot, Cabernet Franc, and Trebbiano. The 51-56 year old block at Lang Vineyards on the Naramata Bench contains Maréchal Foch, and according to winery staff, is the only vineyard plot at the winery that looks healthy and is expected to produce in 2024 (June 20, 2024). The Southeast Kelowna Sperling Vineyard has 46 year old Riesling (Clone 21) on S04 rootstock, used for the super premium production of Martin’s Lane wine. The self-rooted Hillside Gamay Noir block on the Naramata Bench is 41 years old, and as of June 20 2024, is reported by winery staff to be 90-95% healthy, with both top growth and viable suckers. Noble Ridge’s Cabernet Sauvignon and Merlot (Clone 118) block in Okanagan Falls is 38 years old. The winery reported (June 20, 2024) that this block is shooting from the base, and has an estimated 75-85% survival rate.

## VARIATIONS OF YIELD

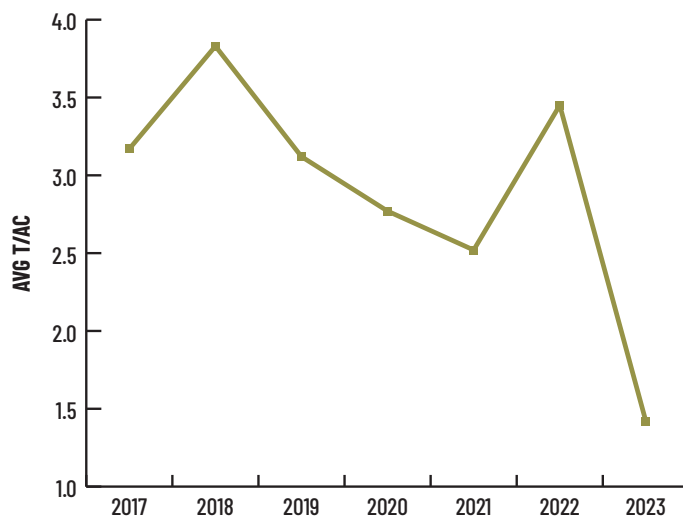
FIGURE 3: SUPPLY OF WINE GRAPES IN BC



Source: BCWGC, 2023

The supply of wine grapes in BC has declined markedly in the past seven years, with the exception of a bumper crop in 2022. A total of 33,630 tons was harvested in 2017. An increase in yield of 24% (41,671 tons) was realized the following year in 2018 but the downward trend began the year after that. In 2019, overall yield in BC dropped to 35,377 tons, almost back to the amount harvested in 2017. In 2020, 32,261 tons were harvested representing a further drop of 9%. In 2021, yields dropped only slightly by 2%. After a slow and cool start to the growing season in 2022, it was warm and dry from July through October, allowing for a bumper crop of 43,849 tons. This represented an increase of 39% over the prior year. In December 2022, a cold snap damaged and further stressed vineyards to varying degrees. In 2023 only 18,405 tons were harvested in BC, a drop of 42% over the previous year.

FIGURE 4: PRODUCTIVITY OF BC VINEYARDS 2017-2023



Source: BCWGC, 2023

The productivity of BC vineyards has declined steadily over the past seven years. While acres of vineyard increased each year, yields declined. An average of 3.17 tons/acre was recorded in 2017, whereas an average of 2.77 tons/acre was recorded in 2020 and 1.42 tons/acre harvested in 2023 (BCWGC, 2024). Although additional acreage has been planted to vines, the productivity overall is in decline.

This decline in productivity is not unique to British Columbia vineyards. Climate change, paired with increased disease and pest pressure has led to a global decline in grape productivity (Riffle, 2021). While some perennial commodities might have less focus on age, the fruit from wine grapevines of considerable age are highly sought after and can command a higher return in the marketplace from wine producers as well as consumers (Riffle, 2021).

## Disease Impact

Previously, the amount of acreage impacted by disease and climate-related damage was estimated to be between 3,814 and 7,492 acres (Cascadia Partners, 2023). This estimate was based on 29% of the industry’s 12,681 acres (in 2023) having succumbed to winter damage from the extreme cold event of December 2022 (Cascadia Partners, 2023). An additional 30% of the total acreage was estimated to suffer from viral diseases (Cascadia Partners, 2023). The sum of the two categories was determined to be an upper bound, while the larger of the two categories was considered to be the lower bound, as it was expected that there would be significant overlap between the two categories (Cascadia Partners, 2023). Many blocks that were damaged by viruses would also have succumbed to the December 2022 cold snap.

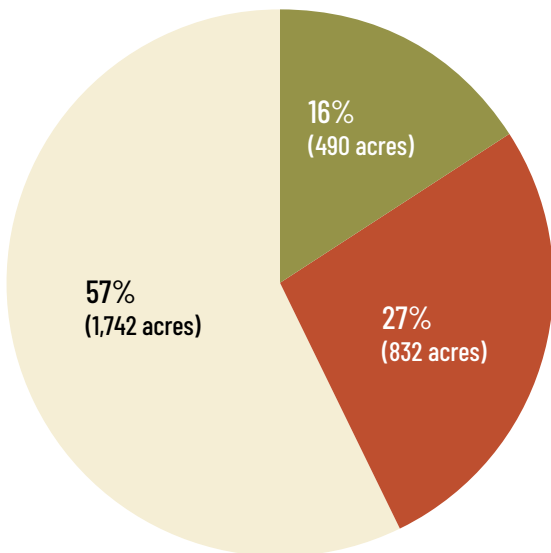
## WINTER VINE DAMAGE

<p><b>12,929</b> acres of vineyard in 2023</p>	<p><b>5,579</b> acres currently in need of replanting</p>	<p><b>4,549</b> acres anticipated to be replanted in 1-5 years</p>
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A damaging cold snap in January 2024 caused significant vine and bud damage. In the June 2024 grapevine impact survey (Terroir Consulting, 2024), respondents estimated 27% of planted vineyard acres would need replanting due to this extreme cold event (832 acres of the reported 3,064 acres).

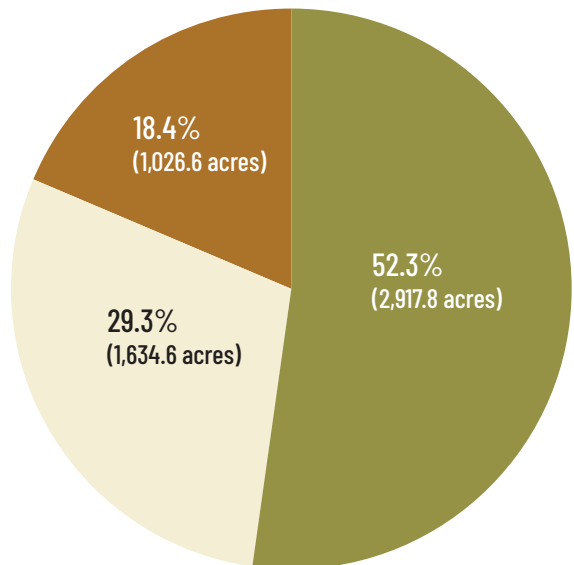
## ACREAGE THAT NEEDS REPLANTING AND INTENTIONS WITH THOSE ACRES

FIGURE 5: ACREAGE THAT NEEDS REPLANTING



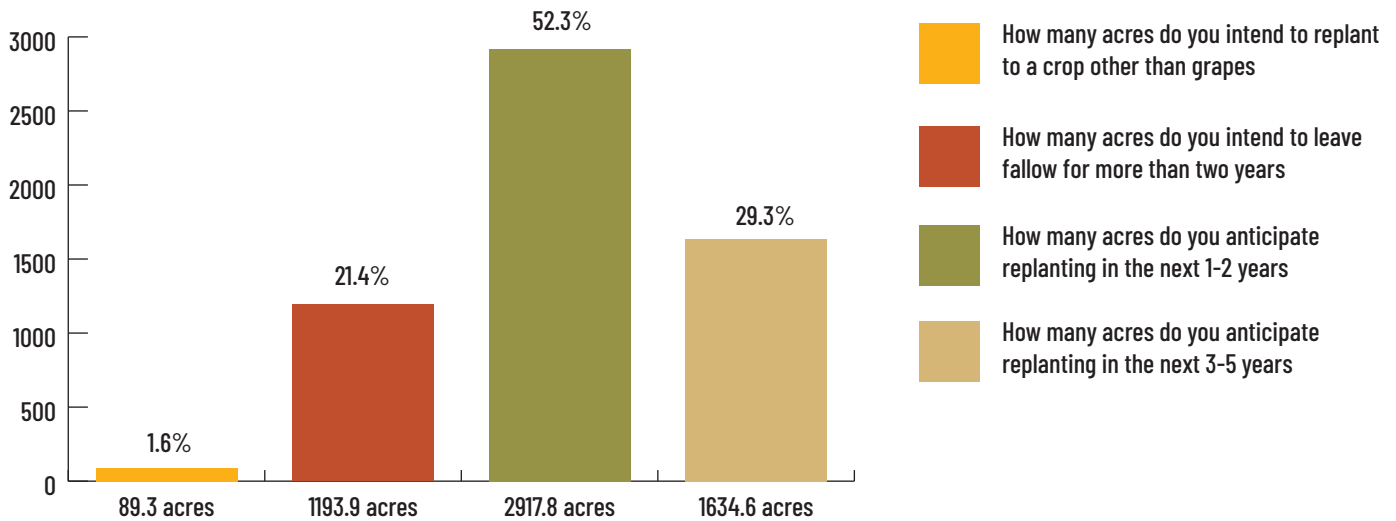
- Acres that don't need replanting
- Additional acres require replanting specifically due to the January 11th cold snap
- Acres that need replanting for loss or damage that already occurred

FIGURE 6: INTENTION TO REPLANT ACRES



- How many acres do you anticipate replanting in the next 1-2 years
- How many acres do you anticipate replanting in the next 3-5 years
- Do not intend to replant in the next 5 years

FIGURE 7: INTENTION FOR ACRES THAT NEED REPLANTING



Base: n= 71

Q9. We would like to better understand the amount of acreage that needs replanting and what you anticipate doing with that land. Please estimate to the best of your ability.

Source: Terroir Consulting, 2024

Using this 27% estimate from the study and applying it to British Columbia's 12,929 vineyard acres forecasts to an additional 3,510 acres that may need replanting due to the January 2024 cold snap. Survey respondents also noted that an additional 16% of their acreage required replanting prior to the January 2024 event (Terroir Consulting, 2024), which forecasts an additional 2,069 acres that require replanting province-wide. In total, including acreage forecasted to be replanted before and after the January 2024 event, total current replanting needs comprise a forecasted 5,579 acres, not including acreage impacted by diseases.

Of the acreage needing to be replanted, producers intend to replant a forecasted 2,918 acres in the next 1-2 years, and an additional 1,635 acres in the subsequent 3-5 years (for a total of 4,553 over the next 5 years.) Of note, grape growers intend to leave a forecasted 1,194 acres fallow for more than 2 years and there appears to be little intention to plant with a crop other than grapes at this time (89 acres).

## GRAPEVINE TRUNK DISEASES

Grapevine trunk diseases (GTD) are associated with several pathogenic fungi species (DeKrey et al., 2022). A province-wide field survey for GTD was conducted between 2010-2014 by Agriculture and Agri-Food Canada (AAFC), with the incidence of trunk disease explored in

117 vineyards and 60,000 vines inspected for foliar GTD symptoms (Úrbez-Torres et al., 2014a; Úrbez-Torres et al., 2014b). Of those vines, approximately 10% showed GTD symptoms, while 95% of all surveyed vineyards contained at least some level of GTD (Úrbez-Torres et al., 2014a; Úrbez-Torres et al., 2014b). A more recent grapevine trunk disease survey was conducted by AAFC in March, 2024 and examined 1,530 vines in 153 Okanagan vineyards (Urbez-Torres, 2024a). Vines were cut to soil level and checked for trunk disease infection, with 100% of vines showing signs of infection and varying sizes of canker (Urbez-Torres, 2024a). This data has not yet been published but indicates that previously reported levels of trunk disease may be underestimations, as only 2% of survey respondents indicated that they have confirmed the presence of trunk disease through formal testing and 89% of respondents suspecting that less than a quarter of their vines are currently impacted by trunk disease or viruses (Terroir Consulting, 2024).

GTD appears to be widespread throughout the province, with 95% of vineyards demonstrating some level of GTD (Úrbez-Torres et al., 2014a; Úrbez-Torres et al., 2014b), however, 32% of survey respondents feel they have no trunk disease in their vineyard and 89% of respondents suspect that the incidence of trunk disease is less than 25% of their vineyard block, indicating a lack of testing for GTD.



## GRAPEVINE VIRUSES

Field surveys conducted by AAFC between 2014-2018 sampled 15,000 vines from 156 vineyards throughout BC and analyzed them for the presence of Grapevine Leafroll Associated Virus (GLRaV) and Grapevine Red Blotch Virus (Poojari et al., 2017a, 2017b). All Okanagan subregions had considerable levels of GLRaV (all greater than 36%), with the Central Okanagan and South Okanagan vineyard blocks containing the highest presence of GLRaV at 62% and 67% respectively (Poojari et al., 2017a, Úrbez-Torres, 2024a). The presence of GLRaV was also confirmed in Kamloops, Fraser Valley, Vancouver Island, and Gulf Islands vineyards (Poojari et al., 2017a).

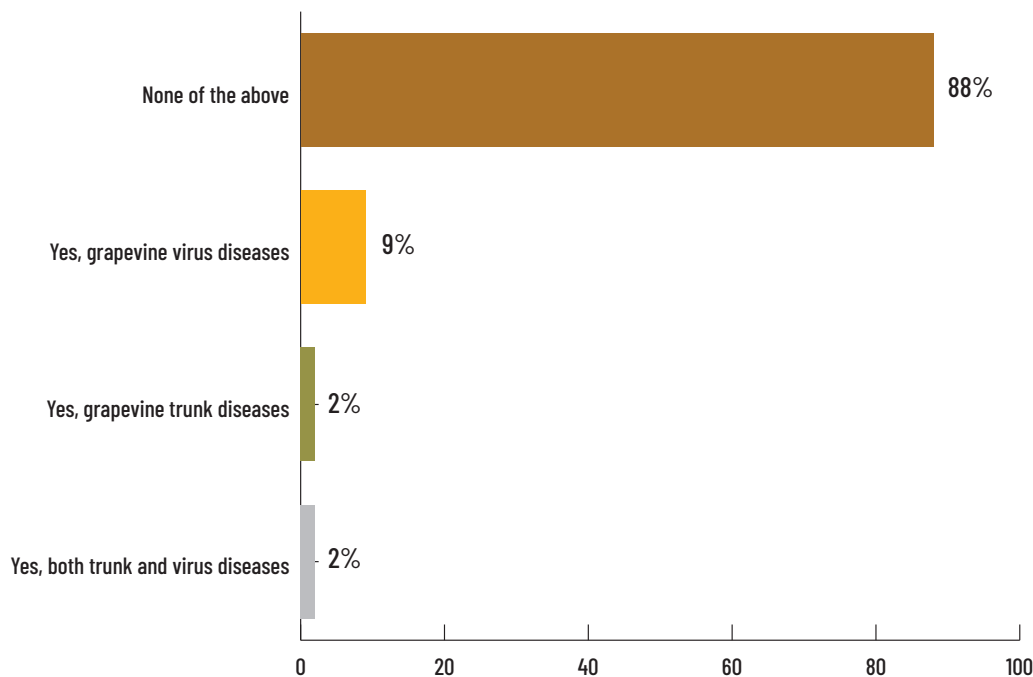
The rate of spread of GLRaV virus can be rapid, with the study analyzing three blocks and finding the annual rate of spread of GLRaV-3 to be between 0% and 19.4%, depending on the block (Poojari et al., 2017a). Of the 3,261 panels tested province-wide, 26.3% were positive

for GLRaV, while 54.3% of the analyzed vineyard blocks were positive (Poojari et al., 2017a; Úrbez-Torres, 2016). The presence of Grapevine red blotch virus was less than 2% for both mature vineyards (>10 years of age) and young vineyards (Poojari et al., 2017b), though it is unclear how many of these vines might also have tested positive for GLRaV.

Despite over half of respondents suspecting some GTD or virus in their vineyards (Terroir Consulting, 2024), a lack of testing may lead to underestimation as the results of the field surveys (Poojari et al., 2017a; 2017b) contrast with those of the grapevine impact survey. While the grapevine impact survey found that only 11% of respondents had confirmed the presence of viruses in vineyard blocks, the field surveys found 26% of analyzed vineyard panels and 54.3% of vineyard blocks province-wide tested positive for grapevine viruses (Poojari et al., 2017a, 2017b; Úrbez-Torres, 2016).

## GROWER SUSPECTED AND CONFIRMED INCIDENCE OF VIRUSES AND/OR GRAPEVINE TRUNK DISEASES

FIGURE 8: CONFIRMED TO HAVE GRAPEVINE TRUNK DISEASES AND/OR GRAPEVINE VIRUS DISEASES

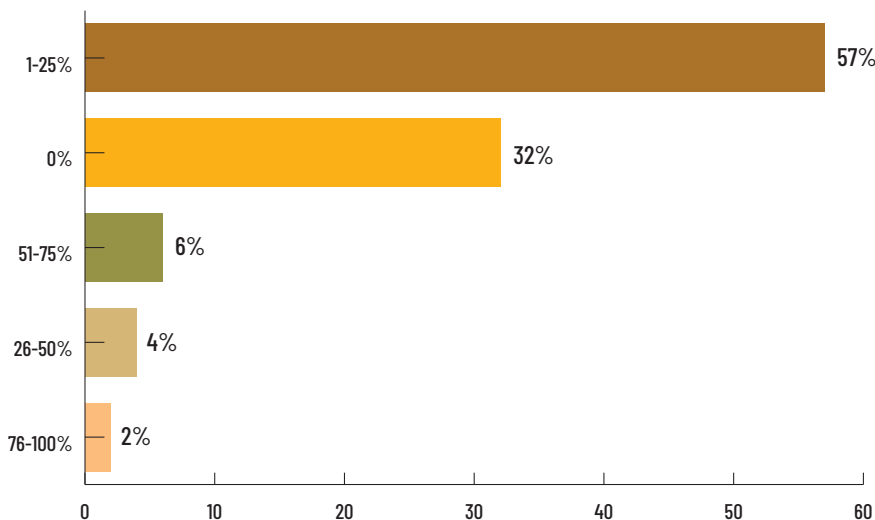


Base: n= 56

Q29: Has the block been confirmed to have grapevine trunk diseases and / or grapevine virus diseases below through either commercial laboratory testing and/or sample collection and participation in AAFC surveys?

Source: Terroir Consulting, 2024

FIGURE 9: PERCENTAGE OF BLOCK SUSPECTED TO BE IMPACTED BY GRAPEVINE TRUNK DISEASES AND/OR GRAPEVINE VIRUS DISEASE



Base: n= 53

Q33: What percentage of your block do you suspect has been impacted by grapevine trunk diseases and/or grapevine virus disease?

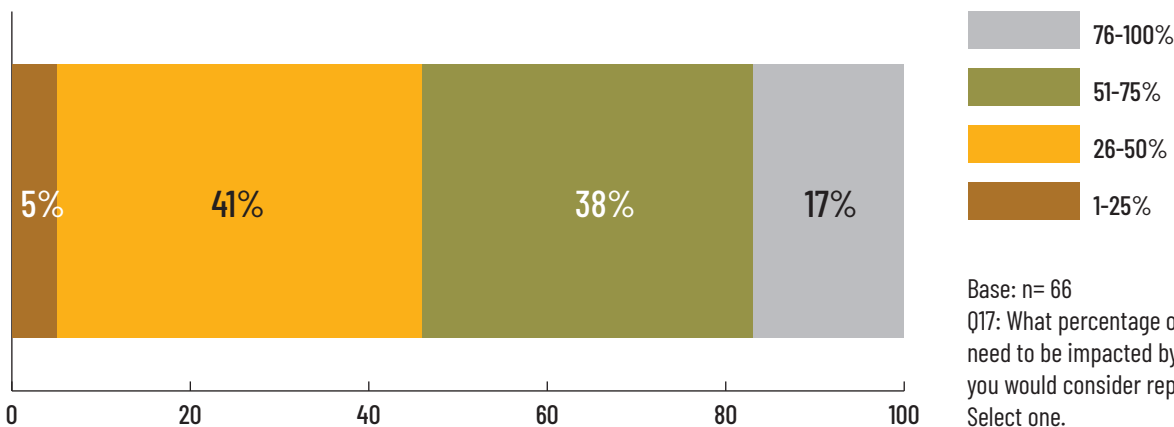
Source: Terroir Consulting, 2024

The grapevine impact survey asked respondents about the disease level they would tolerate before replanting. Grape growers may weigh economic damages due to the presence of virus, trunk disease, or cold damage with the cost of replanting an entire block. The actual economic threshold of damage before deciding to replant a vineyard block remains a knowledge gap for future research. Survey results show that 95% of respondents would only replant if over 25% of their block showed disease, with 55%

waiting until more than half the vines are affected (Terroir Consulting, 2024). This suggests many growers are willing to delay replanting despite significant disease impact. In contrast, Poojari et al. (2017a) found that viruses can spread rapidly, up to 19.4% per year, indicating that many growers' tolerance and thresholds for replanting may not be optimal for pathogen control.

## GROWER TOLERANCE BEFORE REPLANTING

FIGURE 10: PERCENTAGE OF BLOCK WITH CHRONIC DISEASE BEFORE REPLANTING



Base: n= 66

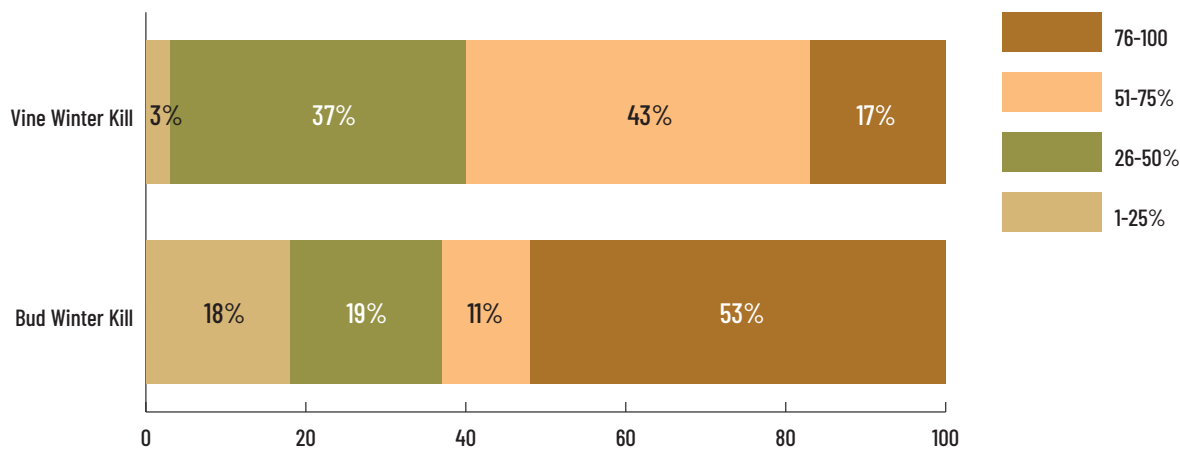
Q17: What percentage of vines within a block need to be impacted by chronic disease before you would consider replanting the entire block? Select one.

Source: Terroir Consulting, 2024

A similar question was asked of respondents with respect to their threshold for vine or bud winter damage before replanting. The results indicate that the majority of respondents (53%) would need near total bud loss (76-100% loss) before considering replanting. Moreover, 40% indicated they would be willing to accept up to 50% vine death before considering replanting the entire block (Terroir Consulting, 2024).

This high tolerance for damage poses economic challenges, but it is unclear how many growers would seek to improve vineyard health without replanting the entire block. There is a gap in information regarding vine death patterns within blocks, and growers may elect to interplant vines (plant new vines in between established healthy vines) if vine death is at a sufficiently low level and sporadic. Respondents to the grapevine impact survey note considerable tolerance to the presence of diseased or damaged vines within vineyards, which may have economic and pathogen control implications.

FIGURE 11: PERCENTAGE OF BLOCK WITH VINE/BUD WINTER KILL BEFORE REPLANTING



Base: n= 65

Q14: At what level of vine or bud winter kill do you typically believe an entire block/vineyard must be replanted? Select one for both vine and bud winter kill.

Source: Terroir Consulting, 2024

## CLIMATE CHANGE AND GRAPEVINE DISEASE

Climate change is expected to further exacerbate the presence of grapevine trunk disease (GTD) in BC vineyards (Úrbez-Torres, 2024b). The fungi responsible for GTD are much more aggressive during times of heat or water stress in vineyards, while warming conditions may create conditions for the import of additional GTD pathogens (Úrbez-Torres, 2024b).

There is a knowledge gap regarding the impact of cold stress on both GTD and grapevine viruses. Additional invasive virus vectors may also continue moving northward into BC with additional warming (Úrbez-Torres, 2024b). A warming climate is expected to create additional stresses on vines and provide new avenues for the spread of viruses.

SECTION 2

# BC Wine Grape Operations



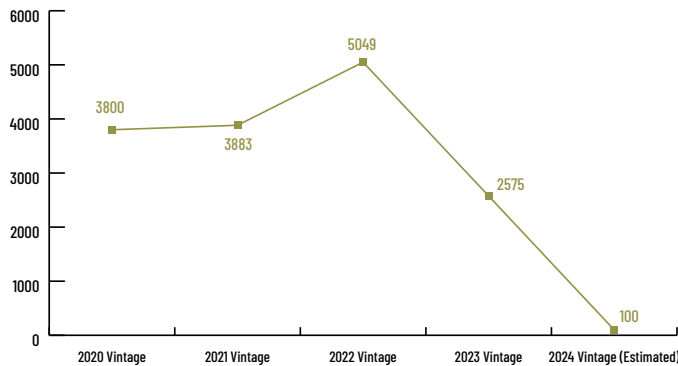
## Provincial Wine Grape Production

The BC wine industry grew from 19 grape wineries in 1990 to more than 330 in 2024 (Wines of British Columbia, 2023). British Columbia’s wine industry and related production have grown dramatically over 34 years.

Three events have precipitated the first multi-year, prolonged lowering of wine grape production over the last five year span. The first was in 2022, when ideal growing conditions supported grape growers to produce a bumper crop. Respondents in the Grapevine Impact Survey indicated more than a 20% production increase in 2022 from the two previous vintages in 2020 and 2021 (See Figure 12 below), which correlates with the 43,849 tons reported in the BCWGC crop report from 2022.

A deep freeze in the winter of early 2023 dramatically lowered grape harvest yields, with grape growers reporting in the Grapevine Impact Survey. The 2020-2022 average yield was 4.2 short tons per acre, which declined to 1.9 short tons per acre for the 2023 vintage (see Figure 13 below). Another even more severe deep freeze followed in the winter of early 2024. Survey respondents indicated they expect a very small crop in 2024.

FIGURE 12: MEDIAN CASES OF WINE PRODUCED WITH 100% BC GRAPES

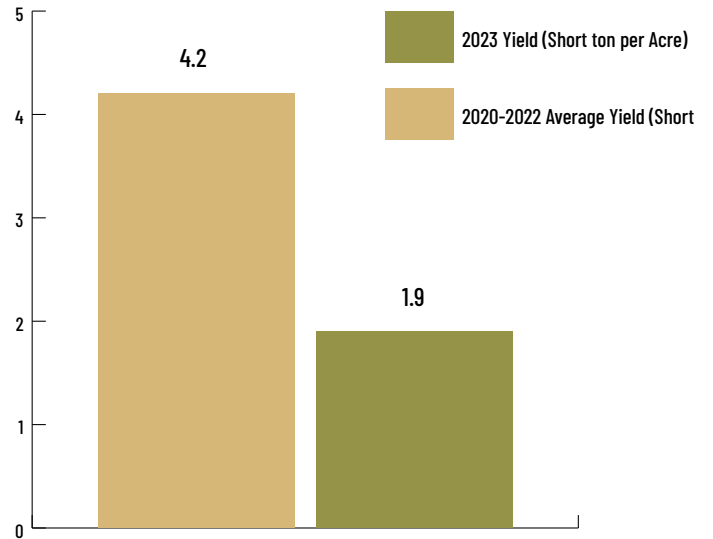


Base: n= 54

Q2: Please indicate how many cases of wine you produced with 100% BC grapes from each of these vintages as well as your best estimate for 2024. (Enter the number of cases for each year).

Source: Terroir Consulting, 2024

FIGURE 13: AVERAGE YIELD COMPARISON FROM 2020-2022 TO 2023



\*11 respondents entered total yield and their responses were removed from the calculation.

Base: n= 59

Q8. Please tell us your 2023 yield (short ton per acre) and the 2020-2022 average yield (average short ton per acre for all 3 years). Please note: 1 Short ton= 2000 pounds.

Source: Terroir Consulting, 2024

## Industry Distribution

### WINE GRAPE OPERATIONS

In 2019, there were 800 grape growers that produced 24,950 tonnes of grapes from 11,086 acres in British Columbia (Wines of British Columbia). The same year, 284 British Columbia wineries sold over 7 million cases (9 litre equivalent) of wine. By 2023, the number of grape growing operations in BC had grown to 888 (BCWGC, 2023).

BC wineries use a mixed grape sourcing model, which includes growing their own grapes and purchasing grapes from other grape growers and wineries. In the Grapevine Impact Survey, respondents indicated that 68% of grape growers also make wine, and 32% solely grow grapes (Terroir Consulting, 2023).

Grape growers who do not produce wine may sell their grapes exclusively to one winery, or may supply grapes for multiple production facilities, either on an ongoing, or ad hoc basis. Grape growers may own the land and be responsible for farming the vineyards, or may lease the land from another landowner and solely be responsible

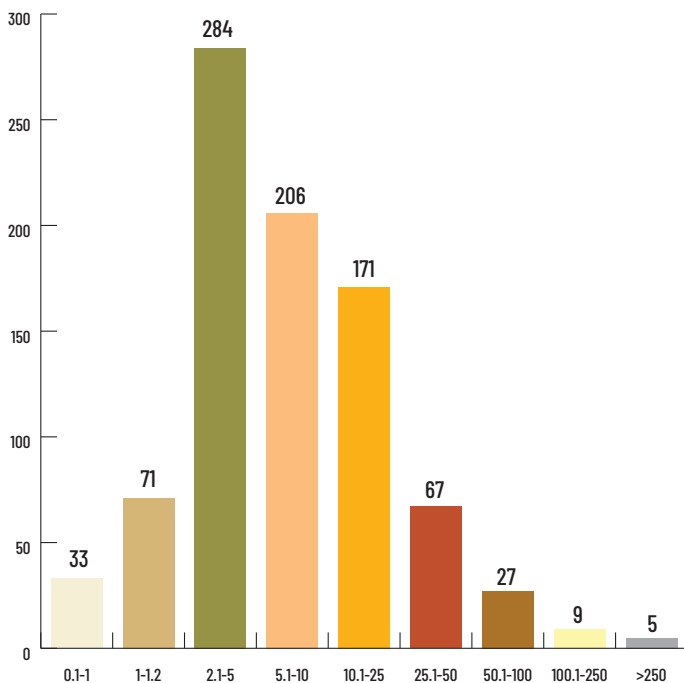
for farming. This variation of farming models and vested interest is reflected in BC's crop insurance model (BC Ministry of Agriculture and Food and Food, 2023) which enables non-landowners with a five year farming lease to apply for crop insurance.

According to the 2023 crop report data (BCWGC, 2023) covering 888 farms, the following range of farm sizes exist:

- 55% of farms are between 2-10 acres in size
- 30% of farms are between 10 and 100 acres in size
- 12% of farms are under two acres in size
- <2% of farms are larger than 100 acres

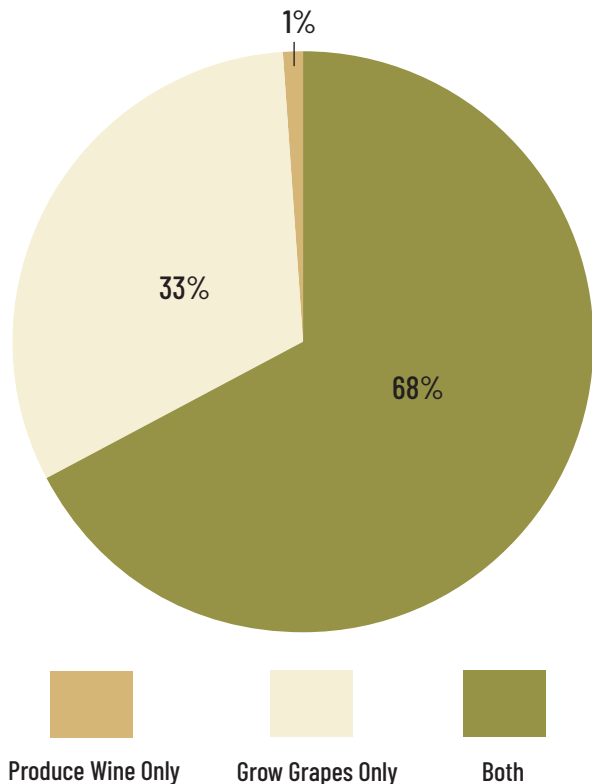
Of the 888 farms, only 14 grape growers farm over 100 acres. Notably, the largest group of 284 farmers are responsible for 2.1-5 acres of vineyard, and 206 farmers are responsible for between 5.1-10 acres of vineyard. At this farming level, most of the work is done by a farming family without any additional hired support. Grape growers farming above 10 acres typically will have seasonal staff, whereas grape growers farming over 25 acres will have year round staff.

FIGURE 14: VINEYARD SIZE BY OWNER/FARMER



Source: Terroir Consulting, 2024

FIGURE 15: ORGANIZATIONAL ACTIVITIES



Base: All respondents (n= 142)  
 Q1: Which of the following activities does your organization conduct?  
 Source: Terroir Consulting, 2024

## Replanting Estimate

### ACREAGE IMPACTED BY DISEASE, VIRUS, AND EXTREME COLD

This report considers four contributors to replant needs: grapevine trunk diseases, grapevine viruses, winter damage before 2024, and the January 2024 extreme cold event. The estimated percentage of vines impacted by each is listed in Table 5.

The percentage of vines impacted by virus is an estimate based on the findings of the province-wide field surveys, in which 26.3% of the 3,261 analyzed panels tested positive for grapevine-leafroll virus (Poojari et al., 2017a). The percentage of vines impacted by grapevine trunk disease is an estimate based on the findings of the province-wide field surveys, in which 10% of 60,000 inspected vines showed foliar GTD symptoms (Úrbez-Torres et al., 2014a; Úrbez-Torres et al., 2014b).

Survey respondents estimated 16% of their vines required replacement prior to 2024, while also estimating an additional 27% would require replanting due to the January 2024 extreme cold event. A replant estimate lower bound is thus based on those two percentages combined and then extrapolated over the province-wide acreage total of 12,929 acres.

This lower bound assumes that those vines impacted by GTD and virus are the same vines requiring replanting due to prior damage and due to damage from the January 2024 event. However, some overlap is expected, particularly as vines weakened by GTD or virus may be more susceptible to cold damage.

An upper estimate sums all contributors, meaning that no overlap exists between the vines damaged prior to 2024 and in January of 2024 with vines damaged by trunk disease or virus.

## REPLANTING FORECAST

The forecast of replanting needs may be underestimated as the grapevine impact survey data was based on grower self-reporting. There may be additional disease presence due to potential contributions from other diseases such as Crown Gall (Úrbez-Torres, 2024b), the ongoing spread of grapevine viruses (Poojari et al., 2017a), or the spread of GTD as demonstrated by the AAFC March 2024 field survey (Úrbez-Torres, 2024a). However, replanting acreage forecasts may be overestimated because growers may tolerate certain levels of disease and damage and/or use strategies to mitigate vineyard damage that does not involve replanting.

## REPLANT NEEDS

5,579	10,233	12,929
acres estimated to need replanting (lower bound)	acres estimated to need replanting (upper bound)	total provincial acreage in 2023

A lower-bound estimate of vineyards currently in need of replanting is 43% of province-wide acreage, or 5,579 acres.

An upper-bound estimate of vineyards currently in need of replanting is 79% of province-wide acreage, or 10,233 acres.

TABLE 5: ESTIMATION OF REPLANT NEEDS

TOTAL PROVINCE-WIDE ACRES: 12,929		
	Estimated Percentage of Vines Impacted	Estimated Acreage Impacted
Virus	26%	3361
Grapevine Trunk Disease	10%	1293
Pre-2024 Damage	16%	2069
2024 Winter Damage	27%	3510
Lower Bound (Complete Overlap)	43%	5579
Upper Bound (No Overlap)	79%	10233

Source: Terroir Consulting, 2024 and AAFC March 2024 Field Survey

## Funding Allocation Recommendations

Please see the Re-Planting Guidelines and Recommendations report for the BC Ministry of Agriculture and Food for details.

SECTION 3

# BC Wine Grape Viability





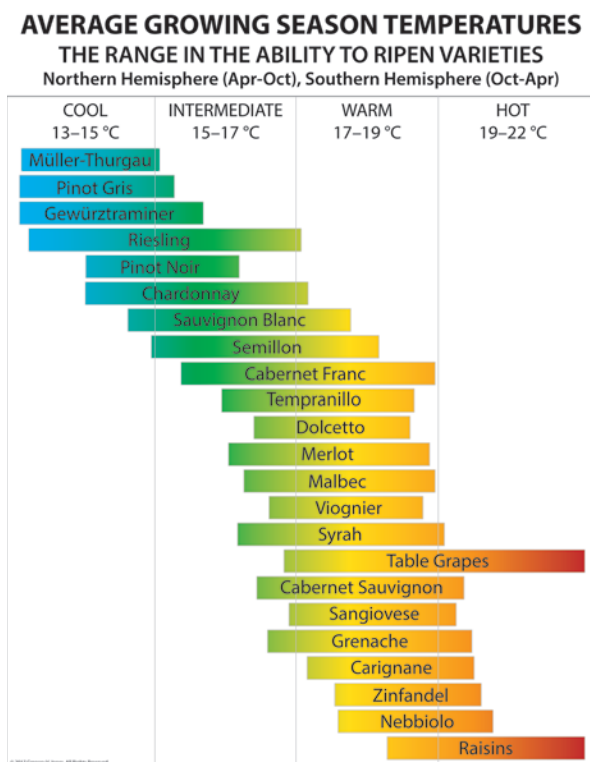
## Climate Susceptibility and Geographical Limitations

A variety of geographical factors, including continentality, land cover, topography, and elevation influence the local climate to create the environmental limitations under which grapevines can be grown, with climate arguably being the greatest determinant of the ability of a particular site to grow grapes (Jones et al., 2005; Jones et al., 2012).

### TEMPERATURE

Temperature is viewed as the critical factor for the productivity of wine grapes (Jones et al., 2012), with the bounds of grape growing globally largely determined by a growing season mean temperature of 13-21°C (Jones et al., 2012). Grape cultivars mature at different rates (Fraga et al., 2012), and the maturity groupings of common European (*Vitis vinifera*) varieties can be found in Figure 16.

FIGURE 16: GRAPEVINE MATURITY GROUPINGS FOR COMMON VITIS VINIFERA CULTIVARS



Note. Reprinted from "The climate component of terroir", by G.V. Jones, 2018, *Elements*, 14(3), 167-172.

Grapevine growth begins when daily mean temperatures reach above 10°C (Jones, 2006). As such, growing degree days (GDD) for grapes are calculated using a base temperature of 10°C. A growing season total of 850 GDD is considered a minimum for all wine grapes (Jones et al., 2010), with the Winkler Index providing some guidance regarding appropriate GDD for different varieties (Winkler, 1974). GDD is not the only temperature metric used when considering the suitability of a region and may have methodological issues (Jones et al. 2010), including poorly differentiating between the effect of the range between minimum and maximum temperatures (Agriculture Canada, 1984), but is the current metric used by the Summerland Research and Development Centre in their heat summation reports (Estergaard et al., 2024). Other metrics may include average growing season temperature (as seen in Figure 16), the Huglin index, or the biologically effective degree-day index (Jones et al., 2010).

Grapevines are susceptible to extreme cold weather, though hardiness varies between cultivars. Certain hybrid cultivars, bred between *Vitis vinifera* and other species of North American and Eurasian origin, are notably more winter hardy and can withstand temperatures ranging from -29°C to -37°C (University of Minnesota, 2024). *Vitis vinifera* cultivars range in hardiness from -5°C to -20°C or more (Jones, 2018; Mills et al., 2006), with additional variability from vine age (Mills et al., 2006), clone and rootstock selection (Hébert-Haché et al., 2021), and other factors (Mills et al., 2006), including poor management practices (Agriculture Canada, 1984).

Vineyard sites that grow *Vitis vinifera* ideally should not have mid-winter minimum temperatures (Tmin) below -25°C (BCWGC, 2010), or minimum shoulder month (November and March) winter temperatures below -20°C (BCWGC, 2010) or significant bud or vine damage may occur.

The frequency of extreme heat can also limit successful vineyard sites, as prolonged maximum temperatures (Tmax) above 35°C during the ripening period can induce heat stress (Jones, 2018) and heat acclimation mechanisms are activated (Venios et al., 2020). Such heat stress may lead to premature veraison, berry abscission, or poor flavour ripening (Mullins et al., 1992).

### GROWING SEASON LENGTH

The length of the frost-free season necessary to ripen grapes depends upon the cultivar, but averages 170-190 days for *Vitis vinifera* cultivars (Mullins et al., 1992, as cited in Jones, 2006), with a minimum of 150 days (BCWGC, 2010). Early ripening interspecific-hybrid cultivars may have even shorter growing season requirements (Gutierrez et al., 2021).

## WATER AVAILABILITY AND INSOLATION

The amount of water needed to grow wine grapes varies widely, and depends on the cultivar (Tomás et al., 2012), crop load (Naor et al., 1997), and evapotranspiration levels (Jones, 2018). Excessive precipitation may lead to disease outbreaks and be detrimental to crop health (BCWGC, 2010). In hot climates, annual precipitation of less than 500 mm may limit grapevine growth (Jones, 2018), though this can be mitigated through irrigation.

A minimum of 3200 MJ/m<sup>2</sup> of solar radiation (insolation) is considered fair suitability for grape growing in the Grape Atlas (Agriculture Canada, 1984) and is determined by slope, aspect, latitude, and atmospheric impacts such as cloud cover (Jones, 2018).

Minimum requirements to grow wine grapes are a frost-free growing season length of 150 days (or longer for most varieties), a T<sub>min</sub> no colder than -25°C, precipitation of at least 500 mm/annum (Jones, 2018) or access to sufficient irrigation, limited occurrences of T<sub>max</sub> exceeding 35°C, at least 850 GDD (Jones et al., 2010), and a minimum of insolation of 3200 MJ/m<sup>2</sup>.

## CLIMATE CHANGE PROJECTIONS

TABLE 6: MODELLED 30-YEAR CHANGE IN CLIMATE VARIABLES FROM REFERENCE PERIOD BY BC VITICULTURAL REGION AND SHARED SOCIOECONOMIC PATHWAY

All data from ClimateData.ca (2024).

All data is based on downscaled and bias-adjusted CMIP6 modelling for the 30-year period of 2021-2050, with the exception of Growing Degree Days (GDD) and Extreme Heat, which is based on CMIP6 modelling for the 31-year period of 2020-2050, using the BCCAQv2 method (Cannon et al., 2015; McKenney et al., 2011).

Data is relative to modelled historical data for the reference 30-year period of 1971-2000, with the exception of Growing Degree Days (GDD) and Extreme Heat, which is relative to modelled historical data for the 31-year period of 1970-2000 (Cannon et al., 2015; McKenney et al., 2011).

CLIMATE VARIABLE
<b>Extreme Heat</b> - Median Change in # of Days Annually with T <sub>max</sub> Above 35°C
<b>Extreme Cold</b> - Median Change in # of Days Annually with T <sub>min</sub> Below -25°C
<b>Warming</b> - Change in Annual GDD (Above 10°C Threshold)
<b>Wet Days</b> - Median Change in # of Days of >10 mm Precipitation
<b>Drought</b> - Median Change in Maximum # of Consecutive Dry Days (<1 mm precipitation)
<b>Growing Season Length</b> - Median Change in # of Days of Frost Free Season

	REGION		
	VANCOUVER ISLAND (NORTH SAANICH)		
	SSP1	SSP2	SSP5
Extreme Heat	No Change	No Change	No Change
Extreme Cold	No Change	No Change	No Change
Warming	+327	+337	+385
Wet Days	+2 Days	+1 Day	+1 Day
Drought	+3 Days	+2 Days	+4 Days
Growing Season Length	+44 Days	+41 Days	+55 Days

	REGION		
	FRASER VALLEY (ABBOTSFORD AIRPORT)		
	SSP1	SSP2	SSP5
Extreme Heat	No Change	No Change	+1 Day
Extreme Cold	No Change	No Change	No Change
Warming	+375	+379	+438
Wet Days	+1 Day	+1 Day	+1 Day
Drought	+2 Days	+3 Days	+3 Days
Growing Season Length	+43 Days	+45 Days	+55 Days

	REGION		
	NORTH OKANAGAN (KELOWNA)		
	SSP1	SSP2	SSP5
Extreme Heat	+6 Days	+7 Days	+9 Days
Extreme Cold	No Change	No Change	No Change
Warming	+362	+378	+426
Wet Days	+1 Day	+1 Day	No Change
Drought	+1 Day	+1 Day	+2 Days
Growing Season Length	+32 Days	+28 Days	+32 Days

	REGION		
	SIMILKAMEEN (KEREMEOS)		
	SSP1	SSP2	SSP5
Extreme Heat	+6 Days	+7 Days	+8 Days
Extreme Cold	-1 Day	-1 Day	-1 Day
Warming	+346	+351	+401
Wet Days	+1 Day	No Change	No Change
Drought	No Change	+1 Day	+3 Days
Growing Season Length	+22 Days	+25 Days	+29 Days

	REGION		
	CENTRAL OKANAGAN (SUMMERLAND)		
	SSP1	SSP2	SSP5
Extreme Heat	+8 Days	+9 Days	+11 Days
Extreme Cold	No Change	No Change	No Change
Warming	+378	+393	+444
Wet Days	No Change	No Change	No Change
Drought	No Change	+1 Day	+2 Days
Growing Season Length	+33 Days	+30 Days	+33 Days

	REGION		
	THOMPSON VALLEY (KAMLOOPS)		
	SSP1	SSP2	SSP5
Extreme Heat	+7 Days	+8 Days	+10 Days
Extreme Cold	-1 Day	-1 Day	-1 Day
Warming	+358	+365	+416
Wet Days	No Change	No Change	No Change
Drought	No Change	+1 Day	+1 Day
Growing Season Length	+22 Days	+27 Days	+27 Days

	REGION		
	SOUTH OKANAGAN (OSOYOOS)		
	SSP1	SSP2	SSP5
Extreme Heat	+12 Days	+12 Days	+15 Days
Extreme Cold	No Change	No Change	No Change
Warming	+395	+406	+459
Wet Days	No Change	No Change	No Change
Drought	+2 Days	+2 Days	+3 Days
Growing Season Length	+27 Days	+27 Days	+30 Days

Climate change has the potential to impact the suitability of the BC environment for grapes. This report discusses projected trends in a changing climate: warming, changes in precipitation patterns, and extreme heat or cold events.

BC vineyards cover a diverse range of climate regions facing diverse climatic challenges. This report separates the BC grape-growing regions into two categories: coastal and continental. The coastal regions consist of the Fraser Valley, Vancouver Island, and Gulf Islands geographical indications. The continental regions consist of the Okanagan Valley, Similkameen Valley, Thompson Valley, Lillooet, Shuswap, and Kootenays geographical indications.

## LIMITATIONS OF CLIMATE MODELS

A direct comparison of climate projections to historical weather station data is inaccurate, as the CMIP6 modelling is not at a sufficiently granular level to compare to specific weather station data. Instead, climate trends must be based on modelled projections referenced against modelled historical simulations. The CMIP6 model on ClimateData uses 10 km x 6 km grid sizes that do not perfectly correspond to traditional vineyard land covers, but incorporate a variety of land covers, topography, and elevations (ClimateData.ca, 2024). As such, data does not necessarily reflect the exact point/proxy selected for each region but is a modelled average of the grid rectangle.

### *Climate Variables and Viticultural Considerations*

#### EXTREME HEAT

Extreme heat was ranked as the second greatest climate-related threat by respondents in a ranked-choice industry survey question. The number of days with a daily Tmax exceeding 35°C is expected to increase for all continental proxy locations listed in Table 6, with the South Okanagan facing a particularly large projected increase (ClimateData.ca, 2024). This is further reinforced by climate change impact assessment (CCIA) research demonstrating that days above 32°C at the Kelowna Airport weather station increased at a rate of 0.16 days/year for the 1970-2019 period, while the number of days above 32°C in an average growing season is expected to increase to 74 of 214 (36%) by the 2050s (Hewer & Gough, 2021). This alternative 32°C threshold was determined through research analyzing grape yields from 1930-1989 in the Okanagan Valley (Caprio & Quamme, 2002), and indicates that the 35°C threshold may not need to be reached before yields are negatively impacted.

Extreme heat may require growers to adjust what cultivars are planted, as certain cultivars are more tolerant of extreme heat than others (Xu et al., 2014). Some hybrid cultivars of *V. labrusca* and *V. vinifera* have demonstrated higher tolerance to extreme heat versus that of *V. vinifera* (Xu et al., 2014); however, such *V. labrusca* hybrids are not commonly found in the BC wine industry and are not permitted by the *Wines of Marked Quality Regulation*. There is a knowledge gap regarding the heat tolerance of some of the more popular cold-tolerant hybrid cultivars currently planted in the province. Although extreme heat represents a significant threat to grape quality (Mullins et al., 1992) and to yield (Caprio & Quamme, 2002), typically it does not

pose as significant of a threat to long-term vine survival as extreme cold unless combined with long periods of drought and the absence of irrigation.

Proxy locations representing continental winegrowing regions of BC in Table 6 are expected to experience more frequent occurrences of extreme heat exceeding a Tmax of 35°C (ClimateData.ca, 2024), this extreme heat may have consequences for grape yield and quality.

## CHANGES IN PRECIPITATION PATTERNS AND DROUGHT

The majority of vineyards in BC are irrigated, providing some insurance against prolonged dry periods. Modelled changes in the length of potential droughts as well as the frequency of very wet days appear nominal in all proxy locations listed in Table 6 (ClimateData.ca, 2024), while CCIA research demonstrates drying in the Okanagan Valley in the RCP4.5 and RCP8.5 climate scenarios after 2050 (Hewer & Gough, 2021). However, access to reliable irrigation sources is essential and water availability is expected to decline in many regions. Research singles out the Okanagan as being highly vulnerable to future freshwater supply shortages in summer (Bonsal et al., 2020). Decreasing summer flows have already been demonstrated on the Cowichan River (Fleming, 2010, as cited in Bonsal et al., 2020). The Columbia Valley, home to several Kootenay vineyards, is also projected to experience severe dry conditions (Mahmoudi et al., 2021).

When planning future vineyards, growers should verify the long-term viability of irrigation sources prior to planting, as irrigation sources in multiple regions are expected to decline.

## WARMING

Modelling projects every proxy location listed in Table 6 to gain at least 300 GDD compared to the reference period, independent of the SSP (ClimateData.ca, 2024). Such projections are estimates, particularly at more granular levels, however, such a gain in GDD would, in theory, move all of the land classified as Class 2 (good suitability) for growing degree day suitability and a significant portion of the Class 3 land (fair suitability) in the Grape Atlas (Agriculture Canada, 1984) to Class 1 (most suitable). In a vacuum, such warming would dramatically expand the available acreage to plant in the province, however, other climate variables must be considered. Further research supports this data, demonstrating that sites along Okanagan Lake have seen GDD increases of nearly 50% since the 1970s (Rayne & Forest, 2016). Current GDD

trends put the central and southern parts of the Okanagan Valley in the same climate classification category as warmer wine regions of Spain, France, and Australia (Rayne & Forest, 2016), while the northern part of the Okanagan is similar to Northern Oregon and the Loire Valley of France (Rayne & Forest, 2016).

Climate change projects to increase GDD in all proxy wine region locations listed in Table 6, though wine grape cultivars vary in their response to warming (Schultz & Jones, 2010).

## GROWING SEASON LENGTH

Projections found in Table 6 for the 30-year period of 2021-2050 indicate the frost-free growing season will extend by 3+ weeks in the continental proxy locations and 5+ weeks in coastal proxy locations for all SSP scenarios versus the reference period (ClimateData.ca, 2024). It is our opinion that this will extend the land classified as suitable for freeze risk within the Grape Atlas (Agriculture Canada, 1984). However, damaging spring freezes ( $<-1^{\circ}\text{C}$ ) have occurred as late as April 18-19 in 2023 and April 20 in 2022 in the Okanagan (Osoyoos, Summerland, and Kelowna Airport ECCC weather stations - Environment and Climate Change Canada, 2024). Autumn freezes arrived as early as October 9-10th 2019 throughout the Okanagan (ECCC, 2024), indicating that growing season length is still a factor when considering suitable varieties and vineyard locations. Moreover, microclimates created by depressions and ravines, or frost pockets created by windbreaks or embankments, are difficult to account for at landscape mapping scales (Agriculture Canada, 2024). Further CCIA research on the Fraser Valley notes a lengthening of the frost-free growing season but notes the possibility that frost risk may persist if warmer temperatures create the conditions for an earlier bud break (Beech & Hewer, 2021), and a similar risk may exist in other regions.

Climate change modelling projects all the proxy locations for all BC winegrowing regions in Table 6 to have a longer frost-free season for the period of 2021-2050 versus the reference period; however, there are negative potential implications if such warming coincides with earlier bud break.

## EXTREME COLD

Extreme cold was ranked by respondents as the greatest climate-related threat to vineyards in the industry survey. Although the global trend of warming temperatures has been established, scientific opinion on the likelihood of future extreme cold events remains somewhat divided. The

CMIP6 modelling shown in Table 6 demonstrates either no change or a reduction in the number of days with  $T_{\text{min}}$  less than  $-25^{\circ}\text{C}$  in all proxy locations that were analyzed (ClimateData.ca, 2024). However, research is divided as recent observational research has shown that Arctic amplification (a rapidly warming Arctic relative to global temperature rise) may result in stronger or more frequent extreme cold events (Cohen et al., 2021) while modelling experiments demonstrate that Arctic amplification has either no effect or may reduce the incidence of polar vortex events (Cohen et al., 2020). This Warm Arctic Cold Continent (WACC) phenomenon is expected to moderate with continued warming (Hong et al., 2023), but many researchers note a need for ongoing study of the phenomenon and it remains unpredictable.

The Agriculture Canada (1984) Grape Atlas notes widespread damage to vineyards in the winter of 1978/79 when temperatures fell to  $-25.0^{\circ}\text{C}$  in Osoyoos,  $-22.5^{\circ}\text{C}$  in Summerland,  $-20.8^{\circ}\text{C}$  at the Penticton airport, and  $-30.5^{\circ}\text{C}$  at the Kelowna airport. Weather data from Environment and Climate Change Canada (2024) research stations during the January 2024 cold snap show temperatures of  $-22.3^{\circ}\text{C}$  in Osoyoos village,  $-26.2^{\circ}\text{C}$  in Summerland,  $-27.6^{\circ}\text{C}$  at the Penticton airport, and  $-29.5^{\circ}\text{C}$  at the Kelowna airport. Similarly, during the December 2022 cold snap, temperatures from those same stations reached  $-21.8^{\circ}\text{C}$  in Osoyoos village,  $-23.0^{\circ}\text{C}$  in Summerland,  $-22.3^{\circ}\text{C}$  at the Penticton airport, and  $-31.6^{\circ}\text{C}$  at the Kelowna airport (ECCC, 2024). Most vineyards are situated on sloping hillsides or subregions that tend to be slightly warmer than low-lying areas such as the Penticton and Kelowna airports. However, this data indicates that even in a warming climate, winter extreme temperatures are still currently capable of reaching or even surpassing the winter extremes of 45 years ago, and variability in low winter temperatures at the latitudes of BC winegrowing regions remains a risk (Jones & Schultz, 2016). Accordingly, there is an information gap regarding the future susceptibility of wine grapes to climate-change-induced extreme cold events in BC.

Climate science around the future frequency of extreme cold events is uncertain and growers should not rely solely on warming trends when making viticultural decisions, in particular scion varietal choice.

## FREQUENCY AND INTENSITY OF WILDFIRE

Although wildfire frequency is not projected in typical climate models such as CMIP6, wildfire activity has increased significantly since 2005 in British Columbia (Parisien et al., 2023). Not only does wildfire smoke negatively impact wine quality (Kennison et al., 2008), but

anecdotal evidence notes that the presence of smoke can impact viticulture through changes in humidity, decreased insolation, and reduced potential GDD. Respondents noted wildfire as the third greatest climate-related threat in the ranked-choice survey question.

## OTHER CLIMATE VARIABLES

Other potential trends due to climate change such as warmer nights, changes in airflow patterns, or humidity are not discussed in detail within the scope of this report but may have impacts on the suitability of environments for grapes, as well as their potential quality. Higher humidity levels may lead to increased pressure from fungal diseases (Jones, 2018). Warmer nights may reduce diurnal temperature variation and impact quality/wine style (Gaiotti et al., 2018). Changes in airflow patterns can impact disease pressure and evapotranspiration levels (Jones, 2018). Additional variables such as prolonged warm spring temperatures before typical bud break timing may also have negative impacts.

“We wish to thank ClimateData.ca for providing the climate information used in this paper. ClimateData.ca was created through a collaboration between the Pacific Climate Impacts Consortium (PCIC), Ouranos Inc., the Prairie Climate Centre (PCC), Environment and Climate Change Canada (ECCC) Centre de Recherche Informatique de Montréal (CRIM) and Habitat7.”

## *Farming for Adaptation and Resilience*

Innovative strategies for vineyard resilience include but are not limited to practices that improve soil health, increase biodiversity, protect from cold damage and minimize disease impact. Every practice in the vineyard has a cost and a benefit.

## BIODIVERSITY

Biodiversity, in various forms, may represent an opportunity for growers to mitigate environmental impacts and climate extremes. Vineyards with low levels of species richness have poor resilience to environmental impacts (Goodall et al., 2023). Vineyards that have incorporated agroforestry systems have demonstrated drought resistance, while also mitigating insufficient ripening that may occur as a result of climate change (Riekotter & Hassler, 2022). Such drought resistance is due to trees' ability to modify microclimates, reduce

evapotranspiration, and distribute water through hydraulic lift (Favor & Udawatta, 2021).

Cultivar diversity also stands as an opportunity to mitigate the effects of climate change (Rusch et al., 2021). Grape yield losses in a 2°C warming scenario were reduced by 57% with cultivar turnover (where growers change the cultivars planted to more well-adapted varieties), though the benefits of cultivar turnover were dampened at higher warming (Morales-Castilla et al., 2020). Utilizing the inherent phenological diversity of grapes is viewed as critical to mitigating the impacts of climate change (Wolkovich et al., 2017).

## SOIL HEALTH

At a local level, cover cropping has been demonstrated to be even more effective than agroforestry for disease control, while also improving soil quality (Bellouin et al., 2021). Above-ground plant diversity also positively impacts soil biodiversity (Wagg et al., 2014), which may realize benefits in nutrient cycling (Hooper et al., 2012), thus positively impacting plant health. A loss of soil species richness reduces a variety of ecosystem functions (Wagg et al., 2014; Glassman et al., 2018; Domeignoz-Horta et al., 2021).

Some additional practices that enhance soil health include (Acton, 1995):

- Rotational grazing where manure from livestock is directly deposited and understory is “mowed” by grazing animals
- Conservation tillage and minimal soil disruption
- Contour cultivation on hilly land
- Application of organic amendments such as manure or compost
- Planting shelterbelts and agroforestry that reduces erosion and encourages biodiversity

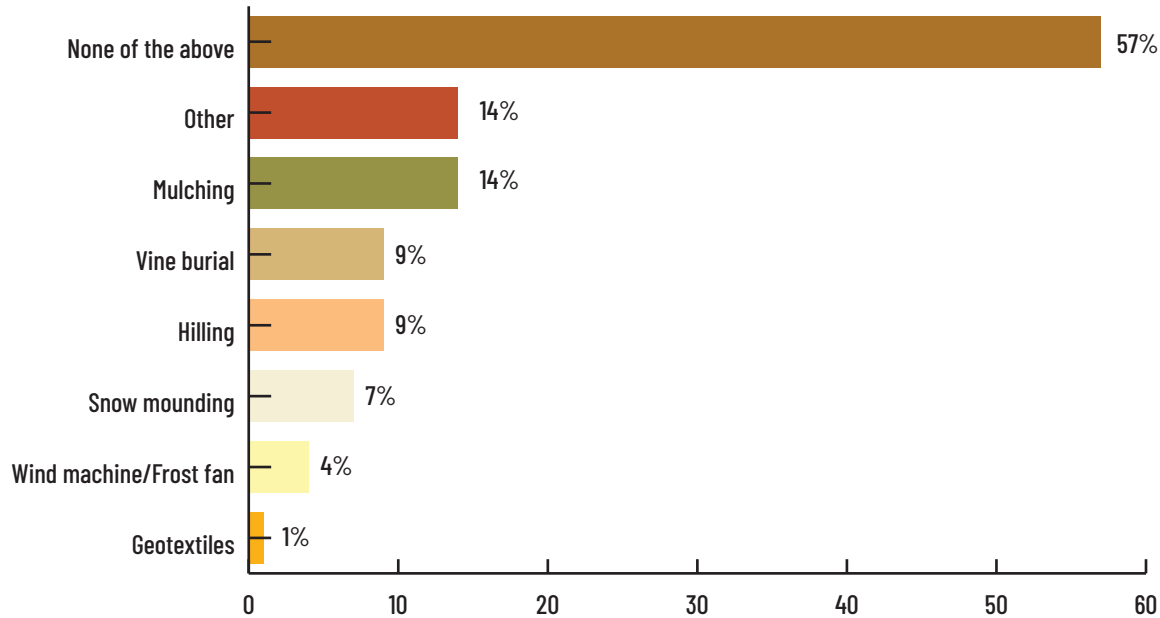
## COLD DAMAGE PROTECTION

When resources are tight, growers may be forced to compromise. To improve the sustainability of a vineyard, the production method needs to be economically viable, environmentally beneficial as well as socially responsible. Each operation must weigh risks and rewards of practices to determine feasibility.

Some production materials such as geotextiles are quite expensive and bulky to store making them undesirable for some. The practice of “hilling up” where soil is mounded to cover all or a portion of the vine can protect graft

unions from cold damage (Gohil, H. et al 2017). In the survey (Terroir Consulting, 2024) nine percent of respondents were practicing some form of vine burial. Some sites in BC might benefit from this practice but microclimates and which extreme weather event a grower focusses on and when might be hard to determine.

FIGURE 17: TECHNIQUES USED TO PREVENT WINTER INJURY TO VINES/BUDS



Base: n= 69

Q13: Which of the following techniques are you using to prevent winter injury to vines/buds? Select all that apply.

Source: Terroir Consulting, 2024

SECTION 4

# BC Wine Grape Market



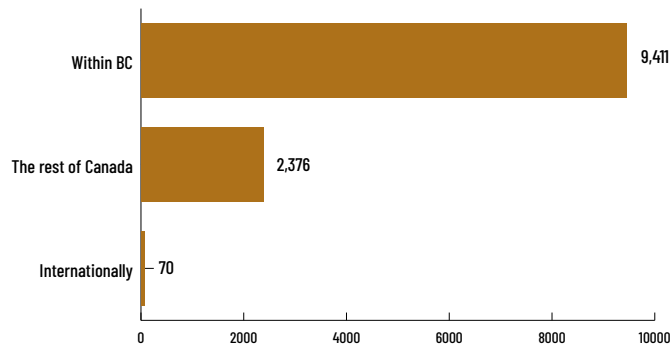


# Market Channels

## MARKET DISTRIBUTION

The majority (79% in Grapevine Impact Survey) of wine made with BC wine grapes is sold within British Columbia with an additional 20% distributed to the rest of Canada (Terroir Consulting, 2024). While actual export data of BC wine was unavailable for this report, it represents a very small distribution channel, which was reflected in the survey as well (about 1%).

FIGURE 18: AVERAGE ANNUAL MARKET DISTRIBUTION OF WINE MADE WITH 100% BC GRAPES TO DIFFERENT MARKETS



Base: n= 37

Q3: Please estimate the distribution of your wine made with 100% BC grapes to these different markets. Please enter the average annual number of cases for each market.

Source: Terroir Consulting, 2024

## DISTRIBUTION CHANNELS AND PROFITABILITY

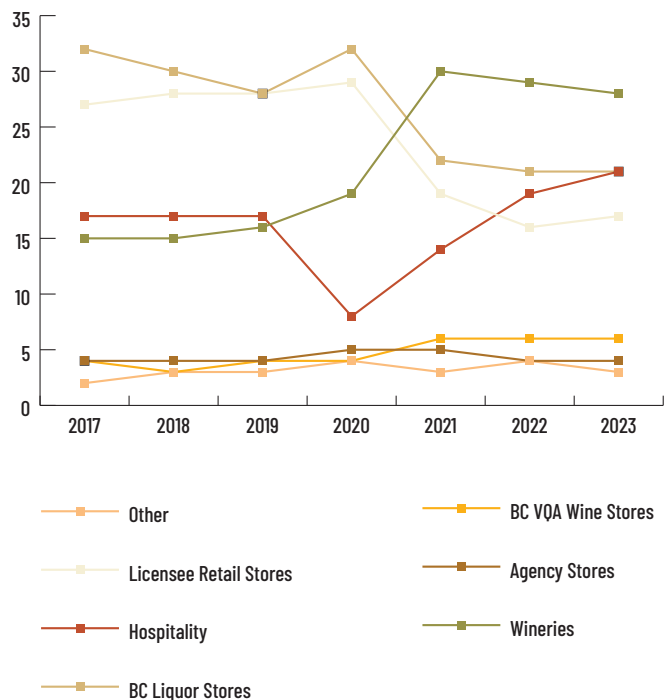
Most wine made with BC VQA and 100% BC Grapes is sold within British Columbia (Terroir Consulting, 2024) and the largest distribution channel for this wine in 2023 was wineries, with 23% of all litre sales (See Figure 19 below). In 2019, this distribution channel was the 4th highest (16%) behind BC Liquor stores (28%), Licensee retail stores (28%), and hospitality (17%). From 2020-2021, this distribution of BC wine began to change as winery sales became the largest channel for BC wine the past three years.

Notably, in 2020 during the outbreak of the COVID-19 pandemic, hospitality sales of BC wine declined from an average of 17% from 2017-2019 to only 8%. This distribution channel has rebounded and now makes up 21% of distribution. Although individual retail channels make up a smaller percentage of the overall distribution then they did 4-7 years ago, it remains an important

channel for BC wine with 47% overall (Agency stores, BC VQA stores, BC Liquor stores, and Licensee retail stores combined).

The distribution of litre sales aligns with the responses from the Grapevine Impact Survey (Terroir Consulting, 2024) as respondents indicated that winery visitation and wine club shipments within BC are the sales channels with the highest volume of wine distributed, followed by hospitality and retail (See Figure 20).

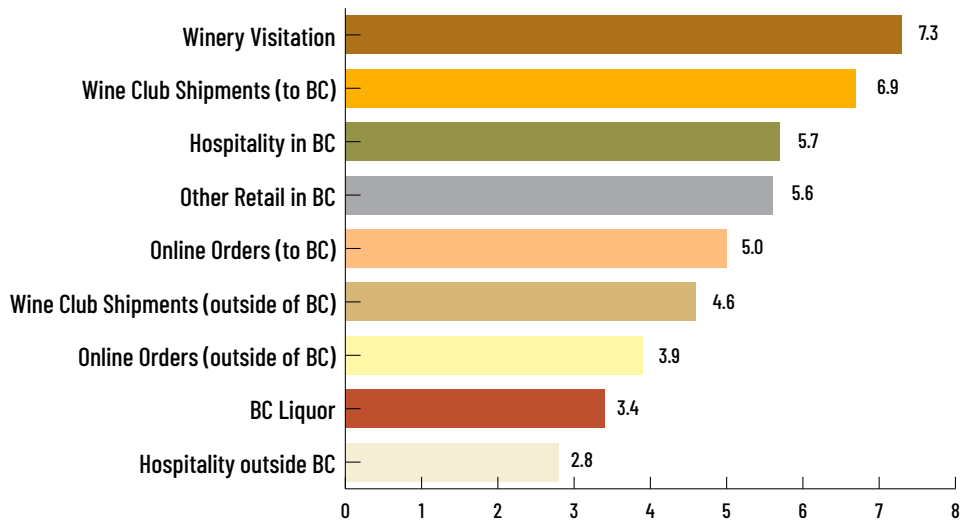
FIGURE 19: DISTRIBUTION PERCENTAGE OF BC VQA AND 100% BC GRAPE LITRE SALES BY CHANNEL - YEAR OVER YEAR



Source: Wine Grower's British Columbia purchased sales data from the BC Liquor Distribution Branch.

Respondents in the Grapevine Impact Survey (Terroir Consulting, 2024) indicated that the sales channels with the highest profitability of wine made with 100% BC grapes are those that come directly from the winery (See Figure 21 below). Winery visitation is the most profitable, followed by wine club shipments and online orders. Hospitality and retail are the least profitable distribution channels.

FIGURE 20: SALES CHANNELS WITH THE HIGHEST VOLUME OF WINE MADE WITH 100% BC GRAPES

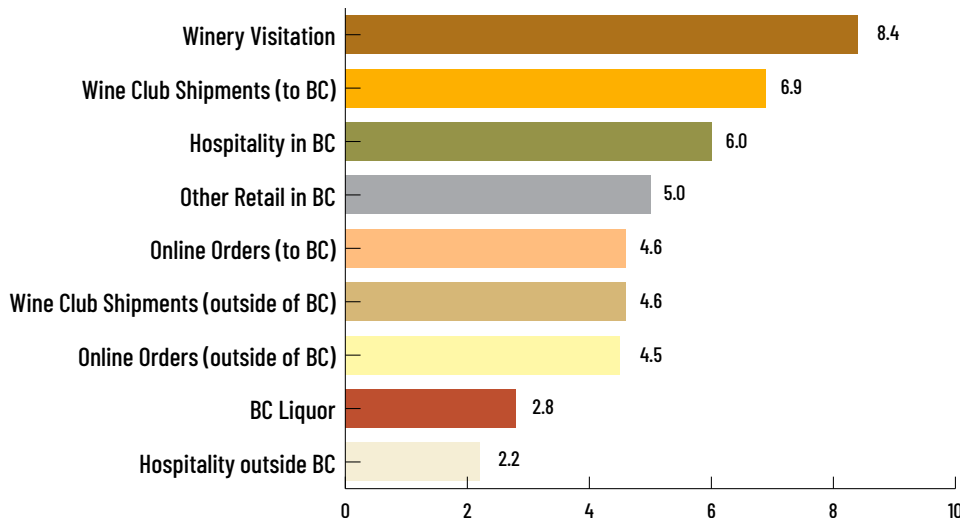


Base: n= 59

Q4: Please rank the following sales channels by where you sell the highest volume of wine made with 100% BC grapes. (1=Least Volume, 9= Most Volume).

Source: Terroir Consulting, 2024

FIGURE 21: SALES CHANNELS WITH THE HIGHEST PROFITABILITY OF WINE MADE WITH 100% BC GRAPES— RANKED



Base: n= 54

Q5: Please rank the following sales channels by what is most profitable to sell wine made with 100% BC grapes. (1=Least Profitable, 9= Most Profitable).

Source: Terroir Consulting, 2024

The majority of BC wine continues to be sold within British Columbia. The highest volume channel the past 3 years has become winery visitation, which is also the most profitable means of distribution. Hospitality and retail channels remain important for distribution within BC; however, in-person and online sales directly through wineries continue to grow in importance, both for volume and profitability.

## PRICING VARIATION

Using data purchased by WGBC from the BC Liquor Distribution Branch (See Table 7) and applying a 20% markup to wholesale prices, BC VQA wine has the highest average sales price/litre through the winery distribution channel in 2023 at \$28.73 (WGBC, 2024). This channel has consistently had the highest average price the past 7 years. One notable change in price variation is restaurants (hospitality), which went from having the lowest average sale price seven years ago (\$12.91/litre in 2017) to having

the second highest average price in 2023 (\$19.93/litre). Licensee retail stores have also seen a notable difference the past seven years as they had the lowest average retail price in 2017 (\$15.25) to the highest in 2023 (\$19.38). This compares to the other three retail distribution channels of BC Liquor (\$15.41 in 2017, \$17.32 in 2023), WGBC Save-On Foods (\$16.97 in 2017, \$17.33 in 2023), and non-Wine Grower BC grocery Loblaws stores (\$15.84 in 2017, \$18.20 in 2023).

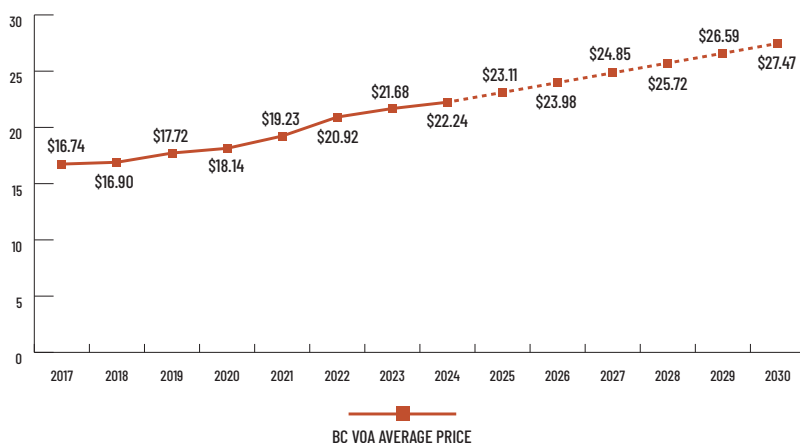
TABLE 7: BC VQA LITRE SALES PRICE BY CHANNEL

BC VQA LITRE SALES AVERAGE PRICE BY CHANNEL (WHOLESALE + 20% MARKUP)							
YEAR	ALL	BC LIQUOR STORE	LICENSEE RETAIL STORE	RESTAURANTS	WINERIES	WINE GROWERS BC SAVE-ON-FOODS	NON-WINE GROWERS BC LOBLAWS STORES
2023	\$21.68	\$17.32	\$19.38	\$19.93	\$28.73	\$17.33	\$18.20
2022	\$20.92	\$16.87	\$18.67	\$18.82	\$27.70	\$16.49	\$16.99
2021	\$19.23	\$15.46	\$17.12	\$17.78	\$25.64	\$15.72	\$15.16
2020	\$18.14	\$14.55	\$16.09	\$16.33	\$24.19	\$15.40	\$14.66
2019	\$17.72	\$14.90	\$15.89	\$15.52	\$24.51	\$15.94	\$14.68
2018	\$16.90	\$15.05	\$15.76	\$13.49	\$23.34	\$16.27	\$14.98
2017	\$16.74	\$15.41	\$15.25	\$12.91	\$22.70	\$16.97	\$15.84

Source: Wine Grower's British Columbia purchased sales data from the BC Liquor Distribution Branch. A 20% markup is added to wholesale prices to determine an average price per litre by channel. Note: only BC VQA wine is included in this valuation as 100% BC wine data is unavailable.

Overall, the average price per litre of BC VQA wine has grown from \$16.74 in 2017 to \$21.68 in 2023 (WGBC, 2024). Using a linear trend for the past seven years, the forecasted average price for BC VQA wine from 2024 to 2030 will continue the upward trend, with a forecasted increase of approximately \$0.87 per year until it reaches \$27.47 in 2030 (See Figure 22).

FIGURE 22: BC VQA LITRE FORECASTED SALES PRICE



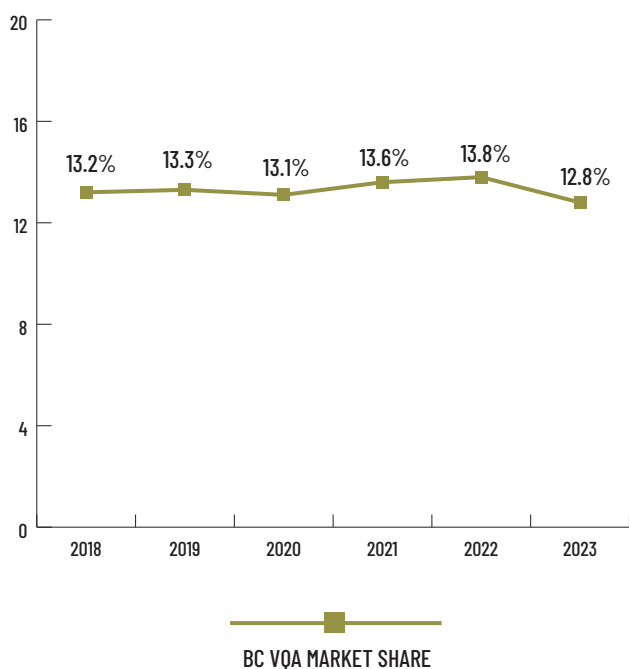
Source: Wine Grower's British Columbia purchased sales data from the BC Liquor Distribution Branch. A 20% markup is added to wholesale prices to determine an average price per litre by channel. Note: only BC VQA wine is included in this valuation as 100% BC wine data is unavailable.

## BC Domestic Market Demand

The strongest and largest market for BC wine is within British Columbia (See Figure 18). In 2022, there were 3,306,258 British Columbians that consumed wine at least yearly, spending an average of \$116 per person/year (Wine Growers BC, 2022). Importantly, the same study found that 91% of these wine consumers in BC have tried BC wine at least once in the past year, with 53% consuming it monthly. The most profitable distribution channel for BC over the past 3 years has been winery visitation (Figure 21) and 58% of BC wine consumers plan on visiting a BC winery in the future and 47% believe locally procured wine is important (Wine Growers BC, 2022).

In addition to a strong market and demand for BC wine within British Columbia, the overall domestic wine market share for BC VQA wine has been relatively consistent the past six years between 13.2% in 2018 and 12.8% in 2023 (See Figure 24).

FIGURE 23: PROVINCIAL MARKET SHARE OF BC VQA AND 100% BC GRAPE

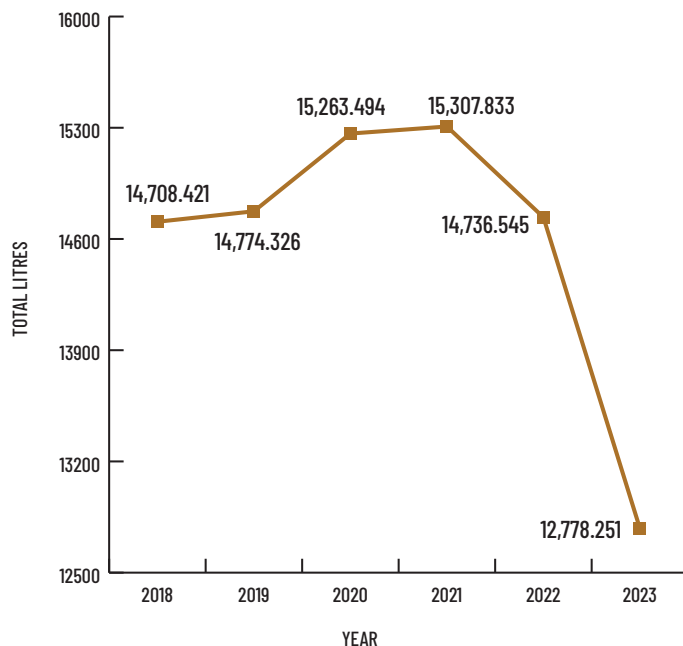


Source: Wine Grower’s British Columbia purchased sales data from the BC Liquor Distribution Branch. Note: only BC VQA wine is included in this market share as 100% BC wine data is unavailable.

Over the past 6 years, the total litre production of BC VQA wines peaked in 2021 (15,307,833 litres) and has slowly declined to 12,778,251 litres in 2023 (See Figure 24). Over 85% of grapes grown in BC are used in BC VQA wine (the data for the remaining litre production 100% BC grapes

are currently unavailable). Several environmental factors contributed to this decline in supply, including deep freeze in the winter of late 2022 and extreme wildfires.

FIGURE 24: TOTAL LITRES OF BC VQA WINE (2018-2023)



Source: Wine Grower’s British Columbia purchased sales data from the BC Liquor Distribution Branch. Note: only BC VQA wine is included in this market share as 100% BC wine data is unavailable.

Overall, the demand for BC wine within British Columbia remains strong, including through the most profitable distribution channel, winery visitation. The overall provincial market share of BC VQA wine has remained consistent the past 6 years. The consistent trend of the provincial market share for BC VQA wine over the past 6 years demonstrates that BC wine consumers will continue to support wine made with BC wine grapes. Supply has decreased the past two years, highlighting the need to ensure supply of BC wine keeps up with the strong provincial demand for the product.

## Canadian Market Demand

Global wine consumption has decreased to a 27 year low (Ruitenberg, 2024); however, closer examination reveals that consumption trends vary widely depending on the regional market. Researchers Ohana-Levi and Netzer (2023) examined the International Organisation of Vine and Wine (OIV) database for country-specific long term trends. Their temporal analysis of 1995-2021 revealed that although European production companies have

experienced strongly declining long-term consumption, non-European wine-consumption countries, including Canada, have experienced long-term strongly rising levels of consumption.

Canada demonstrated a sharp increase of winemaking participation, but even more notably, of all the countries examined in a long-term trend analysis, Canada led the globe in growth of wine imports. Appetite for domestic wine and healthy wine imports are the two main reasons Canada is considered by Wine Intelligence as the second most desirable wine consumption market in the world (2020).

In Canada, average consumer value continues to rise, reflecting the macro global market trends, as well as the increasing purchasing power of younger, more discerning drinkers between the legal drinking age (LDA) and 35. In contrast to other countries (such as the UK, US, Sweden and Japan,) Canada's LDA-age 35 segment participation rates (defined as the % of a given age group who say they drink wine at least once a month) remained stable from 2010-2020, and the baby boomer segment increased consumption during the same period (Wine Intelligence, 2022).

Since the pandemic, Canadians' trust level of Canadian wine has increased, along with self-reported purchases of Canadian wine (Wine Intelligence, 2020). However, there is persistent consumer confusion between wine made from 100% Canadian grapes and international bulk wine that is packaged in Canada (Cole-Johnson, 2024). Within British Columbia, 48% of wine consumers indicate that a quality assurance recognition program, like BC VQA, is an important factor when deciding which wine to purchase (Wine Growers BC, 2022).

In April 2024, Canada's population surpassed 41 million people (Statistics Canada, 2024a). Applying the 2020 participation percentages from the Canada Wine Landscapes report (Wine Intelligence, 2021) based on a 2020 population of 38 million (Statistic Canada, 2024b) to the corresponding 2024 population, it is estimated that there are currently 24.5 million wine drinkers (red, white or rosé wine) in Canada. It is estimated that Canada has 18.9 million regular wine drinkers who consume wine at least once per month, and 13 million weekly wine drinkers who consume wine at least once per week. Note these are estimates only, and do not take into account economic variations or consumption patterns of newcomers to Canada.

An application of the 15 litres consumed per capita by Canadians (Wine Intelligence, 2020), a stable rate

over five years, to the current population of 41 million, approximates that Canadians will consume 615 million litres of wine in 2024.

## *International Market Demand*

Despite very small amounts of bottled Canadian wine being exported internationally, approximately 23,000 hectolitres (OIV, 2023), there is high demand for these bottlings. Allegorically, the 2024 Financial Times festival in Washington, DC, featuring Canadian wines, saw the biggest turnout in its history (Robinson, 2024). The annual Canadian wine tasting at Canada House in London, UK, is always sold out, even in direct event competition from New Zealand, a much more widely distributed, higher volume export country in the UK market (Robinson, 2022).

British Columbia wines are well positioned to meet international market demand due to millennial taste and packaging consumer preferences, as well as overall country brand perception, and production methods that meet key export market consumer values. The challenge for British Columbian producers to meet strong demands in international markets are offering consistent allocations, determining stable market channels, and meeting international pricing criteria (Terroir Consulting, 2021).

## *Consumer Preferences*

Market demand for wine is subject to trends and fashion, like any consumer product. As international trade of bottled and bulk wine highly influences British Columbian wine's competitive set - for example, only 12.8% of wine sold in BC are BC VQA (FIGURE XX ( Provincial Market Share of BC VQA and 100% BC Grape)) - it is important to look at macro global wine consumption trends as well as those trends particularly influencing the domestic market.

Canada as a country is becoming a more sophisticated wine market. Within Canada, tracked consumer awareness of global wine-producing countries, wine styles, and general levels of wine knowledge increased dramatically between 2014 and 2020 (Wine Intelligence, 2020.) Variety remains the top wine-buying choice cue for 73% of Canadian consumers in 2019, followed by specific brand, recommendations, and promotions (66% each.)

Canadians recognize and are open to a wide range of grape varieties, with the BC market producing 102 grape varieties for domestic (79%) and Canadian market sales (20%) (see Figure: B.C. wine grape market channels and fluctuations in price by market channel.)

Broadly, Canadians are most familiar with grape varieties grown/originating in France and Italy, with 57% (France) and 54% (Italy) of Canadians consuming wine from these countries of origin in the last 6 months, followed by 35% drinking at least one bottle from the USA and 30% from Spain. (Wine Intelligence, 2020.) As an active importation country for wines from Germany to Argentina to Greece, Canadians are well versed and familiar with a wide variety of wine grapes, with names and styles in multiple languages. Additionally, the surge of wine e-commerce and digital during and post-pandemic (Wine Intelligence, 2021) means Canadians now have easy access to wine information (Bousquet, 2023), and are less deterred by unfamiliar grapes and styles.

The results of the Grapevine Impact Survey (2024) indicated the top five varieties that BC growers/producers find easy to sell are Pinot Gris, Pinot Noir, Chardonnay, Merlot and Syrah; however, the same survey data indicated the varieties they find hardest to sell were Riesling, Gewurztraminer, Chardonnay, Merlot and Pinot Noir. This seeming contradiction is an indication of the complexity of the wine industry, where different wineries cater to different customers, making varied styles and quality of wine at related price points.

TABLE 8: EASIEST VARIETIES TO SELL

VARIETAL (MINIMUM 3 MENTIONS)	MENTIONS
Pinot Gris	28
Pinot Noir	23
Chardonnay	19
Merlot	18
Syrah	16
Riesling	10
Rosé	5
Viognier	4
Sparkling	4
Blends	3
Gewurztraminer	3
Malbec	3

Base: n= 50

Q6: In your experience, please list the top five varieties that are the easiest to sell. List up to 5.

Source: Terroir Consulting, 2024

TABLE 9: MOST DIFFICULT VARIETIES TO SELL

VARIETAL (MINIMUM 3 MENTIONS)	MENTIONS
Riesling	14
Gewurztraminer	11
Chardonnay	10
Merlot	7
Pinot Noir	7
Hybrids	4
Viognier	4
Pinot Blanc	3
Muscat	3
Marechal Foch	3

Base: n= 50

Q6: In your experience, please list the top five varieties that are most difficult to sell. List up to 5.

Source: Terroir Consulting, 2024

## Top 5 Marketable Wine Styles

British Columbia has an exceedingly broad array of climates available to grow wine grapes, and these climatic factors in combination with soil conditions and water availability dictate the viability and productivity of the grape varieties for each region, vineyard and plot.

At this point, climate viability for each possible variety in the context of British Columbia's diverse growing regions is not available. The following are highly marketable wine styles with suggestions for possible grape variety plantings to meet those styles. Suggested varieties represent marketable solutions, but each variety must be examined by a grape grower for climate, soil, and general suitability in the specific intended planting area, before planting. Matching marketable styles and varietal viability on a provincial scale is work that remains to be done.

To produce marketable styles, grape varieties and related farming methods must support the target price, quality, and yields, with the constraints of the region. To that end, notes on quality targets, consumer segments, market price, and yield levels are suggested for each marketable style.

## QUALITY SPARKLING WINE

In Canada, sparkling wine has experienced tremendous momentum, with an annual growth rate of 6% between 2014 and 2018. The COVID pandemic globally boosted international sparkling wines sales, and the growth persisted post-pandemic with double-digit annual growth rates in most international markets splitting between retail and on-premise growth (Wine Analytics Report, 2024c).

Canada's domestic sparkling wine offerings represented only 17% of consumption in 2018, as stable production failed to keep up with the growth of imports (annual growth rate of 9%) in this segment. Of all sparkling wines sold in Canada, Italy represented 33% of sales, led by tank method Prosecco, consumed by 19% of Canadian wine drinkers at least once a year. Prosecco showed statistically significant growth between 2014 (12%) and 2018 (19%). The most marketable sub-category for tank (Martinotti, Charmat) method wines is extra dry, followed by brut and dry.

The combined 28% of French and Spanish wine sales were more dominated by traditional method bottling, indicating another market for this type of sparkling wine. A quarter of Canadian wine drinkers (25%) reported consuming French traditional method Champagne at least once a year: this number was stable between 2014 and 2018. The most marketable sub-category for traditional method wines is brut nature, followed by extra brut. For both methods, preferred sweetness levels vary by gender and age group (Kiefer & Szolnoki, 2023).

It should be noted that the average price for Italian, mostly tank method wines was \$12 USD, and the average for French wines, produced mainly in the traditional method, was \$34 USD, showing the gap in value between the two methods from the world's leading countries of production (Wine Intelligence, 2020).

Ancient method sparkling wines are included in the recommended Experimental and Quaffable wine style below. Carbon-injected sparkling wine is not recommended as a marketable wine style for British Columbian production, as it lowers consumer quality expectations and has a price-limited market appeal.

### TRADITIONAL METHOD SPARKLING TOP GRAPE VARIETIES

- Arinto
- Chardonnay
- Chenin Blanc
- Pinot Blanc
- Pinot Noir
- Meunier
- Riesling

### TRADITIONAL METHOD SPARKLING OTHER SUGGESTED GRAPE VARIETIES

- Assyrtiko
- Baga
- Furmint
- Monastrell
- Olaszrizling
- Parellada
- Sémillon
- Sumoll
- Viura
- Xarel-lo

### TANK METHOD SPARKLING TOP GRAPE VARIETIES

- Glera
- Lambrusco Sorbara\*
- Pinot Gris
- Riesling

### TANK METHOD SPARKLING OTHER SUGGESTED GRAPE VARIETIES

- Barbera
- Bonarda
- Bacchus
- Brachetto
- Chardonnay
- Friesa
- Gamay
- Lambrusco Salamino\*
- Madeleine Angevine
- Malvasia family
- Moscato Bianco
- Pinot Auxerrois
- Seyval blanc
- Other moderately-aromatic grape varieties

\*Note, these varieties must be co-planted.

## QUALITY TARGETS

Traditional method wines may be made in a non-vintage blended house style, or a vintage styled aged at least 18 months to fit the premium category, and at least 36 months on lees to fit the super premium category.

Tank method wine production should be aimed at the mid-market and premium levels to align with international offerings. These wines should have minimal lees contact or aging, instead aiming for freshness and fruit expression.

## CONSUMER SEGMENTS

In 2022, Wine Growers BC conducted a consumer segmentation study to identify the attitudes, behaviours, and preferences of BC wine consumers. The full report is available through their organization, which also details the demographic profile and communication preferences of each segment. Both traditional method and tank method wines are suitable for BC's Social Samplers and Passionate Advocates consumer segments. Secondly, traditional method wines are suitable for Engaged Explorers (Wine Growers BC, 2022).

## MARKET PRICE

Target market price for traditional method sparkling wines should align with international quality-focussed regions making similar wines, such as crémants from France, Franciacorta and Trentodoc from Italy, as well as Australia and American traditional method bottles. Note Cava and Spanish traditional method wines are perceived to have lower value in the Canadian market and should not be used as cases for price alignment.

Target market price for tank method wines should follow style, with mid-market and premium wines aligning to Prosecco and Lambrusco in Italy.

## YIELD LEVELS

As the focus for traditional method wines is on aromatic compounds and textures from secondary fermentation, moderate to higher cropping for modern fruit concentration is appropriate. Conversely, tank method wines require more primary fruit expression and should be cropped to a moderate level to ensure primary fruit concentration.



## WORKHORSE WHITES

As red wine sales have fallen globally, white wine sales have increased, with annual growth of nearly 5% to the end of 2022, to a total global value of \$39 billion, and an expectation to reach around \$67 billion by the end of 2033 (Carter, 2024). In 2021, white wines accounted for 43% of global wine sales. The country with the largest increase in white wine consumption was the USA, with an increase of 65% in the 2000-2021 period (Ruitenbergh, 2023). As per the shift from heavy red wine to light red and rosé, white wine has benefited from decreasing meat consumption and a change in consumers to more healthful options (Carter, 2023).

In Canada, regular wine drinkers reported drinking the following top white varieties in the past 6 months: Sauvignon Blanc (52%) followed by Pinot Gris (51%) and Chardonnay (51%) (Wine Intelligence, 2020). White blends have shown a statistically significant increase since 2017; however, aromatic varieties including Gewürztraminer and Viognier have seen a statistically significant decline in consumption (Wine Intelligence, 2020).

The following recommendations for workhorse white varieties were chosen for their moderate or neutral level of aromatics (with the notable exception of Sauvignon Blanc) and the ability of the grape varieties to crop at moderate levels without substantive loss of grape quality, maintaining appropriate concentration for the production of mid-market white wines. This category notably does not include the variety Gewürztraminer, which was noted by BC grape growers as one of the most difficult varieties to sell in the Grapevine Impact Survey, and has low consumer interest.

### TOP GRAPE VARIETIES

- Chardonnay
- Pinot Gris
- Sauvignon Blanc

### OTHER SUGGESTED GRAPE VARIETIES

- Arneis
- Albariño
- Biancolella
- Catarratto
- Chasselas
- Cortese

- Completer
- Friulano
- Garganega
- Pinot Blanc
- Rauschling
- Verdicchio
- Verdejo

Other neutral to moderately aromatic grape varieties with moderate concentration at moderate crop yields.

### QUALITY TARGETS

White wines may be made as single variety or blended wines, with moderate concentration of fruit, in either savoury or fruit-forward styles. Oak usage is not ideal for mid-market target consumers who prefer the fresh fruit from reductive and moderately oxidative winemaking in inert, temperature controlled vessels. These wines are intended for early consumption.

### CONSUMER SEGMENTS

In 2022, Wine Growers BC conducted a consumer segmentation study to identify the attitudes, behaviours, and preferences of BC wine consumers. The full report is available through their organization, which also details the demographic profile and communication preferences of each segment. The primary target for mid-market white wines is the Comfortable Casuals market segment, with a secondary target of Engaged Explorers (Wine Growers BC, 2022).

### MARKET PRICE

Market price should be determined with a cost basis as a lower bound and price matching to mid-market white wines from New Zealand, Italy and the USA as an upper bound.

### YIELD LEVELS

For mid-market selections, moderate concentration of fruit at moderate yields is appropriate to meet the intended style.

## LIGHT REDS AND ROSÉ

Big, bold reds from Bordeaux are representative of the general decline of mid-market heavier red wine styles, being replaced by mid-market lighter reds and rosé. According to the Wine Market Council (Wine Analytics Report, 2024a), a backlash against high tannin, high oak red wines is shaping the global market away from heavier red wines to lighter, more elegant red offerings. In France, a global mass market trend leader in both production and consumption, rosé sales have repurposed fruit previously intended for red wine sales. Two thirds of 18-24 year old French wine drinkers do not drink red wine, reporting not to like the taste (Thompson, 2024). Canada ranked among the top ten countries still drinking red wine, with 57% of consumption in this category (OIC, 2023b); however, the countries on this list tend to be market followers, indicating this number may still fall.

Rosé production increased 25% between 2001 and 2021 across the world, accounting for a portion of the much larger concurrent 25% decrease in red wine wine (OIV, 2023b). After a decade of strong growth, the demand for rosé has moderated in the US market, with a 9% annual decline tracked in retail sales in 2023 (Wine Analytics Report, 2024b). In addition to Canadian rosés, Canadians mostly consume rosé wines from the Napa Valley, USA, Maipo, Chile, and Provence, France. (Wine Intelligence, 2020). It is important to realize that the diversity of rosé styles from these regions indicate that Canadians are not as focussed on the very light colour from direct pressing, typical of the Provençal style, as the rest of the world. In fact, consumers may prefer a tone or hue of pink colour from a local wine, simply because it is what they are used to (Peres et al., 2020).

It is important to note that lighter bodied, lower alcohol, fresher red wines, including rosé versions, also provide an option to harvest earlier and mitigate the effects of smoke taint, a persistent oenological issue in British Columbia (Osborne & Tomasino, 2019). At mid market production with moderate crop loads, rosé can also be a more profitable solution for red grapes (Costello et al. 2023). The following varieties were chosen for their lower anthocyanin levels, ability to retain freshness, and slow to moderate sugar accumulation during the growing season, supporting lower alcohol bottlings.

### TOP GRAPE VARIETIES

- Blaufrankisch
- Cabernet Franc
- Gamay Noir
- Grignolino

- Nerello Mascalese
- Pinot Noir
- Schiava Gentile

### OTHER SUGGESTED GRAPE VARIETIES

- Barbera
- Blauer Wildbacher
- Bondola
- Cinsault
- Dolcetto
- Frappato
- Frühburgunder
- Garnacha
- Hondarribi Beltza
- Kadarka
- Malbec
- Marquette
- Monastrell
- Montepulciano
- Saint Laurent
- Schiava Grigia

### QUALITY TARGETS

Light red and rosé wines may be made as single variety or blended wines, with moderate to high concentration of fruit, in either savoury or fruit-forward styles. New oak usage is not necessary for lighter reds and rosés; whereas careful fruit handling and moderate fermentation temperatures to preserve delicacy and fresh fruit are key. These mid-market to premium wines are meant for early consumption or short aging.

### CONSUMER SEGMENTS

In 2022, Wine Growers BC conducted a consumer segmentation study to identify the attitudes, behaviours, and preferences of BC wine consumers. The full report is available through their organization, which also details the demographic profile and communication preferences of each segment. Mid-market wines are appropriate for the Comfortable Casuals market segment. Premium light red and rosés are meant for the Social Samplers and Passionate Advocates markets.

### MARKET PRICE

Market price should be determined with a cost basis as a lower bound and price matching to mid-market and premium varietal equivalents as an upper bound.

### YIELD LEVELS

Fruit should be harvested with freshness and moderate alcohol in mind. For mid-market selections, moderate concentration of fruit at moderate yields is appropriate; for premium wines intended for short aging, higher concentration of fruit from moderate to low-moderate yields is required to meet the intended quality tier.

## SUPER PREMIUM REDS

Unlike other wine segments, super premium, or “fine” wine is tracked on resale markets with trading indices. These indexes can be helpful in understanding global preferences for classic wine styles, even outside the original origin of production.

The market for super premium wine grew rapidly for a decade: fine wine outperformed all other global commodities and equities at the end of 2022, except for oil (Liv-ex, 2022). The focus of collectors’ attention has been on Burgundy, and secondarily, Champagne. Wildly escalating prices for village to grand cru Burgundy wines was driven by younger wine drinkers. In secondary trading, 28-50 year olds drive the market (Carter, 2022); and Sotheby’s wine auctions reports that now 40% of purchasers are under 40 years old (Carter, 2023). Burgundy purchasers are high net worth individuals looking for alternative investments with their escalated post-pandemic earnings (Carter, 2022).

In 2023, as the global economy reacted to the skyrocketed prices of Burgundy and Champagne, a double-digit correction in the fine wine market cooled trading. Despite this recent development, prices for Burgundy remain at an all-time high, and strong market demand has opened the door for super premium Pinot Noir from other regions. Top Pinot Noirs are able to raise prices and are sought by affluent wine lovers as alternatives to cru Burgundy. Notably, British Columbian regular wine consumers rank the Okanagan Valley parallel to Burgundy comparing the percentage of regionally produced wines as “very high quality”, indicating the willingness to rank top BC wines in the super premium category. The BC wine trade is more discerning, with 66% associating Burgundy with “very high quality” and only 30% associating British Columbia with “very high quality.” Additionally, BC consumers associated the quality of “wines I am proud to serve” higher for all Canadian wines than wines from any other origin (Halstead, 2021).

The escalating prices of Burgundy, strong sommelier following, and the demand for regional Pinot Noir-like replacements has raised the prices and relative value perception of Beaujolais (Schiessel Magrini, 2023). Burgundy producers are now investing in the region, and Gamay-based wines across the world are becoming in higher demand (Abhay, 2024). Canadian Syrah is another variety recognized for its super premium market potential. At Canada House tastings in London (Abhay, 2024, Robinson, 2022), Canadian wine awards (MacNaull,

2024) and international varietal wine competitions (Stephanowicz, 2023), both Gamay and Syrah single-variety wines are attracting attention as notable varieties expressed in a Canadian style.

Other strongly sought-after super premium wines on the secondary market included collectable Italian options such as Nebbiolo from Barolo and Sangiovese from Montalcino. In Canada, Tuscany is the second most recognized global region of origin (after the Napa Valley) and Italy has the highest number of recognized regions of origin with Canadians of any import country (Wine Intelligence, 2020). In international trade, the 2024 Bordeaux release of the 2021 vintage saw a dramatic decline in price offerings en primeur (pre-bottling), with some chateaux setting 2023 prices for the 2020 vintage at 40% less than the vintage before (Cole-Johnson, 2024). These price declines resulted in increased trading; however, it is prudent to understand Bordeaux blends are not as in demand globally, with the exceptions of Super Tuscans from Italy and California big reds. After the Italian theme at the Vancouver Wine Festival, BC Liquor stores saw a jump in demand for Italian wine (Rowan, 2024). Consumption of California wine, including Bordeaux variety blends, remains high in British Columbia. Canada receives 33.3% of all US global wine exports (AAWE, 2023). Big, bold red blends with higher alcohol and full body, often with some residual sugar, have become very popular in the market with millennial men (Carter, 2024).

### TOP GRAPE VARIETIES

- Cabernet Franc
- Gamay
- Pinot Noir

### OTHER SUGGESTED GRAPE VARIETIES

- Cabernet Sauvignon
- Merlot
- Nebbiolo
- Sangiovese
- Syrah

### QUALITY TARGETS

Super premium red wines should be made with the highest possible quality to be expressed, combining careful fruit selection and winemaking, as well as premium barrel selection to set up wines for improvement in bottle for at least 10 years.

## CONSUMER SEGMENTS

In 2022, Wine Growers BC conducted a consumer segmentation study to identify the attitudes, behaviours, and preferences of BC wine consumers. The full report is available through their organization, which also details the demographic profile and communication preferences of each segment. BC super premium reds are dominantly appreciated by consumers in the Engaged Explorers and Social Samplers segments.

## MARKET PRICE

Market price for super premium BC wines should be positioned with price matching to premium, and lower-tier super premium prices in comparison to international equivalents: Pinot Noir from non-Burgundy quality production regions, Bordeaux blends from Australia and Chile, and Italian varieties from DOC or regional levels.

## YIELD LEVELS

In the vineyard, careful methodologies for optimal quality including careful irrigation and canopy management practices should be employed. Vineyards should be planted at higher density in richer soils and moderate density in less rich soils. Yields should be carefully restricted to ensure fruit concentration. Fruit should be carefully selected from only the best plots, harvested with freshness and phenolic development in mind, and carefully sorted to ensure inclusion of only super premium fruit.

## EXPERIMENTAL AND QUAFFABLE

Driven by the Passionate Advocates consumer segment, this highly experimental category is continually changing. Blending innovation and tradition, using rare and even hybrid grape varieties, this category produces quaffable, contemporary styles. It is the world's strongest alternative opportunity category (Wine Intelligence, 2022b), yet the most loosely defined. From the consumer and trade standpoint, this category is a place of discovery, with storytelling and novelty being primary value attributes.

The Experimental & Quaffable category is a collection of evolving, trending wine styles that will change over time. In 2024, the wine style segment prioritizes the following sub-categories:

**TEXTURAL WHITES:** moderately aromatic or neutral grape varieties create wines with moderate alcohol, moderate to medium acid, medium to full body, and texture on the palate from winemaking. If moderately aged, these wines are ready for consumption on release.

**SKIN-CONTACT WHITES:** pale orange to medium amber in colour, extended skin contact white wines have phenolic grip, low to medium levels of tannins, and pronounced plate texture and concentration. Wines may be aged in the fermentation vessel; however, are ready to drink on release.

**ANCIENT METHOD SPARKLING WINES:** pétillant naturel wines may use white or black grapes to make a range of colours. In the Canadian market, fully dry, savoury wines with moderate levels of alcohol and moderate level of mousse (2-4 bars of pressure) are preferred.

**SAVOURY REDS:** similar to the Light Reds and Rosé category; however the winemaking focus is on enhancing savoury character. Grapes with higher levels of anthocyanin are also acceptable if made with moderate alcohol. If moderately aged, these wines are ready for consumption on release.

**VIN GRIS:** using black grapes to make an almost white wine, this category is useful for bleeding juice quickly off skins, including for avoiding smoke taint, and for creating delicate, fruity wines. Aging is not required and wines should be consumed immediately on release.

Suggested grape varieties are a very wide selection, as variety is a key success element of this category. Hybrid grapes are included, as knowledge of producing quality wine at the premium level is increasing. As an indication of evolving quality, in 2024, the Decanter World Wine

Awards awarded the first gold medal to Pennsylvania's Mazza, The Perfect Rosé 2022, produced from 100% Chambourcin – a French-American hybrid variety.

### SUGGESTED GRAPE VARIETIES

- All white and red varieties listed in Workhouse White and Light Reds/Rosé.

### ADDITIONAL SUGGESTED GRAPE VARIETIES

- Chambourcin
- Frontenac
- Gamaret
- Grüner Veltliner
- Marquette
- Saperavi
- Savagnin
- Semillon
- Timorasso

### QUALITY TARGETS

This wine style is premium in nature, requiring careful fruit selection, thoughtful winemaking, expressing savoury or moderately fruity styles. This group of wines is meant for immediate consumption, with any aging done pre-release.

### CONSUMER SEGMENTS

In 2022, Wine Growers BC conducted a consumer segmentation study to identify the attitudes, behaviours, and preferences of BC wine consumers. The full report is available through their organization, which also details the demographic profile and communication preferences of each segment. This experimental category is led by the Passionate Advocates market segment, with broad support and engagement from the Social Samplers segment.

### MARKET PRICE

Market price for experimental BC wines should be aligned with premium wines appealing to the same curious market segment, from contemporary wine regions, such as the Loire Valley and Jura, France, Sicily and Lazio, Italy, Swartland, South Africa, Patagonia, Argentina, Tasmania, Australia, Greece, Croatia, and Hungary.

### YIELD LEVELS

Fruit should be harvested with freshness and moderate alcohol in mind. For premium wines intended for short aging, higher concentration of fruit from low-moderate yields is required; whereas moderate yields may be appropriate for wines for early release.

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