fermentasmania

SIPP Grant 2023
Polyphenolic Fruit Waste Valorisation Study

Stage 2

Target Fruit Waste Report

SUPPORTED BY

Tasmanian Government

PROJECT PARTNERS

Fruit Growers Tasmania

UNIVERSITY of TASMANIA

TIA

Tasmanian Institute of Agriculture

TIA is a joint venture of the University of Tasmania and the Tasmanian Government

Startupbootcamp FoodTech

the forager food co.

redefining the food experience

Clever intelligent fermentation

© 2024 FermenTasmania Inc.

Authors: Dwayne Baraka, Michael Landman, Anna Barlow and Kim Seagram Graphic Design by: Lachlan Winspear

Executive Summary

The Stage 2 report of the Polyphenolic Fruit Waste Valorisation Study, funded by the Department of Natural Resources and Environment (NRE) 2023 Strategic Industry Partnership Program (SIPP) Grant, focuses on the amount of available fruit waste from selected target fruits in Tasmania. This project leverages the state's rich agricultural heritage and forward-thinking sustainability practices to address the dual challenges of waste management and economic development in the agricultural sector.

Tasmania's fruit growers face the perennial problem of managing waste from second-grade fruits and fruit by-products. Traditionally, such waste has been seen as an unavoidable loss, often ending up in landfills or as compost. This not only represents a significant environmental issue but also a missed economic opportunity for growers, who could benefit from alternative uses that add value to these by-products. By exploring and implementing valorisation strategies, the project aims to turn waste into valuable resources, creating new revenue streams for growers, reducing environmental impact, and contributing positively to the state's economy. Annual Fruit Waste streams from apples, cherries and grapes are high enough to explore viable alternative uses (Table 1).

Table 1 – Target Fruit Waste amounts in the current Tasmanian Ecosystem

Fruit Waste Identified	Low Estimate	High Estimate	Confidence Level
Apples	2,450 tpa	4,350 tpa	Moderate
Cherries	750 tpa	2,000 tpa	Low - Moderate
Grapes	2,150 tpa	4,750 tpa	High

This report identifies existing solutions identified by growers for valorising fruit waste from apples, cherries, and grapes. It also identifies the development of some products new for Tasmania such as polyphenol concentrates and utilising fermentation technologies to extract

and/or increase the yield of valuable compounds. The report underscores the importance of further research and development, infrastructure investment, and ecosystem development to realise these opportunities.

The study also outlines several potential benefits for growers:

- **Increased Revenue Streams**: By valorising fruit waste, growers can tap into new markets, by selling what was once waste as valuable products,
- **Reduced Waste Management Costs**: Converting waste into products on-site can significantly lower the costs associated with waste management and disposal,
- **Enhanced Sustainability**: Participation in waste valorisation contributes to a more sustainable agricultural ecosystem, potentially attracting consumers interested in sustainable products, and
- **Reputation and Brand Value**: Engaging in innovative sustainability practices can enhance the reputation of Tasmanian fruit growers, both domestically and internationally.

If the identified Fruit Waste is fully valorised the size of **increased revenue for Growers of the Target Fruits is likely in the range of $AUD 1.2 to 10.2 m** and **the size of increased GDP for Tasmania is indicatively within the range of $AUD 55 to 275 m** (Table 2). In addition, it is expected that **fully valorising Fruit Waste will create jobs between 100 and 500 ongoing full-time equivalent (FTE) jobs.**

Table 2 – Estimates of value of valorisation of Target Fruit Waste in Tasmania

	Low Estimate	High Estimate
Fruit Waste Value	$140 - 300 per tonne	$450 - 1,500 per tonne
Value to Growers (selling identified fruit waste)	$1.2 million	$10.2 million
Additional Value if Growers participate in value-adding processes	$54 million	$275 million

The report concludes that the potential economic benefits to growers from fruit waste valorisation are substantial, and that the next three stages of the Project will be crucial. It calls for further investigation to refine these solutions, including the development of new technologies, the building of partnerships across the agricultural and food processing sectors, and the exploration of new markets for valorised products. Additional valorisation opportunities are available and will be identified in the Stage 3 New Ecosystem Report.

As the project progresses, it will focus on creating and testing new processes, business models, and ecosystems to utilise target fruit waste effectively. This includes identifying opportunities for growers and non-growers alike, supplementing existing ecosystems with additional resources, and supporting fermentasmania's goal to create up to 650 jobs through innovative valorisation strategies.

Fermentasmania and all the Project Partners underscore their commitment to Tasmanian farmers. The project embodies a comprehensive approach to agricultural innovation, one that respects the heritage of Tasmanian farming while forging a path towards a more sustainable and prosperous future.

"We are proud to be part of creating new income streams for Tasmanian farmers. We are equally proud to be diverting waste away from carbon emissions and into products that advance Tasmania's economy and global health"

Kim Seagram, fermentasmania Chair

About fermentasmania

Fermentation is the delicious alchemy that transforms our food - grains into bread, cabbage into kraut, milk into cheese, grapes into wine.

At fermentasmania, we believe in the power of fermentation to transform our produce, our people, and our place. By connecting industry, educators, government, and consumers, we are cultivating a community of creative food lovers & innovators.

The word fermentation comes from the Latin verb "fervere" which means to boil. We believe fermentation can turn the heat up on Tasmania, creating new jobs and new businesses on our island and helping Tasmanian food reach new markets. Through fermentation, we can craft innovative, value-added food & drinks that take a taste of Tasmania to the world.

Human history is replete with examples of resourceful use of food ‘waste’ and also of making ‘hay’ (fermented food products) while the ‘sun’ shines (before foods are spoiled). Fermented foods formed part or the core of staple diets across global cultures; from Kim Chi in Korea, to Sauerkraut in Germany, to food produced by indigenous Australian cultures.

Fermentation is culture and in Tasmania our culture is alive. Join us on our journey, as we put Tasmania on the map as a unique global centre for excellence in fermentation.

The Fermentas Trade Network is your one-stop-shop for our island's premium fermentation businesses. Let us put you in touch with small and large producers alike to bring a taste of Tasmania to you.

Ask us if you want to know more about the value of fermented foods.

Defined Terms

Term	Description
1st Grade Fruits[1]	Unblemished fruit that meets direct-to-consumer expectations on size, colour and quality
2nd Grade Fruits	Minor blemished fruit that otherwise meets direct-to-consumer expectations on size, colour and quality
3rd Grade Fruits	Fruits that do not meet direct-to-consumer expectations on size, colour and quality; or are over-ripe for use in direct-to consumer markets
CAS	Controlled Atmosphere Storage
Shelf Stable Products	Products that have a shelf life of at least several months at ambient temperatures; usually in cans or jars and including cider, vinegar, jam, syrups, relishes, etc...
SIPP	Strategic Industry Partnership Program
Target Fruits	Apples, blackcurrants, cherries, elderberries, grapes
Target Fruit Waste	Fruit and fruit by-products from the Target Fruits that are diverted into landfill, compost or animal feed

[1] There is no Australian standard that governs classification of fruits in Australia. The categorisation of fruits as 1st, 2nd and 3rd class is largely driven by market behaviours. The classifications listed here are the usual conventions encountered among growers in Tasmania.

Table of Contents

1. Introduction

Fermentasmania received funds from the Tasmanian State Government Department of Natural Resource and Environment (NRE) 2023 Strategic Industry Partnership Programme (SIPP) Grant scheme to research current uses of certain fruit seconds and by-products in Tasmania and to investigate the viability of increasing the economic value derived by growers (and others).

1.1 Opportunities for Tasmanian Fruit growers

Several main opportunities exist for Tasmanian fruit growers:

1. To increase the viable price for certain unsold first-class fruits, fruit seconds, fruit by-products and fruits that are disposed of for, on average, less than $50 per tonne, and frequently for $0 per tonne,
2. To explore options for certain sub-optimal fruits and fruit by-products that may be higher value to growers than current uses, and
3. To explore participation in the growing demand for nutraceutical products (in mainland Australian markets and globally).

Data from the Survey indicates that the economic opportunity for growers from increased valorisation for unprocessed Fruit Waste is in the range of $1.2 m to $10.2 m per annum. That number rises exponentially if growers participate in value-add processes.

1.2 Project Stage

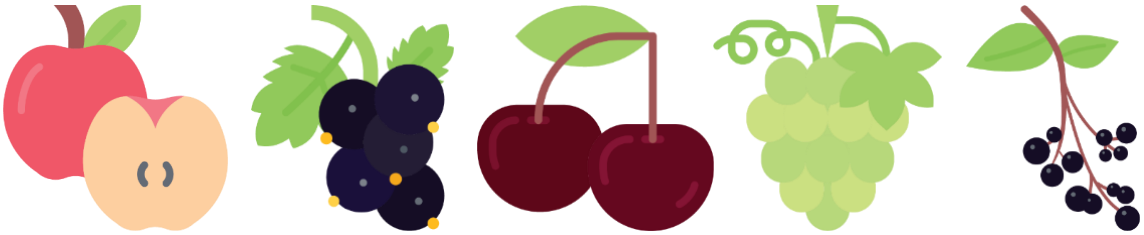
This is Stage 2 of a possible 6 stages in this Project and is a vital building-block for remaining stages (for more details see Appendix A).

Stage 1 – Existing Ecosystem Report (complete)
Stage 2 – Polyphenolic Fruit Byproduct / Waste Report (this report)
Stage 3 – New Ecosystem Viability Report
Stage 4 – Ecosystem Trial Report
Stage 5 – Funding Report
Stage 6 – Fruit Waste Ecosystem Report

1.3 Further Project Stages

Future focus for the Project is on creation and testing of new processes, Grower relationships, business models and ecosystems that will utilise Target Fruit Waste and monetise / valorise opportunities for growers. That will necessarily involve identifying:

- Opportunities for growers,
- Opportunities for non-growers, and
- Parts of the existing ecosystem that need to be supplemented with additional resources and general ecosystem developments that will help add to Tasmania's GDP and jobs.



2. Target Fruits

Target Fruits were chosen primarily on polyphenol content and availability of waste as described in more detail in the preceding Stage 1 Existing Ecosystem Report.

2.1 Target Fruit Waste

Target Fruit Waste is defined in Stage 1 of this Project as "fruit and fruit by-products from the Target Fruits that are diverted into landfill, compost or animal feed". For further details of identification and classification of fruit and fruit by-products as Fruit Waste, please refer to the Stage 1 Existing Ecosystem Report and the Maps included.

Growers use a variety of strategies to minimise Fruit Waste, including:

- Forward contracting,
- Selling from the Farm Gate,
- Selling at Farmers' Markets,
- Producing own-branded, shelf-stable products,
- Freezing surplus produce, and
- Actively creating other products.

2.2 Food Loss and Waste Standard

Survey data was captured in accordance with the Fruit Loss and Waste Standard. Further details on the Standard are included in the Stage 1 Existing Ecosystem Report.

2.3 Known Target Fruit Waste Destinations

Target Fruit Waste occurs at several points in the existing ecosystem:

- Chemical and physical thinning leads to Fruit Waste that has no viable economic path,
- Target Fruits that don't leave farms due to spoilage (picked and unpicked fruits) creates Fruit Waste on-farm that is usually disposed as composting or animal feed,
- Target Fruits that leave farms and enter storage facilities in Tasmania and subsequently spoil creates Fruit Waste that could be used for further value-add production,
- On-farm value-add processes leads to Fruit Waste (such as grape marc and apple pomace) that could be used for further value-add production,
- Tasmanian commercial value-add processes leads to Fruit Waste at the site of processing that could be used for further value-add production, and
- Fruits processed on the mainland or overseas leads to Fruit Waste that Tasmanian businesses cannot use as a value-add product.

Table 3 (below) further identifies where fruit seconds and by-products are diverted to become Target Fruit Waste in Tasmania.

Table 3 – Target Fruit Waste locations in the current Tasmanian Ecosystem

Farm Activity	Type of Activity	Detail of Activity	Strategy / Conclusion	Market	Sub-Market	Sales Channel / Product						Resulting Waste Type			
						Gate Sales	Farmers' Markets	Primary Food Sellers	Shelf-Stable Products	Frozen Products	Freeze Dried products	Landfill	Compost	Livestock Feed	Unknown Waste
Thinning	Chemical	Increased Yield											✓		
	Physical	Increased Yield										✓	✓	✓	✓
Harvest	Picked	Strip Picked	Sell all	Tasmanian Markets				●				✓	✓	✓	?
				Australian Markets				●							x
				Global Markets				●							x
		Selectively Picked / Sorted	1st Grade	On-Farm use		●	●		●			✓	✓	✓	✓
				Tasmanian Markets				●				✓	✓	✓	✓
				Tasmanian Processing				●	●	● +	●	✓	✓	✓	?
				Australian Markets				●							✓
				Global Markets				●							✓
			2nd Grade	On Farm Use		●	●		●			✓	✓	✓	✓
				Tasmanian Markets				●	●			✓	✓	✓	✓
				Tasmanian Processing				●	●	●	●				?
				Australian Markets	'Ugly' Fruits			●							✓
				Global Markets				●							✓
			Waste	Unknown								✓	✓	✓	✓
	Not Picked	Left on Farm	Waste	Unknown									✓	✓	✓

Table 1 Key

- ● Sales Channel / Product distribution path
- ✓ Waste available for use by growers
- ? Waste not available to growers; may be available to other users.
- x Waste not available for use by growers
- \+ Resulting product may be available to growers for further value-adding processes

2.4 Target Fruit Growing Characteristics

Target Fruits are all affected to lesser or greater degrees by seasonal variability, geographic clustering, climate change and grower behaviour. Each of those factors are briefly described below.

2.4.1 Seasonal Variability

Seasonal variability affects all growers and all harvests of Target Fruits and yields rise and fall with varying growing conditions. Of the Target Fruits, cherries are especially susceptible to unfavourable weather conditions in any given year (growers reported variation of up to 100% from the least to most productive years), and because there isn't any significant infrastructure to shift supply to match demand, a much higher percentage of cherries end up as Target Fruit Waste than other Target Fruits. By contrast, almost all grapes grown in Tasmania are high quality and utilised in the production of wines almost immediately after harvest, regardless of quantity available.

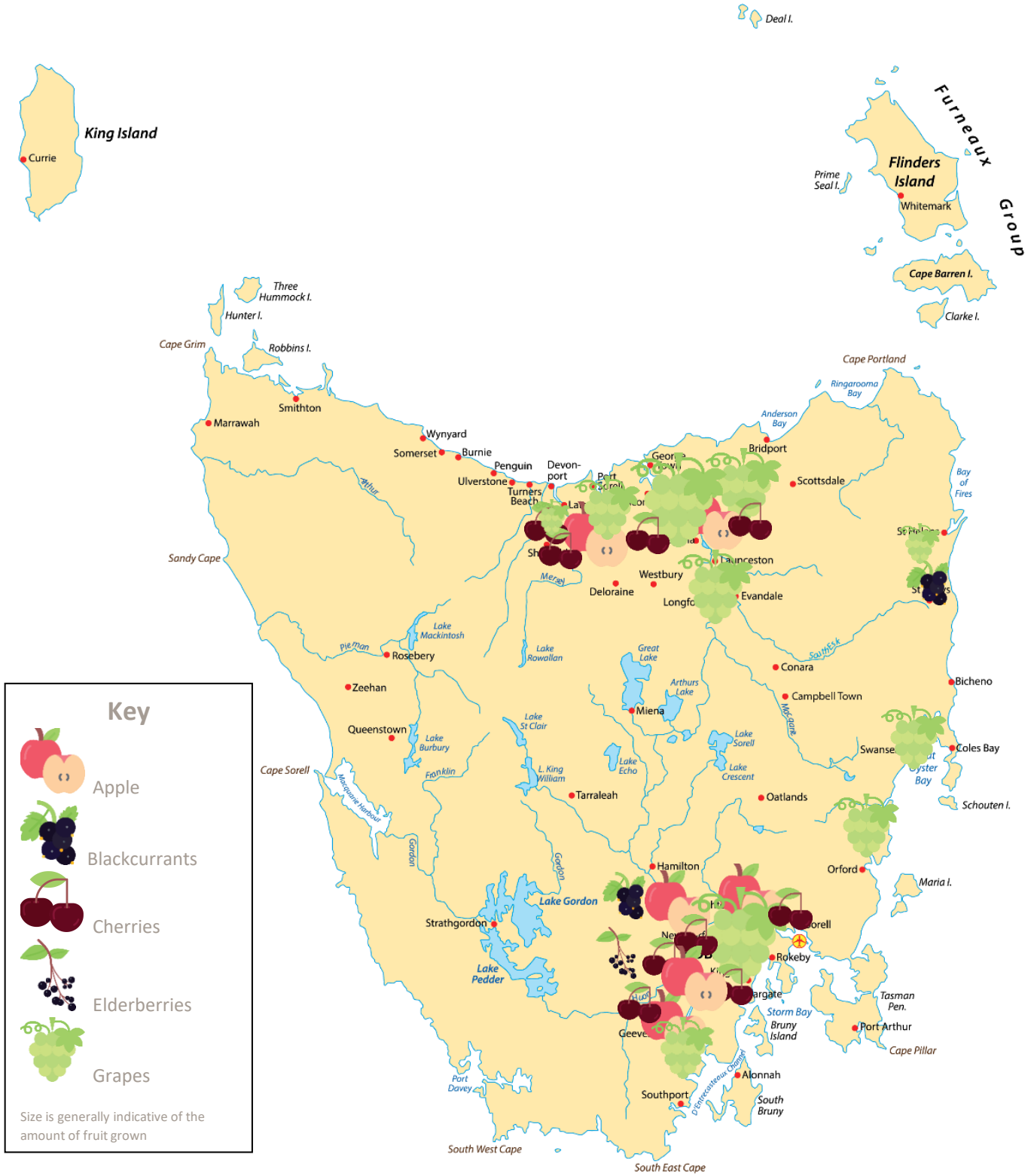
Apples are commonly stored in Controlled Atmosphere Storage (CAS), either on-farm or by third parties, meaning that supply is shifted outside harvest times to ensure year-round availability of apples. Third-grade apples are sometimes left unharvested, and, in rare years, second-grade apples also remain unharvested.

2.4.2 Geographic Clustering

Growers of the Target Fruits are distributed across Tasmania and each of the Target Fruits have geographic clusters (Figure 1). Apples have a wide distribution around the State, with areas of concentration in the upper and lower Huon Valley, Spreyton, Legana, Sidmouth and Hillwood. Cherries are clustered around Huon Valley, Channel Valley, Coal River Valley, Derwent Valley, Hillwood, Sidmouth, Spreyton and Sassafras, with small plantations in the northeast that mainly focus on Farm Gate sales and Cottage industry. Grapes are grown around Hobart, throughout the Tamar Valley, Lebrina, Pipers Brook, North West (mostly in and around Sassafras) and the East Coast (including Coles Bay and Freycinet). The growing conditions in many fruit-growing areas of Tasmania are suitable for growing blackcurrants and elderberries.

Geographic clustering helps to identify viability of accessing Target Fruit Waste, particularly any infrastructure needed to support better valorisation. In addition to clusters of growers, processing facilities also tend to be clustered around Hobart in the south and Launceston in the north. Forager Foods, a Project Partner, recently became the largest freezing and freeze-drying facility in Australia and have operating facilities near Deloraine, Scottsdale and Launceston (at Western Junction).

Figure 1 – Clusters of Target Fruits in Tasmania[2]



[2] Data sourced from: Fruit Growers Tasmania (Apples - https://tasmaniangrown.au/what-we-grow/fruit/apples/), Cherry growers Australia (Cherries - https://www.cherrygrowers.org.au/tas/), and Wines Tasmania (Grapes - https://winetasmania.com.au/wine-trails/tasmanian-wine-trail).

2.4.3 Climate Change

The impact of climate change for Tasmania[3] remains somewhat uncertain due to lack of updated Tasmania-specific research, although existing climate change models have successfully predicted climate changes that Tasmanian growers are experiencing[4]. Care needs to be taken to understand the difference between ongoing climate change and normal, short-term seasonal variability.

Tasmania is especially susceptible to changes in ocean temperatures and acidity due to the East Australia Current that pushes warmer oceans from the east coast of Australia to the north-east and east of Tasmania[5] changing weather patterns and ocean temperatures. Ocean-based effects are likely to rapidly increase the effects of Climate Change for Tasmania's land-based growers, particularly those nearer the north-east and east coast due to changed rainfall patterns and generally higher temperatures.

As one example, a surveyed cherry grower identified storm-based rainfall that resulted in record cherry losses for the last three growing seasons that the grower hadn't experienced in living memory[6].

The two most likely outcomes for land-based growers in Tasmania are:

1. **Warmer Conditions -** Most climate change models for Tasmania predict an average increase in temperatures for land-based growers that will result in decreased yields due to sub-optimal growing conditions and increased Fruit Waste due to damage from storms and high rainfall events. The increase in sea temperatures around Tasmania (some of the fastest warming oceans anywhere on the planet[7]) will exacerbate conditions because of warmer off-shore air temperatures, resulting in compounding increases in land-based temperatures at certain times of the year and more extreme storm and rain fall events for most of Tasmania. Bushfires are also expected to be more frequent and longer lasting[8].

2. **Changed Weather Systems -** Along with fewer frosts, Tasmania can expect more and longer heatwaves, longer periods of rain-free days, increased wind speeds, and increased storm events. Rainfall patterns in Tasmania are changing to include longer periods without rain and periods with more (and more intense) rain. The changed weather systems will result in sub-optimal growing conditions and more fruit that is damaged due to adverse weather events.

Climate Change will mean that traditional weather models will need to be revised and growers will also need to plan for changed weather patterns. Specific Climate Change effects for each of the Target Fruits, where known, is noted in their respective sections.

---

[3] https://www.climatechangeinaustralia.gov.au/en/changing-climate/state-climate-statements/tasmania/

[4] See https://www.stategrowth.tas.gov.au/recfit/climate/climate_science and https://recfit.tas.gov.au/what_are_the_projected_impacts_for_tasmania among many websites for more information.

[5] For more details see https://figshare.utas.edu.au/articles/chapter/East_Australian_Current/23056922 and https://www.redmap.org.au/article/climate-change-on-the-apple-isles-doorstep-eac-warms-tasmanian-waters/

[6] The grower has grown cherries in Tasmania for more than 30 years

[7] https://www.climatecouncil.org.au/wp-content/uploads/2023/11/CC_MVSA0383-CC-Report-on-Oceans_V8-FA-Screen-Single.pdf, https://www.redmap.org.au/article/climate-change-on-the-apple-isles-doorstep-eac-warms-tasmanian-waters/ among many.

[8] https://nespclimate.com.au/wp-content/uploads/2019/11/A4_4pp_brochure_NESP_ESCC_Bushfires_FINAL_Nov11_2019_WEB.pdf

2.4.4 Grower Behaviour

Grower behaviour in relation to use of Target Fruits and, therefore, also Target Fruit Waste varies significantly among growers of the same fruit and across growers of each Target Fruit. Current Grower behaviours for Target Fruits is identified in each section.

2.5 Testing Tasmanian Fruits

The specific chemical composition of Tasmanian-grown Target Fruits not yet been scientifically quantified. However, it is likely that Tasmania's growing conditions (cooler and slower growing) will lead to above average concentration of beneficial compounds (polyphenols, anthocyanins, antioxidants) than certain other locations in Australia and globally. Stage 4 of this Project (Ecosystem Trial Report) may further investigate polyphenol content of Tasmanian-grown Target Fruits.

3. Survey Overview and Results

3.1 Survey Methodology

The target audience for the survey was growers of Target Fruits in Tasmania. They were identified by web searches, personal identification (by other growers or industry associations) and attendance at the Fruit Growers Tasmania Annual Conference in June 2023 where the survey[9] was launched. Surveying continued until February 2024 and participation in the survey was voluntary with no remuneration offered. Most growers participated directly in the online survey, while certain growers were supported to record data over the phone or in person.

3.1.1 Survey Period - 2023 Harvest

The survey data is for the 2022/23 Summer up to July 2023. Reference growing data for Tasmania for the 2022/23 harvest is sourced from the 2022/23 Australian Horticulture Statistics Handbook[10] unless otherwise referenced.

Table 4 – Survey Data gathered compared to all Tasmanian growth of Target Fruits[11] [12] [13] [14]

	Apples	Blackcurrants	Cherries	Elderberries	Grapes
Tasmania (total ha)	≈1,000[11]		≈800[12]		2,084[13]
Survey respondent (total ha)	174.5		157.5		180
Survey respondent proportion (total ha)	≈17%	≈100%	≈20%	≈17%	9%
Tasmania production (t)	29,523		3,794		12,390[14]
Survey respondent (t)	8,140		1,465		5,183
Survey respondent proportion (t)	28%	≈100%	39%	≈100%	42%
Projected available fruit waste (t)	1,150 - 3,750	< 1	750 - 2,000	< 2	2,250 - 4,350

Apples, cherries and grapes all viable amounts of Fruit Waste that could be used for increased valorisation.

[9] the survey questions are in Appendix E, with certain exceptions related to gathering of private information.
[10] https://www.horticulture.com.au/contentassets/a36fdfa2427d4ad284c426663b06f15c/hort-stats-fruit-22-23.pdf
[11] Source: https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-2022-2026-pdfs/hort-innovation-sip-2022-26-apple-pear-r.pdf (extrapolated from data of total Australian production.
[12] Data extrapolated from combined data from https://www.cherrygrowers.org.au/industry-statistics/ and https://www.horticulture.com.au/contentassets/a36fdfa2427d4ad284c426663b06f15c/hort-stats-fruit-22-23.pdf
[13] https://www.wineaustralia.com/getmedia/44064273-4518-4412-af1c-84f98de0b67b/Tasmania-Snapshot-2022-23.pdf Noting that Wine Australia tends to report lower numbers for tonnes crushed than Wines Tasmania, and the hectares reported here may be low.
[14] https://winetasmania.com.au/vintage2023

3.1.2 Validity of Data

Table 4 (above) shows data gathered in the survey represents 9% to 100% of the land (in hectares) used to grow Target Fruits, and from 28% to 100% of Target Fruit grown in Tasmania. Growers who were also buyers of fruit for processing and/or processed fruits on other Grower's behalf were encouraged to submit data for fruit processed and Fruit Waste generated within their operations. As a result, apples and grapes have relatively larger percentages of tonnes of fruit compared to hectares under growth. The amount of Fruit Waste identified in the Survey is higher than if it only recorded data for fruits grown on each farm. This distortion means that data presented in this report is biased toward actual use of Target Fruits and, therefore, is richer in Fruit Waste data. In calculating estimates of Fruit Waste from apples, figures were adjusted based on estimates derived from the data.

3.1.3 Data Used

Responses from growers of blackcurrants and elderberries represented almost all those fruits grown in Tasmania and therefore all information provided in the survey is commercially sensitive. The responses from those growers have been described and analysed in the body of this report, with commercially sensitive and identifying information excluded from the data tables. Other than the above exception, 100% of remaining respondents' data was usable.

3.1.4 Geographic Validity

Respondents to the survey are from known locations of the Target Fruits and in similar proportions to known regions.

3.2 Survey Responses

Growers were generous and forthright with observations about the project and how to maximise economic value created from Target Fruit Waste, including from growers who did not participate in the survey. Many growers are already investigating additional revenue opportunities, with some frustration identified from previous interactions with businesses that didn't deliver on proposed deals or didn't provide enough value to make the transactions viable. Several growers did not want to participate in the Survey, mostly captured in these sentiments:

- "We don't participate in surveys"
- "We are too small to be useful"
- "There are just too many surveys"
- "We don't have any waste"
- "We sell everything we can grow"

Smaller growers tended to decline participation in the Survey, citing they didn't see how identifying their data would change industry practice or they were already maximising revenue from Target Fruits through mechanisms like on-farm sales, on-farm value-added processes (most commonly jams, juices, syrups, vinegars and alcohol) and seeking local collaborations to create shared value their fruits.

3.3 fermentasmania as Innovation Facilitator

As a result of the time taken to create relationships and cultivate conversations, in addition to the data gathered from the survey, fermentasmania has insights, reflections and observations that it will carry through the Project and subsequent Stage reports. The role of fermentasmania as an innovation hub, including a hub that passes on insights from growers and from Product Innovators, is clearer than ever.

4. Fruit-Specific Analysis

Survey data shows that all the Target Fruits have different harvesting requirements, channels to market, end-use destinations and location of Fruit Waste when diverted. This section gives more detail of each of the Target Fruits.

4.1 Apples

Table 5 – Summary of Fruit Waste and grower data for apples in Tasmania

Apples in Tasmania

Land Used
≈1,000 ha.[17]

Tonnes Grown
29,523 t.

Survey Data

Land Used
174.5 ha. ≈17%

Tonnes Grown
8,140 t. 28%

Markets	Sale Price (range/t.)
Ready Packed	$1,500 - $3,000
Commercial	$300 - $450
Wholesale	$1,000 - $2,500
Farm Gate	$2,500 - $5,000
On-Farm Value-Add	**Sale Price (range/t.)**
Juice	$2,000 - $3,000
Cider	$10,000 - $17,500

Fruit Waste Type: Apple Pomace

Fruit Waste Usage:	Animal Feed & Composting
Fruit Waste Estimate:	150 - 250 t.
$ Generated (per tonne):	$0 - $150
$ Potential (per tonne):	$0 - $300

Fruit Waste Type: Unharvested Fruits

Fruit Waste Usage:	Juice/Cider & Ugly Fruits
Fruit Waste Estimate:	2,000 - 4,500 t.
$ Generated (per tonne):	$0
$ Potential (per tonne):	Juice/Cider: $0 - $17,500 Ugly Fruits: $300 - $450

Fruit Waste Identified

Fruit Waste Range (t. - est.)
2,150 - 4,750 t.

Confidence Level: Moderate

Tasmania's Apple industry has been in decline since the 1970s, although current growers report stable to declining levels of profitability from relatively stable orchard sizes. From the 1990s, consumers and wholesale buyers have been driven by 'new' brands of apples (Pink Lady and Southern Bliss[15] among others), grown under license and with a price premium. It takes several seasons for Tasmanian growers to switch varieties and changing consumer tastes may have a damaging effect on the Tasmanian industry. For most Tasmanian growers, exporting Tasmanian apples has ceased with just over 1,000 t (~3%) of Tasmanian-grown apples exported[16]. Tasmanian growers produce about 30 kt of apples from approximately 100 ha, with 2,150 t – 4,750 t of Fruit Waste (Table 5).

4.1.1 About Apples

Tasmania's importance to Australia as 'the Apple Isle' has changed in recent years. The most distinctive current advantages that Tasmania has over mainland apple growers is Tasmania's cooler climate which results in arguably better tasting fruits and inarguably lower costs of CAS over the course of any year.

Data from several Apple growers includes fruit from other growers processed on-farm or in on-farm commercial operations. For example, some Apple growers purchased fruit from other growers to process as juice or cider under the farm's brand. In such circumstances, data for fruit processed has been included and the resulting Fruit Waste data has been captured. The nett result on survey data is that tonnes of Fruits grown are disproportionate to hectares, and Fruit Waste data is more reliable.

4.1.1.1 Unharvested Fruits

Apples are generally clear picked, although in certain years, growers leave fruit on trees due to the lack of a viable market for excess 2nd or 3rd class fruits. The amount is estimated to be up to 10% of production in any given year, although some Surveyed growers reported up to 20% of fruits left unharvested for the 2022/23 year, mainly due to hail or other damage.

4.1.1.2 Apple Pomace

Thanks to the ongoing growth of consumer demand for high-quality apple juice and cider products, both alcoholic and non-alcoholic, approximately 20% of Tasmanian apples are used as inputs to Tasmanian cider and juice production and apple pomace is the resulting byproduct. Apple pomace can contain pulp, skins, cores, stems and leaves. Pomace that contains more pulp and skins tends to be more usable in other value-add processes due to higher relative levels of sugars, polyphenols and anthocyanins. Generally, apple pomace is a poor animal feed supplement due to low protein and high sugar content.

[15] Morgana, a variety of apple invented in Belgium, has already achieved wide acceptance in European markets, and is licensed to an Australian Grower who is selling it under the Registered Trademark of Southern Bliss. For more information, see https://www.southernblissapples.com.au/

[16] 1,012 t. of Australia's 1,650 t. exports, mostly into Papua New Guinea and South-East Asian markets. see https://www.horticulture.com.au/contentassets/a36fdfa2427d4ad284c426663b06f15c/hort-stats-fruit-22-23.pdf.

However, one Grower reportedly sells pomace (high in leaves, stems and cores) to a distant dairy farm (where there are no co-located Apple growers) at approximately $150 per tonne, and such valorisation was rare.

Tasmania's largest commercial juicers and cider makers produce more than 2 tonnes of Apple Pomace on a weekly basis. That figure does not include multiple smaller juicing operations. Anecdotal evidence, including from the survey, is that the majority of Apple pomace in Tasmania is either donated to farmers for use as animal feed or much less frequently sent for processing at waste facilities.

At least two smaller growers try to utilise Apple Pomace for production of derived products including Apple flour. There were reports from growers of attempts by non-grower, mainland companies to create an Apple flour industry in Tasmania in the past, with the conclusion that Tasmania does not produce enough Apple Pomace to support either transportation to mainland Australia for processing or investment in infrastructure in Tasmania. Those reports also indicated that local mills were not involved in any such discussions.

4.1.2 Waste 1st Grade Apples

Apple growers have reported slower sales of Fruits in CAS in 2023 and 2024, meaning apples are held in Tasmania at higher than usual levels heading into the 2024 harvesting season. It seems wholesale buyers, such as those for Coles and Woolworths have shown they are willing to buy climate-controlled apples at prices that match year-round averages and are avoiding paying a premium at any time. The increase of apples stored in CAS may result in 1st grade apples being wasted or available for other uses, presumably at lower prices than growers have historically achieved.

4.1.3 Geographic Clustering

Apple growing is biased toward Tasmania's south, although there is still a relatively large percentage of apples grown in Tasmania's north. Tasmania's largest Cider and Juice producers are in Tasmania's north and south, meaning apples and apple pomace is readily available in both regions.

4.1.4 Specific Climate Change Implications

Climate Change models for Tasmania predict that apple growers can expect increased damage to fruits through hail and storm events, and other sub-optimal fruits due to excess heat. Many growers have capacity to increase irrigation, and the effects of excess heat can be at least partially mitigated through increased water use and expenditure on irrigation.

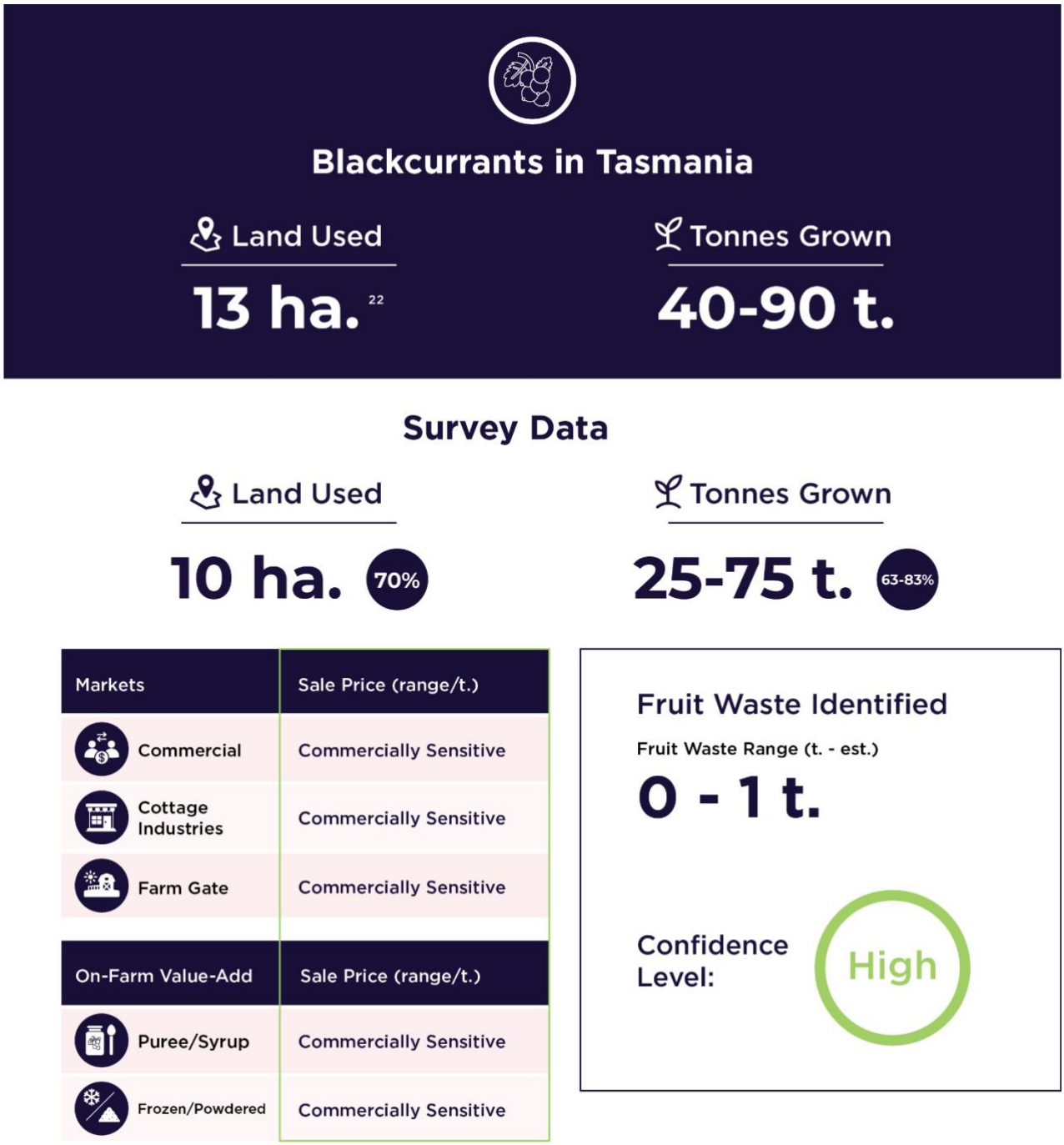
4.1.5 Grower Behaviour

Apple growers tend to target Supermarkets, Farm Gate and Farmers' Markets as primary outlets for 1st grade fruits (approximately 80% of fruits) and 2nd grade apples for juicing and cider production as a secondary market (approximately 20%). Third grade fruits are often left

unpicked and let fall to the ground and left to decompose or compost in situ due to lack of viable markets.

4.2 Blackcurrants

Table 6 – Summary of Fruit Waste and grower data for blackcurrants in Tasmania



Production of blackcurrants peaked in the thousands of tonnes during the 1980s. Less than 100 t was grown in Tasmania during the 2023/23 growing season with less than 1 t of Fruit Waste generated (Table 6). There are two predominant Blackcurrant growers in Tasmania, with the largest of these comprising from 63% to 85% of the Tasmanian market. Given this, we are unable to disclose the grower's commercially sensitive data. Blackcurrants are grown in similar growing conditions as raspberries and blackberries, and there is no viable wholesale market for Tasmanian-grown blackcurrants and the blackcurrant industry in Tasmania focusses on commercial sales and value optimisation by forward contracting,

including growing to contract, creating value-added products and maximising use of Fruit Waste.

4.2.1 About Blackcurrants

Conventional wisdom is that Tasmanian growers can't compete on price with imported fruit and concentrates. Nonetheless, the heritage variety grown in Tasmania remains a viable crop for Tasmania's two primary growers. For the larger grower, blackcurrants are clear picked, with all fruit harvested labelled as 2nd grade because of a lack of a viable path into Supermarkets or other normalised paths for 1st grade fruits. All fruit is used for commercial products for use in the drinks industry, shelf-stable products, farm-gate sales, or cottage-industry production. For the smaller grower, blackcurrants are sold at farm gate including several cottage industry products.

Anecdotal evidence suggests that the heritage variety of blackcurrants grown in Tasmania are likely to be higher in polyphenols than fruits imported into Australia, and the polyphenol content of Australian grown blackcurrants remains worthy of further investigation.

4.2.2 Geographic Clustering

Blackcurrants are sourced from the largest Grower in Tasmania's south and the smaller operation in the north.

4.2.3 Specific Climate Change Implications

Climate Change is likely to have a slight to moderately negative impact on blackcurrant growth and production. Blackcurrant production is susceptible to:

- Warmer winters,
- High rainfall in spring which affects flowering and pollination, and
- Extended periods of heat which will cause fruits to prematurely drop from the plant before they are ripe.

Newer varieties of blackcurrants have been selectively bred in the UK[17] and elsewhere to address the anticipated effects of climate change, although none of the newer varieties are currently grown in Tasmania. It is possible that the stock of Blackcurrant plants in Tasmania have already somewhat adapted to Tasmanian conditions over more than a century, however, their actual resilience to climate change is unknown.

4.2.4 Grower Behaviour

Grower behaviour of blackcurrants is almost entirely focussed on utilising 100% of fruits grown, including being the only sector where growers in the Survey actively targeted Fruits for freeze drying into powdered products, albeit in relatively small quantities. Fruit Waste from blackcurrants is almost non-existent, with waste coming from juicing / puree production, which is only a small amount of use of blackcurrants. Fruit Waste is approximately 10% of pureed fruit by weight.

[17] https://www.hutton.ac.uk/news/pick-bunch-first-crop-climate-change-resilient-blackcurrants

4.3 Cherries

Table 7 – Summary of Fruit Waste and grower data for cherries in Tasmania

Cherries in Tasmania

Land Used

≈800 ha.[24]

Tonnes Grown

3,794 t.

Survey Data

Land Used

157.5 ha. ≈20%

Tonnes Grown

1,465 t. 39%

Markets	Sale Price (range/t.)
Ready Packed	$10,000 - $40,000
Commercial	$350 - $450
Wholesale	$6,000 - $12,000
Farm Gate	$10,000 - $20,000

On-Farm Value-Add	Sale Price (range/t.)
Juice	$2,000 - $15,000
Vinegar	$4,000 - $15,000

Fruit Waste Type: Unpicked Fruits

Fruit Waste Usage:	Unclear
Fruit Waste Estimate:	300 - 800 t.
$ Generated (per tonne):	$0
$ Potential (per tonne):	Unclear

Fruit Waste Type: Spoiled Fruits

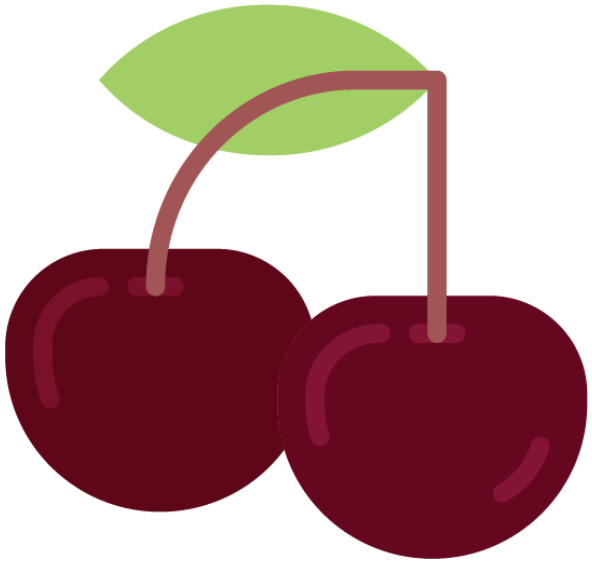
Fruit Waste Usage:	Unclear
Fruit Waste Estimate:	450 - 1,200 t.
$ Generated (per tonne):	$0
$ Potential (per tonne):	Unclear

Fruit Waste Identified

Fruit Waste Range (t. - est.)

750 - 2,000 t.

Confidence Level: Low - Moderate



The amount of land being used to grow cherries in Tasmanian has increased, due in part to relatively high prices achieved compared to other fruits that grow in similar conditions, including some of the other Target Fruits and certain Rubus berries (e.g. raspberries and blackberries). Several surveyed cherry growers also grew apples and reported many hectares of cherry orchards have replaced apple production in recent years.

In Tasmania, cherry production per hectare has increased due to protective coverings (growers achieving the highest prices for their cherries had invested in such protective coverings) and changed cherry orchard management. Cherries grown in Tasmania are subject to regular adverse weather events, particularly heavy rains near harvesting time, and cherry growers are the only growers among Target Fruit growers to use Helicopters to attempt to dry cherry orchards following heavy-rain events.

The Survey data (Table 7) may be biased by participation of some of Tasmania's most productive and profitable cherry operations and, therefore, may not accurately reflect the true amount of cherry Fruit Waste generated, which is likely to be higher for smaller growers. Confidence levels when calculating a range of Fruit Waste from cherries remains low due to that distortion and variability across seasons and lack of participation by growers likely to have higher levels of 2nd and 3rd grade fruits.

There isn't currently a significant market for frozen Tasmanian cherries, not least because processing facilities have been unable to change production lines quickly enough to make use of cherry Fruit Waste at harvest time. Further investigation is needed in order to identify viability of potential uses for the high volume of cherry Fruit Waste, viability of freezing cherries and freezing and fermenting to produce concentrated polyphenols, antioxidants and anthocyanins seems to be worthy of particular focus.

4.3.1 About Cherries

Some cherry growers candidly discussed the difficulty of achieving harvesting of 100% of fruits. Growers made economically strategic decisions about where to send pickers to maximise revenue and in doing so abandoned late-stage cherries to ensure that the highest-value cherries were picked while marginally to substantially lower value cherries were left to fall on the ground. Respondents reported that cherry Fruit Waste in any year is between 20% and 60% of cherries grown in Tasmania either because they aren't picked, or because they can't be moved into markets. Table 7 shows that the likely range of cherry Fruit Waste for the 2022/23 growing season was in the range of 750 t – 2,000 t. Most of the Fruit Waste of cherries is generated on farm.

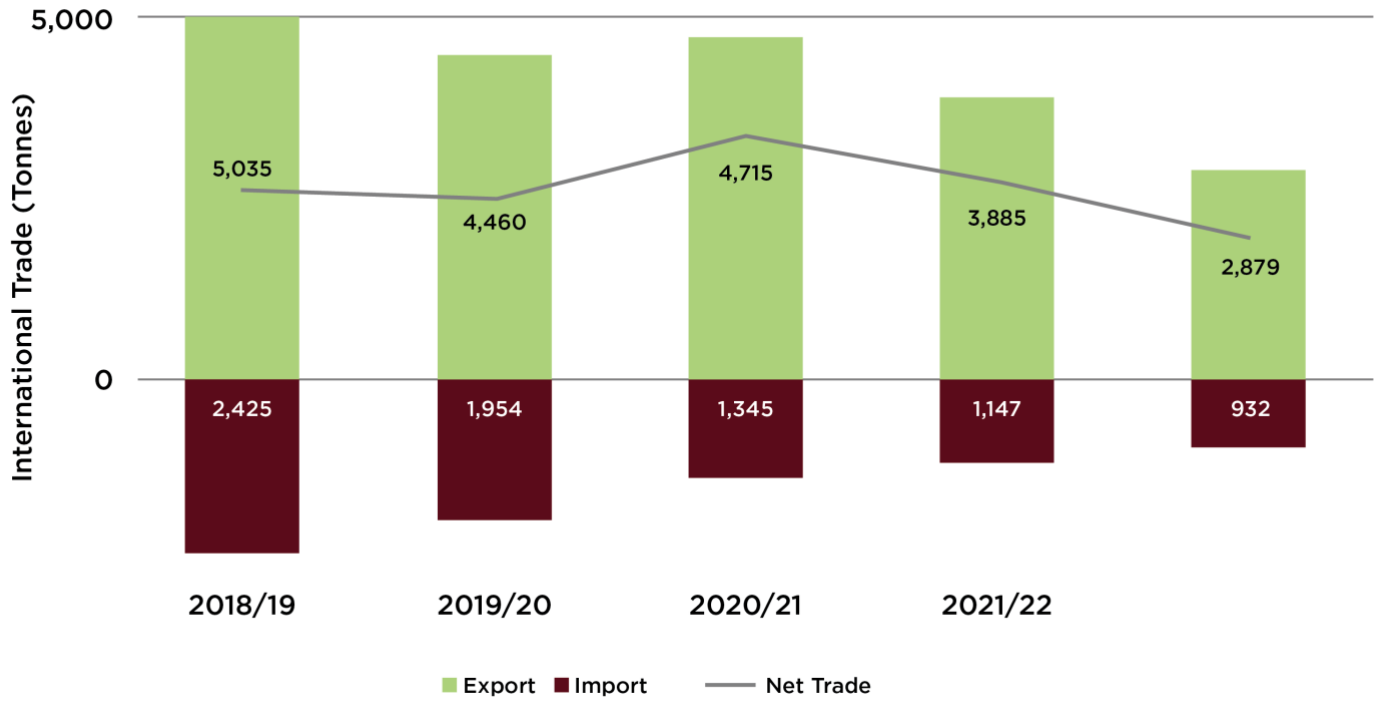
Many Tasmanian cherry growers are hoping to produce fruits that are attractive to the global cherry markets that command a premium price, with over half of cherries grown in Tasmanian being sold into export markets[18] and comprising 70% of all of Australia's cherry

[18] Hort Innovation 2022/23 Australian Horticulture Statistics Handbook, p. 65, 66

exports. Prices for Tasmanian-grown cherries continues to approach the highest prices paid for cherries anywhere in the world. That is partly due to changing practices among growers that helps them to achieve the size and quality desired by consumers in Asian markets including Hong Kong, Taiwan and China.

While the volume of cherries being exported from Australia has been falling since at least 2018 (Fig. 2), prices per tonne domestically and internationally are rising and demand for Australian-grown cherries by Australian consumers has remained strong.

Figure 2 – Australian cherry International Trade Graph[19]



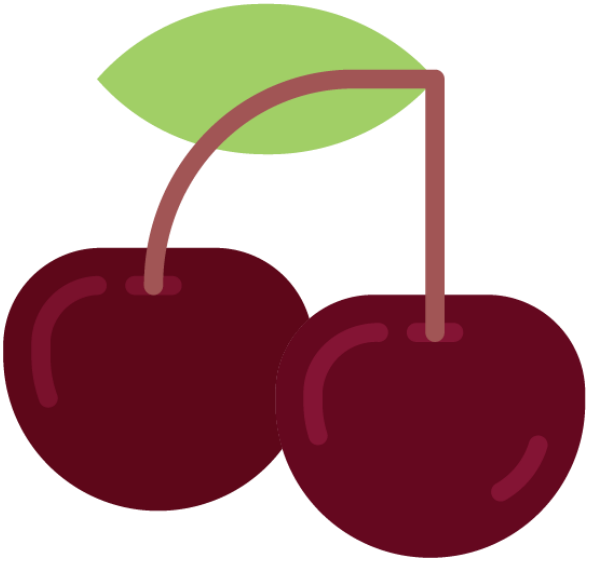
4.3.2 Cherry Waste

Cherries are unique among the Target Fruits in that they are the only crop that has significant quantities of fruit remaining unpicked in years when growing conditions were mostly favourable, but where picking seasons were too short to enable picking all available fruits. In addition, because of the relatively short cold-storage life of cherries, losses are experienced at Tasmanian farms when cherries remain unsold.[20]

Cherries had the highest picking costs of any of the Target Fruits - approximately $500 to $2,500 per tonne depending on quality of cherries and target markets. The highest value cherries necessitated skilled pickers sorting fruits as they picked, especially cherries for export markets. Anecdotally, growers reported that ungraded, clear picking of cherries wasn't used because of a lack of viable markets for 2nd or 3rd grade fruit.

[19] Hort Innovation (2024), *2022/23 Australian Horticulture Statistics Handbook – All Fruit Overview*, https://www.horticulture.com.au/contentassets/a36fdfa2427d4ad284c426663b06f15c/hort-stats-fruit-22-23.pdf

[20] Tasmanian Food Cluster 2019. *Tasmanian Food Cluster Survey – Food Loss*, identifies 593 tonnes farm gate losses at a value of $7m – p.4.



Researchers became aware of at least two alcoholic spirit producers that derived their base alcohol for Tasmanian gin production from cherry Fruit Waste. Both of those producers indicated they had no difficulty sourcing cherry Fruit Waste at prices that were competitive with grape neutral alcohol, although with more intensive labour.

4.3.3 Geographic Clustering

Cherries are clustered around Huon Valley, Channel Valley, Coal River Valley, Derwent Valley, Hillwood, Sidmouth, Spreyton and Sassafras, with additional small plantations in the northeast that mainly focus on Farm Gate sales and Cottage industry products.

4.3.4 Specific Climate Change Implications

Climate Change modelling in Tasmania[21] suggest that cherries will be especially susceptible to the effects of Climate Change, particularly in relation to high rainfall events around and during harvesting times.

4.3.5 Grower Behaviour

Grower behaviour for cherries seems to be dispersing along two main growing and market strategies. Some growers are pursuing covers and changed orchard management techniques to achieve the highest possible prices in international and domestic markets as a consumer fruit, resulting in virtually no cherry Fruit Waste in Tasmania. Other growers continue to pursue more traditional growing methods including less chemical intensive ones such as organic growing and markets such as Farm Gate and Farmers' Markets to maximise revenue, with significant amounts of 2nd and 3rd grade fruits, including related waste, accepted as part of growing cherries.

In any case, cherry growers are motivated by maximising revenue. One cherry grower, who did not participate in the Survey but separately discussed their operations at some length, indicated that they use all fruits grown including 2nd and 3rd grade fruits to make a variety of products, such as jams, chutneys, cordials, syrups and others sold mostly at Farmers' Markets.

Using 2nd and 3rd grade cherries is not ubiquitous among growers, and there remains a large volume of cherry Fruit Waste in each season.

[21] https://recfit.tas.gov.au/what_are_the_projected_impacts_for_tasmania

4.4 Elderberries

Table 8 – Summary of Fruit Waste and grower data for elderberries in Tasmania

Survey Data

Land Used	Tonnes Grown
≈25 ha. 100%	100 t. 100%

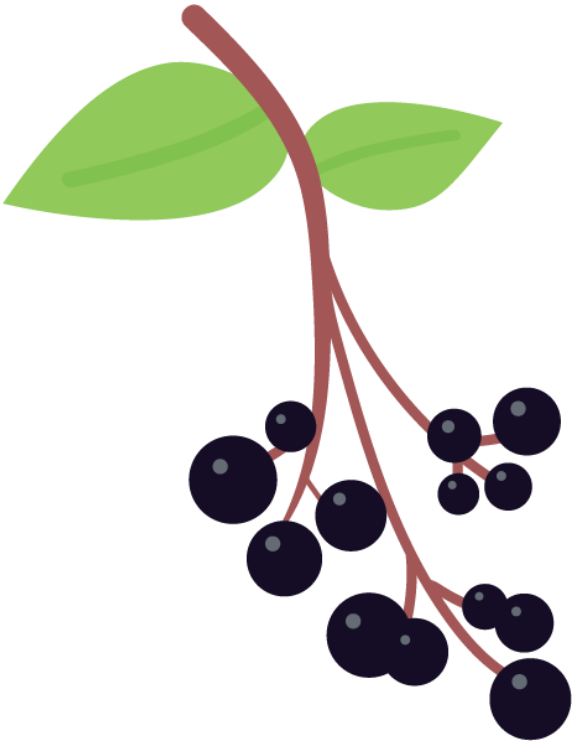
Markets	Sale Price (range/t.)
Ready Packed	Commercially Sensitive
Commercial	Commercially Sensitive
Wholesale	Commercially Sensitive
Farm Gate	Commercially Sensitive
On-Farm Value-Add	**Sale Price (range/t.)**
Juice/Drinks	Commercially Sensitive
Concentrates	Commercially Sensitive
Jam	Commercially Sensitive
Vinegars/Dressings	Commercially Sensitive

Fruit Waste Identified

Fruit Waste Range (t. - est.)

< 1 t.

Confidence Level: High



Elderberry plants have commercial uses for flowers as well as matured fruits that is unique among the Target Fruits. Growers of elderberries need to make choices during Spring about how much to sell as elderflower, which has a different flavour profile to elderberries, and how much to let grow to mature fruit. In general, Tasmanian elderberries are allowed to grow to maturity.

Elderberries represent one of Tasmania's smallest, niche fruit crops (Table 8). One Tasmanian grower comprises virtually 100% of the Tasmanian market and so we are unable to disclose detailed and commercially sensitive data. The scale of production is due to limited markets in Australia where elderberries are sold and to limited commercial opportunities due to the relatively cheap imported elderberry products, such as elderberry concentrate and elderflower cordials and juices.

Elderberries are usually clear picked, with almost 100% of fruit harvested and labelled as 2nd grade, because of a lack of a viable path into Supermarkets or other normalised paths for 1st grade fruits. All fruit harvested is used for Commercial purposes such as products for use in the drinks industry, shelf-stable products, Farm Gate sales, Farmers' Markets and cottage-industry production.

4.4.1 About Elderberries

Elderberries have the highest polyphenol content of all the Target Fruits and indeed among all known fruits, with most polyphenols present in elderberry skins. Because there isn't large quantities of elderberry Fruit Waste available in Tasmania, focussing on production of a concentrated polyphenol ingredient from elderberry waste isn't currently viable.

4.4.2 Geographic Clustering

Elderberries are commercially grown in one location in the South of Tasmania.

4.4.3 Specific Climate Change Implications

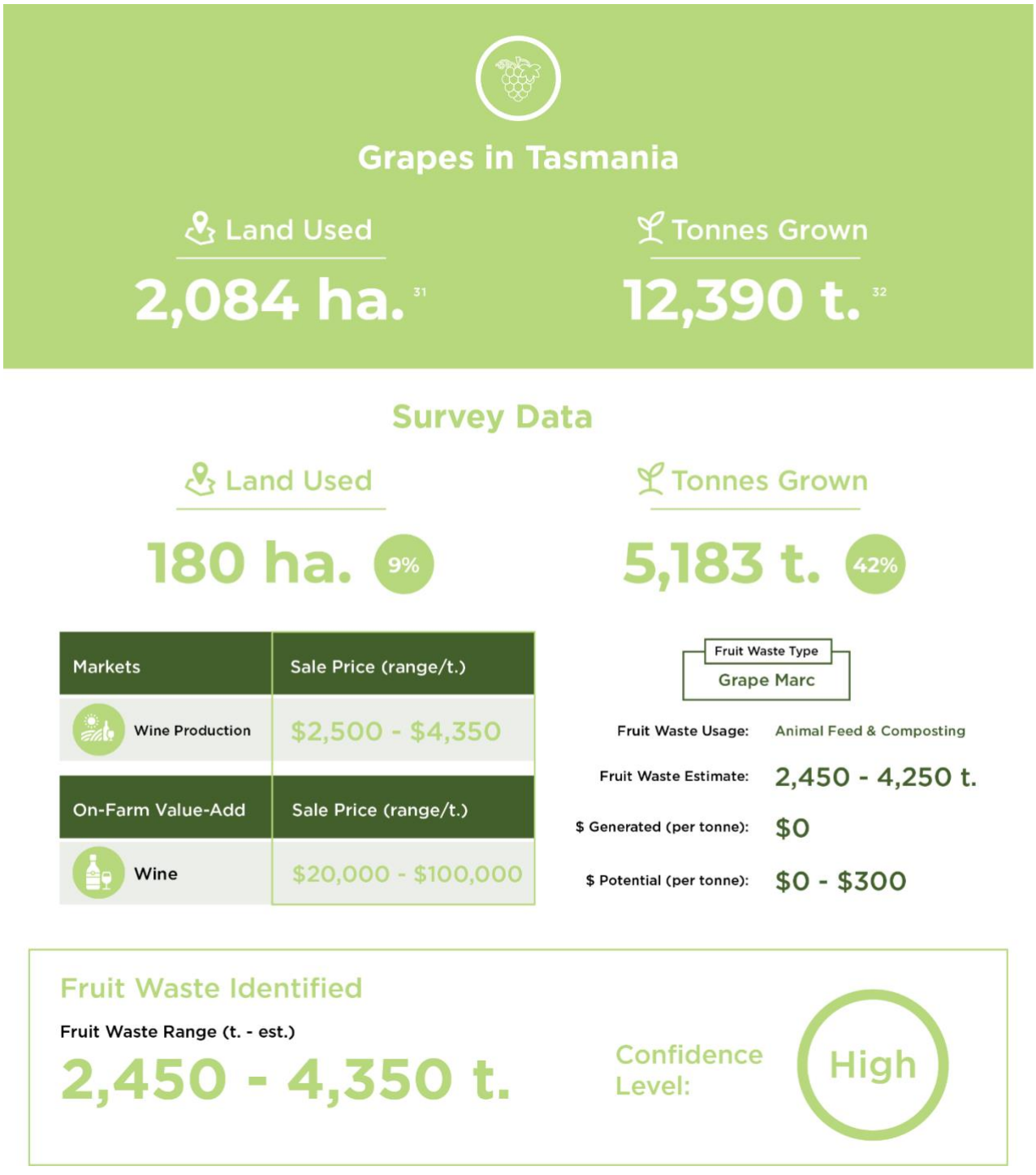
Growers of blackberries and raspberries can presumably offer tips for commercial growth of elderberries, with Climate Change implications similar for all those crops.

4.4.4 Grower Behaviour

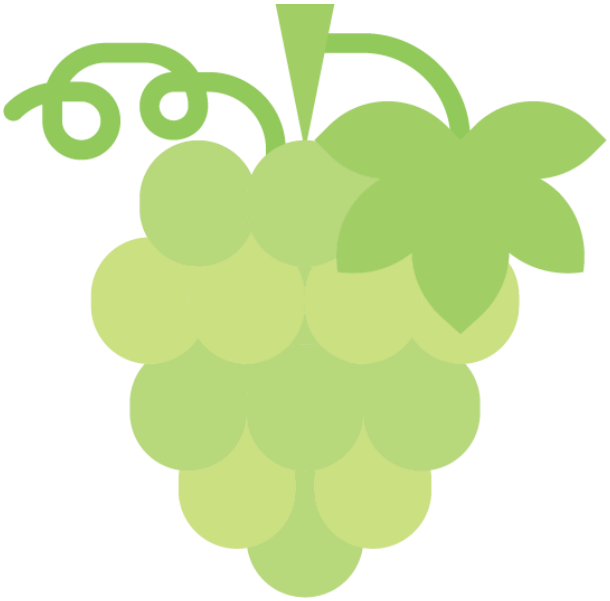
Grower behaviour in relation to use of elderberries, like blackcurrants, is almost entirely focussed on utilising 100% of fruits grown. Fruit Waste from elderberries is also almost non-existent. The only Fruit Waste is generated in juice and concentrate production, being approximately 10% of fruit by weight. Therefore, there is likely less than 10 kg of elderberry Fruit Waste available for any other use.

4.5 Grapes

Table 9 – Summary of Fruit Waste and grower data for grapes in Tasmania



Tasmania has been growing grapes for wine production for over half a century with total grape production now well over 10,000 tonnes (Table 9). Tasmanian grapes now command some of the highest prices in Australia and, as a result, almost every grape grown in Tasmania is harvested and used to produce some of the World's highest quality wines, particularly cool-climate white and sparkling varieties. Tasmanian red wines also command a premium.



Tasmania's slower growing conditions compared to mainland Australia produces a fruit that is more suitable for high-quality and fine wine production. There is an annual trend for more land being used to grow grapes, meaning Fruit Waste is almost certain to increase in coming years. Growers are increasingly focussed on the health of the soil, biodiversity and other aspects of sustainability[22].

4.5.1 About Grapes

Data from several growers includes fruit purchased and processed from other growers in commercial growing operations. For example, some growers purchased fruit to process as wine under their own brand or under the original grower's brand(s). Processors are generally required to deal with resulting production of grape marc. In such cases, data for fruit processed has been included in the Survey and the resulting Fruit Waste data has been captured. The nett result on Survey data is that quantity of grown fruit appears disproportionate to the hectares of land used, and thus the data in relation to Fruit Waste is more reflective of grape Fruit Waste.

4.5.2 Grape Marc

Producers of high-quality wine tend to press grapes at lower levels than for lesser quality wines. Tasmanian vintners press grapes leaving between 20% and 35% as grape marc, with 25 – 30% being more typical from Survey data and in conversations with growers. Because of the Survey's approach to capturing data, and the consistent reporting of use of grapes in Tasmania and the Fruit Waste generated from grapes, the data set for Fruit Waste from grapes is likely to be very reliable, within the typical range of pressing values that leaves 25-30% of grape marc as waste.

We estimate 25% of Tasmanian-grown grapes are crushed and shipped to the mainland for processing in tanker trucks. Survey participants indicated that grape marc invariably stays in Tasmania when grape juice is shipped to the mainland.

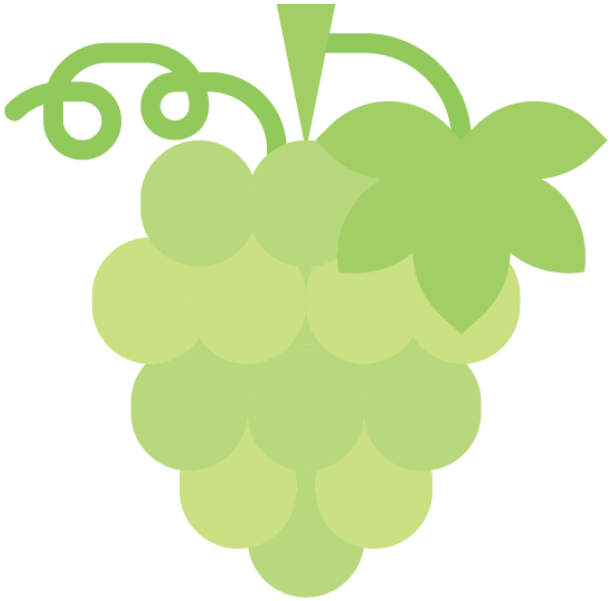
4.5.3 Geographic Clustering

Grape growing in Tasmania is clustered in several regions, being the Tamar Valley, around Hobart and especially the Coal River Valley, Pipers River, Sassafras and the East Coast.

4.5.4 Specific Climate Change Implications

Tasmanian growers of grapes are already experiencing changed growing conditions[23] and growers reported increased reliance on irrigation to ensure high quality grapes to overcome rainfall variations. Production of wines in Tasmania is subject to more favourable conditions in some areas such as fewer extreme cold events and increased rainfall that will are conducive to increased production.

[22] See the Vin Zero programme - https://winetasmania.com.au/vinzerolookingaftertheland
[23] https://www.wineaustralia.com/getmedia/84c3eeeb-96ce-4cc8-88b3-9b2627e8227b/Australia-s-Wine-Future-A-Climate-Atlas-State-TAS-(1)



Other areas will experience worsening conditions that will result in decreased yield through increasing mean temperatures, increased extreme heat events and decreasing rainfall. In addition, increasing fire danger and fires may mean that that grapes can experience smoke tainting, with deleterious flavour effects. Tasmania has already experienced sub-optimal taste profiles in wines produced in areas where bushfires have occurred prior to harvest.

4.5.5 Grower Behaviour

Grower behaviour in relation to use of grapes is almost entirely consistent in Tasmania. Almost every grape grown in Tasmania is harvested and sent for immediate production into wine and virtually all grape marc is diverted as Fruit Waste. In relation to post-processing behaviour, growers / processors tend to have fruit bins sufficient for 1 or 2 days of processing. That is because there are limited commercial opportunities, or lack of perceived opportunities, for commercialisation of grape Marc in Tasmania. A very small number of growers in Tasmania have produced Piquette Wines and high-quality Grappa from grape marc.

5. Conclusions and Recommendations

Several streams of Target Fruit Waste were identified in the Survey with varying degrees of confidence. There are several high-potential viable economic opportunities, which will be further identified and prioritised in the Stage 3 of this Project – New Ecosystem Report.

5.1 Increased Valorisation of Target Fruit Waste

For apples, cherries and grapes there are significant opportunities to increase valorisation of Fruit Waste if growers can identify Target Fruit Waste as a meaningful missed opportunity (Table 10).

5.2 Existing Data Deficiencies

Prior to publication of this Report, very little data was available for any of the Target Fruits in relation to:

- Fruits unharvested,
- Fruits that don't leave Farms, and
- Fruit seconds and by-products.

Further research will lead to better conclusions on managing Fruit Waste.

5.3 Value of this Report

This Report represents a significant new contribution to growers of the Target Fruits in Tasmania, Government and businesses seeking to make better use of Target Fruit Waste. It clearly identifies useful streams of fruit seconds and by-products that are diverted without any payment being made. It may also have implications or identify similar opportunities for other fruits and vegetables grown in Tasmania.

It is anticipated that this Survey provides a baseline for on-farm Target Fruit losses in Tasmania. The Project Partners anticipate this will not be in isolation and will continue to inform part ongoing research activity to promote opportunities for waste reduction, waste valorisation, development of circular economies and continuous improvement within the Tasmanian agricultural sector. The ultimate aims of this on-going activity would be to develop a strong and more sustainable agriculture industry in Tasmania and to support the objectives of the Tasmanian Government to realise a farmgate value of $10 billion by 2050, up from $1.6 billion in 2017-18.[24]

Table 10 (below) shows the valorisation opportunities, including opportunities identified in relation to polyphenol concentrates, for Target Fruit Wastes as identified by Tasmanian growers in the Survey. Additional valorisation opportunities are available and will be identified in the Stage 3 New Ecosystem Report.

[24] https://nre.tas.gov.au/Documents/Tasmanian%20Sustainable%20Agri-Food%20Plan%202019-23.pdf

Table 10 – Valorisation Opportunities for Target Fruit Waste

Fruit	Waste Identified (t.)	Valorisation Opportunities[25]
 Apples	1,150 - 3,750	Unharvested Fruits to: • Juice • Cider • Polyphenol Concentrate Pomace to: • Apple Flour • Polyphenol Concentrate
 Blackcurrants	< 1	Negligible without significant expansion of hectares under growth
 Cherries	750 - 2,000	Unharvested / Over-ripe fruits to: • Shelf Stable products • Freezing and Freeze Drying for underexplored known uses - time shifting of harvested fruits to times of production capacity needs investigation • Polyphenol Concentrate
 Elderberries	< 1	Negligible without significant expansion of hectares under growth
 Grapes	2,450 - 4,350	Marc to: • Piquette Wines • Grappa • Polyphenol Concentrate

6. Related Websites, Reports and Studies

Websites

Cherry growers Australia Inc, *Tasmanian Region*, https://www.cherrygrowers.org.au/tas/
Fruit growers Tasmania, *We are Tasmanian Grown Fruits*, https://tasmaniangrown.au/what-we-grow/fruit/
Wine Australia, *Australian Domestic Wine Insights*, https://www.wineaustralia.com/market-insights/australia-domestic

Reports

Global

WRI (World Resources Institute) (2016), *Food Loss and Waste Accounting and Reporting Standard v1.0*, https://www.flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdf

Australia Wide

Australian Government (2020), *Australia's Wine Future: Adapting to short-term climate variability and long-term climate change*, https://www.wineaustralia.com/getmedia/d1292620-0bdf-497d-a212-6c0fab2d7827/20200220-UT-1504-Final-Report.pdf
Cherry Growers Australia Inc, *Australian cherry Industry Statistics*, https://www.cherrygrowers.org.au/industry-statistics/
Hort Innovation (2024), *2022/23 Australian Horticulture Statistics Handbook*, https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/
Hort Innovation (2024), *2022/23 Australian Horticulture Statistics Handbook – All Fruit Overview*, https://www.horticulture.com.au/contentassets/a36fdfa2427d4ad284c426663b06f15c/hort-stats-fruit-22-23.pdf
Hort Innovation (2022), *Apple and Pear Strategic Investment Plan 2022 – 2026*, https://www.horticulture.com.au/globalassets/hort-innovation/levy-fund-financial-and-management-documents/sip-2022-2026-pdfs/hort-innovation-sip-2022-26-apple-pear-r.pdf

Tasmania Specific

Fruit growers Tasmania (various), *Tasmanian Seasonal Produce Guide*, https://www.fruitgrowerstas.org.au/tasmanian-seasonal-produce-guide/
Tasmanian Department of Natural Resources and Environment (2019, by the Department of Primary Industries, Parks, Water and Environment, as it was then), *Tasmania's Sustainable Agri-Food Plan 2019-2023*, https://nre.tas.gov.au/Documents/Tasmanian%20Sustainable%20Agri-Food%20Plan%202019-23.pdf
Tasmanian Food Cluster (2020), *Tasmanian Food Cluster Survey – Food Loss*, unavailable online
Wine Australia (various 2019), *Australia's Wine Future: A Climate Atlas – Tasmania*, https://www.wineaustralia.com/getmedia/84c3eeeb-96ce-4cc8-88b3-9b2627e8227b/Australia-s-Wine-Future-A-Climate-Atlas-State-TAS-(1)

Wine Australia (2019), *Australian Wine Made Our Way: Tasmania Facilitators Guide*, https://www.wineaustralia.com/getmedia/c5183d77-1006-4028-9744-9d6dbd99e2a1/AWD_Tasmania_FacilitatorGuide.pdf?ext=.pdf
Wine Australia (2023), *Regional snapshot 2022-23 – Tasmania*, https://www.wineaustralia.com/getmedia/44064273-4518-4412-af1c-84f98de0b67b/Tasmania-Snapshot-2022-23.pdf
Wine Tasmania (2023), *Tasmania Vintage 2023 Report*, https://winetasmania.com.au/vintage2023

Appendix A – Stages of this Project

Project Stages

Stage 1 – Existing Ecosystem Report

Farm-forward report that identifies existing valorisation paths for Target Fruits.

Stage 2 – Polyphenolic Fruit Byproduct / Waste Report

THIS REPORT

A Report that identifies the Fruit Waste and by-products from Tasmanian Fruits.

Stage 3 – New Ecosystem Viability Report

Identification of opportunities from a new ecosystem that creates value from Fruit Waste and fruit by-products within Tasmania.

Stage 4 – Ecosystem Trial Report

Trials will be conducted to test all elements of the fermentation ecosystem with a view to various scales of production.

Stage 5 – Funding Report

Details of sources and needs for additional capital and infrastructure investment needed to support a new ecosystem.

Stage 6 – Fruit Waste Ecosystem Report

A report that summarises the whole Project, including the value to Tasmania of creating new ecosystems that support maximisation of Tasmania's Fruits.

Project Timeline

Anticipated Project Outcomes

The Project Partners anticipate several outcomes for the Fruit Growing sector and from the creation of new products and sectors pursuing economic opportunities highlighted in this Project.

Anticipated Project Outcomes for growers

Tasmania's growers can expect to take their share of the creation of new economic opportunities that result in:

- Higher prices for fruits and fruit by-products at certain stages of the existing Target Fruit ecosystem
- Reduced costs in relation to disposal of fruit by-products and fruit waste
- Increased value from fruit by-product streams in new market opportunities
- Reputational benefits flowing from definable and measurable reductions in carbon emissions.

It is anticipated that the final outputs of this project will be the identification of:

- Clearer categorisation of Target Fruit by-products and waste streams
- Better reporting of Target Fruit by-products and waste in certain stages of growth and production
- Viable uses of existing Target Fruit by-products and waste streams in the existing and in new ecosystems.
- Highest value uses for underutilised Target Fruit by-products and waste streams.
- Market value of changing farming practice and achieving higher price points for Target Fruit by-products and waste streams
- Job creation opportunities in the Tasmanian food and beverage sector
- Pinch-points of the existing ecosystem in order to identify growth points for an additional ecosystem
- Viability of new food and beverage sub-sectors in Tasmania
- Increased utilisation of existing Tasmanian infra-structure
- Gaps in understanding of the carbon emissions of the Fruit sector in Tasmania.

Further, the outcomes of this project will be a necessary input to the successful launch of the Fermentation Hub, targeting:

- 650 new jobs for Tasmanians
- Leveraging Launceston's status as a UNESCO Creative City of Gastronomy
- Food Tourism to Tasmania
- Agri-Tourism to Tasmania

Project Limitations and Exclusions

This project is limited to analysis of Target Fruits, and in addition, the following limitations are expected:

- This Project is only relevant to the 2023 growing season (although may be informed by trends in the 2024 growing season)
- In several areas there aren't complete data sets to facilitate high-quality analysis and projection, including amounts of fruit in long-term storage at farm-level.
- Data projections will need to be made from the available data, and it is difficult to know how accurate those projections will be.

Appendix B - Reflections on this Report

This Appendix will be periodically updated, as feedback is received.

fermentasmania **Reflections**

As identified in the McTavish West report in 2020, growers are loathe to recognise and identify fruits and fruit by-products as ‘waste’. Classification of fruit by-products

Project Partners Reflections

Global / Australia Wide

Specific to Tasmania

Other

Appendix C – Project Partners Background and Interested Parties

SUPPORTED BY

Tasmanian Government

Tasmanian Government Supported

In 2021 and 2022, the Launceston region and fermentasmania had watershed years. In no particular order, all of the following happened:

- Funding for building of a Launceston-based world class food hub was secured; including fermenting, distilling and chemical innovation facilities.
- Launceston was designated a UNESCO Creative City of Gastronomy, becoming Australia's second such city.
- fermentasmania successfully applied to the Strategic Industry Partnership Program for funding to engage in this Project.

In 2023, it was announced that fermentasmania had been awarded funding for this project to investigate the viability of using fruit waste as an input into a new and high-value ecosystem.

Fruit Growers Tasmania

Fruit growers Tasmania Supported

Fruit growers Tasmania, as the second peak-industry body involved in guiding the Project, represents apple, pear, cherry, berry and stonefruit growers in Tasmania. It represents the interests of Tasmanian fruit growers and is by Tasmania's fruit growers, for Tasmania's fruit growers.

Fruit growers Tasmania key focus areas are to support growers with matters of pest and disease management, strengthening of national and international trade and to support industry development. Fruit growers Tasmania:

- offers information and support services to make life easier for members as well as other Tasmanian fruit growers.

- organises industry information sharing activities, including orchard walks, field days, and the annual conference.
- ensures representatives and other industry leaders serve on industry Strategic Industry Advisory Panels, representing the State and their colleagues on the boards of national industry peak bodies.
- assists growers with navigating government export registrations and audit processes. Members can use our website to keep up to date with industry and government export information including audit scopes, work-plans, and other relevant information.
- assists growers meet the growing national and international food safety quality assurance certification auditing requirements by coordinating microbiological and residue testing services.

Partner Supported

In addition to Government support, and the peak industry bodies (fermentasmania and Fruit growers Tasmania) several other partners were strategically invited to join this Project. That's because we wanted this project to test the limits of the proposed ecosystem so that any interventions and supports to create new income streams can target the parts of the ecosystem that lack capacity.

Those partners are:

- **University of Tasmania** through **Tasmanian Institute of Agriculture**
  The Tasmanian Institute of Agriculture (TIA) has a mandate to deliver research, industry development and education for the agri-food industry of Tasmania.

  Our vision is to enable Tasmanian food producers and processors to accelerate primary sector productivity while maintaining and improving Tasmania's land and water quality for future generations.

  Close relationships across the agriculture and food value chain at a local, national and international level ensure we are connected with stakeholders and that our research and education priorities support industry needs and aspirations.

  Website: https://www.utas.edu.au/tia

UNIVERSITY of TASMANIA
TIA
Tasmanian Institute of Agriculture
TIA is a joint venture of the University of Tasmania and the Tasmanian Government

- **Startupbootcamp**
  A global family of industry-focused programs that support early to growth stage food, aqua and agritech founders to rapidly scale their companies. We provide direct access to an international network of the most relevant mentors, corporate partners, and investors.

Startupbootcamp FoodTech

We are working with startups with innovative technology, products, services or disruptive business models that solve problems or have solutions for the FoodTech, and Blue/AgriTech sectors.

All our programs align to the UN Sustainable Development Goals, continuing our focus on the Circular Economy, adding value to Australia's animal and horticultural produce as functional foods or ingredients, and finding innovative technologies to help our global food and beverage sector become more efficient and sustainable.

Website: https://www.startupbootcamp.com.au/programs/foodtech-tasmania

- Clever Fermentation
  Clever develops fermented superfruit health ingredients for nutraceutical, supplemental and functional food brands.

  Website: https://cleverfermentation.com/

- **Forager Foods**
  Forager Food Co. is at the forefront of the Australian freeze-drying industry, offering a range of premium freeze-dried products, all expertly crafted using the finest ingredients and the latest in manufacturing facilities and technology. Commencing operations in 2009 we have quickly grown to be the largest and most advanced manufacturer of freeze-dried products in Australia.

  Forager Food Co. processes, dries, and package a diverse range of foods providing extended shelf life whilst protecting the most valuable and delicate ingredients, including vitamins, minerals, antioxidants, colours, and flavours.

  Our production facilities feature state-of-the-art freeze-drying capability and are supported by full-service manufacturing facilities, including ambient, chilled, and frozen storage, food processing, packing, despatch, and logistics services.

  Website: https://foragerfoods.com.au/about/

Interested Parties

In addition to the formal Project Partners, other parties we have identified with significant interest in the outcomes of this project, and the success of the fermentasmania hub, include:

- City of Gastronomy
- City of Launceston
- Enterprize
- Hort Innovation
- Northern Tasmania Development Corporation
- McTavish West
- Tasmanian Farmers and Graziers Association
- Tasmanian Food Cluster
- Tasmanian Fruit & Vegetable Export Facilitation Group
- Van Diemen Project
- West Tamar Council

Throughout the remainder of this project, we will add to the above list. If you would like to be kept informed of the progress of the project, please contact Dwayne Baraka by email, or on 0481 88 00 46.

Interested sub-sectors

In investigating this report, the following sub-industries were identified:

- Grappa production
- Piquette production
- Polyphenol Concentrate production
- Haskap berry growers

Future parts of the study will try to identify interested parties from within those sub-sectors.

Appendix D - Survey Questions

This Appendix produces the majority of the text of the Fruit Waste Survey. Selection methods included drop-down menus, check boxes and multi-select boxes.

Preamble

SIPP Fruit Waste / By-Product Survey

Thanks for helping us investigate the viability of a new ecosystem for Fruit growers in Tasmania.

If it proves viable, we anticipate an ecosystem that adds many millions of dollars to the Tasmanian economy, including the creation of jobs and more and more profitable channels to market for your fruits!

We anticipate that this survey will take 10-20 minutes to complete (longer for farms that have don't have ready access to relevant data). We've asked you to login so you can return to the survey at a later time if needed.

The survey has 8 main parts, all of which are important to estimating the value and viability of a fermentation ecosystem starting from fruit that might otherwise be wasted. The parts are:

1. Production Volumes: Details of the area of production and the volume sold into certain market channels
2. Thinning: Fruit thinned by chemical means, physical picking and pest/animal consumption
3. Waste at Harvesting: Suboptimal fruit not sold or fruit left unharvested
4. Waste Post Harvest: Where and how unsold fruit is discarded
5. Cost of Harvesting: The costs of harvesting fruits
6. Cost of Wasting: The costs of wasting fruit
7. On-Farm Storage: the availability on farm to store fruits for short - long term.
8. Likely Destination: the likely destination of fruits from your farm.

The data from this survey will not be used in any way that would allow data you provide to be attributed to you or your farm. Data will be aggregated and reported by Fruit type only where it is possible to preserve the anonymity of your data.

Identification and Contact Information

Your Name

Business Name and ABN

Farm Main Address

Please leave your phone number in case we need to contact you about this survey

Call Request

If you would like us to call you to complete the survey please check the box

Fruit Grown

Main (drop down with Target Fruits and Other)

Secondary (drop down with Target Fruits and Other)

Waste Terminology

What we mean by Fruit Waste! *
IMPORTANT : PLEASE READ BEFORE CONTINUING!
We are well aware that many farmers currently do their best to use all parts of fruits that they harvested.
This survey will use the term "Fruit Waste" in accordance with Fruit Waste Standards, which doesn't always match how you will use that term.
That Standard includes all non-optimal fruit and fruit waste, ranging from secondary fruit right through to fruit pulp (like grape marc and apple skins). As a result, this survey refers to all the following fruits and fruit by-products as follows:
* sub-optimal fruits
* fruits thinned
* fruits not harvested
* fruits donated to others
* fruits / waste left on land / composted
* fruits / waste sent to landfill / dumped
* fruits / waste diverted to waste water / sewer
* fruit process by-products (eg. marc or apple skins/pulp)
* fruits incinerated (including for energy)
* fruits / waste used in biochemical processes (packaging fibres, alternative products)
* fruits / waste fermented

PLEASE CHECK THE BOX BELOW TO CONFIRM YOU HAVE READ THIS!

Fruit 1 / 2 Questions[25]

Section 1:

Production Area Fruit 1 in Hectares
Annual production Volumes for Fruit 1

For the rest of this section please report average prices and average annual yields in tonnes / annum

Value Add Processes - Fruit 1
Value adding means engaging in processing of fruits that leads to a higher value product, such as making jams, juices, dehydrated products, etc...
The value added product is then sold by the farm.
Our Farm engages in the following to add value to our fruits prior to selling:

- Internal (on farm)
- Neighbour / Co-operative
- Contractors (Processing plants)
- In-kind

Markets: Fruit 1
Our Farm sells to the following markets:
Note: Wholesale would usually then distribute to supermarkets or to other wholesale markets. Commercial would be direct to brands for consumer sale eg. Driscolls.

- Wholesale Markets
- Commercial Markets (includes frozen)
- Direct Exports
- Farmers' Markets
- Gate Sales

Unharvested / unsold Production Volume (estimate) Fruit 1
please estimate fruit that is unharvested or unsold, e.g. remains on farm, is disposed of, or used as feed, goes to landfill etc

Section 2:

Thinning: Is Chemical Thinning part of your process for Fruit 1? *
Please chose an option: YES / NO
How much (estimate) in Tonnes is reduced via chemical thinning for Fruit 1?
tonnes / annum

How much crop of Fruit 1 (estimate) in Tonnes is reduced via physical thinning?
in tonnes/annum (estimate if necessary)

Approximately how much crop of Fruit 1 is lost from pest or animal consumption?
estimate is fine tonnes

[25] The Same Questions were asked in relation to both fruits. To avoid duplication, we have reproduced the question set only once.

Section 3:

Fruit Waste at Harvesting Fruit 1
Does your process create waste at harvesting?
That may include sub-optimal fruit picked, fruit not picked or fruit lost through mechanical damage.
YES / NO

What is the volume of sub-optimal fruit at harvesting of Fruit 1?
estimate in tonnes/annum

What is the volume of Fruit 1 left unharvested, requiring no picking labour?
estimate in tonnes/annum

Section 4:

Waste Post-Harvest Fruit 1
Does your process result in post-harvest fruit waste of any kind?
Such waste might include fruit skins, pulp slurry or other
YES / NO

How do you use / dispose of post-harvest fruit waste - Fruit 1
Select all that apply

- Animal feed
- Biochemical process (e.g. converted to packaging fibres, processed into alternative products)
- Fermentation (e.g. anaerobic digestion)
- Compost (aerobic digestion, e.g. FOGO collection)
- Incineration
- Incineration (for energy production)
- Applied / spread on land
- Dumped
- Sent to Landfill
- Sent to waste water / sewer
- Given Away
- Other

Please estimate volume of post-harvest waste of Fruit 1
tonnes / annum

Section 5:
Cost of Harvesting Fruit 1
Do you know the cost of harvesting?
For the next few questions (until Section 6), we only want you to answer in relation to fruits that were actually harvested.
YES / NO
Harvesting Costs Fruit 1 - Labour
in $ / tonne
Harvesting costs Fruit 1 - Machinery
in $ / tonne
Harvesting costs Fruit 1 - Transport
in $/ tonne

Section 6:
Cost of disposing / utilising sub-optimal Fruit and Fruit Waste for Fruit 1
Do you know the cost of disposing / utilising sub-optimal Fruit and waste Fruit in terms of labour, machinery, transport, landfill or other costs?
YES / NO
Cost of disposing / utilising sub-optimal Fruit and Fruit Waste for Fruit 1 - Labour
$ / tonne (or total $ - please specify)
Cost of disposing / utilising suboptimal Fruit and Fruit Waste for Fruit 1 - Machinery
$ / tonne (or total $ - please specify)
Cost of disposing / utilising suboptimal Fruit and Fruit Waste for Fruit 1 - Transport
$ / tonne (or total $ - please specify)
Cost of disposing / utilising suboptimal Fruit and Fruit Waste for Fruit 1 - landfill and other costs
$ / tonne (or total $ - please specify)

Section 7:
On-Farm Storage: Fruit 1
Does your farm have any post-harvest storage facilities?
Select an option
YES / NO

On-Farm Storage Types - Fruit 1
What types of Storage do you have for Fruit 1?
(select as many as are relevant)
Short-term storage
- Packing Facility
- Chiller
- Controlled Atmosphere storage
- Freezer

Section 8:

Likely Destination - majority - Fruit 1

Where does the majority of your fruit end its journey?

- Supermarket shelves - fresh
- Supermarket shelves - dried
- Supermarket shelves - frozen
- Canning or juicing
- Restaurants
- Alcohol products (gin, wine, vinegar)
- Niche products
- Direct to consumer
- Other
- Don't Know

Likely Destination - secondary - Fruit 1

What are the likely secondary destinations of your Fruit 1 (as far as you know)?

- Supermarket shelves - fresh
- Supermarket shelves - dried
- Supermarket shelves - frozen
- Canning or juicing
- Restaurants
- Alcohol products (gin, wine, vinegar)
- Niche products
- Direct to consumer
- Other
- Don't Know