Discovering Australian Wine Regions

STUDENT WORKBOOK

YEARS 9/10 GEOGRAPHY

gtav
Primary Industries Education Foundation Australia
www.primezone.edu.au primezone The place for all your food and fibre resources
Wine Australia

Information for Teachers

Below is a summary for the teaching of this unit.

Lesson	Structure	Learning objectives
1	Australian wine – history, varieties and regions	• AC9HG9K01, AC9HG9K05, AC9HG9K07, AC9HG9S02 • AC9HG10S02, AC9HG9S03, AC9HG10S03, AC9HG10S06
2	The Australian wine industry and export markets	• AC9HG9K01, AC9HG9K05, AC9HG9K07, AC9HG9S02 • AC9HG10S02, AC9HG9S03, AC9HG10S03, AC9HG10S06
3	Growing wine grapes – climate and conditions	• AC9HG9K01, AC9HG9K05, AC9HG9K07, AC9HG9S02 • AC9HG10S02, AC9HG9S03, AC9HG10S03, AC9HG10S06
4	Response to a changing climate	• AC9HG9K01, AC9HG9K05, AC9HG9K07, AC9HG9S02 • AC9HG10S02, AC9HG9S03, AC9HG10S03, AC9HG10S06
5	Diversification of wine regions	• AC9HG9K01, AC9HG9K05, AC9HG9K07, AC9HG9S02 • AC9HG10S02, AC9HG9S03, AC9HG10S03, AC9HG10S06
6	Research Task – research into a wine region	

Lesson 1:
Australian wine – history, varieties and regions

Australia began making wine almost two centuries ago. Grape vine cuttings arrived on the First Fleet and numerous vineyards were established in the area that is now Sydney, however early attempts to make wine from the first vines planted were not successful.

By the 1890s, the Hunter Valley (New South Wales), Barossa Valley (South Australia), and Yarra Valley (Victoria) had begun to produce wine.

The production of Australian wine improved over time, and with the arrival of people from various parts of Europe with the skills and knowledge to grow grapes in our warm and dry climate, some of Australia's premier wine regions were established.

This has given us a country rich in old vines and has produced multi-generational grape growing and winemaking families and talented individuals with a deep knowledge and respect of the craft.

The Australian wine industry has also evolved and changed significantly in a relatively short space of time.

One of the factors behind the success of Australian wine was the emergence of cooler climate regions and the search for optimal vineyard sites and interesting terroirs. Terroir (pronounced *teuh–waa*) is the natural environment in which a particular grape is produced, and includes factors such as the soil, topography, and climate. This was typically accompanied by the establishment of newer regions and ambitious boutique wineries.

Margaret River in Western Australia is a great example, now home to over 5,000 hectares of vines and more than 200 wineries. The fact that it is a wine region at all is because of the work of Dr John Gladstones, a horticulturist. In 1965 he identified the region as having the ideal climate and soils for wine grape growing, similar conditions to those found in the famous wine region of Bordeaux, in France.

Australia has some of the oldest geology and most complex soils in the world. Our vast size and huge range of climatic and geographical conditions makes it one of the most versatile grape growing and winemaking countries in the world.

Wine is now produced in every state, with 65 designated wine regions totalling approximately 160,000 hectares. Vineyards are located in South Australia, New South Wales, Victoria, Western Australia, Tasmania and Queensland, however Australia's wine regions are mainly in the southern, cooler parts of the country. Overall, the climate is affected by its southerly latitude, but regional features, such as altitude and proximity to the oceans, also play a significant role.

Australia was also instrumental in establishing teaching programs in viticulture (wine grape growing and the cultivation and harvesting of grapes), winemaking and wine science – also referred to as oenology (pronounced *ee–no–luh–jee*).

This set the stage for innovators to explore new grape and wine varieties and techniques, changing perceptions of Australian wine around the world. Today, over 170,000 individuals are involved in growing the grapes, making the wines, and staffing the cellar doors.

ACTIVITY 1A

1. Without searching, list any wine regions in Australia you know.

2. What climatic conditions do you think wine grapes need?

Australian wine regions – Geographical Indication system

In 1993, the Australian Government introduced laws to ensure that all local wine producers use Australia's 'Geographical Indication' system to clearly display the region the grapes for wine are produced in.

The Geographical Indication system has been important in research, regulation, label integrity and in developing an understanding of the unique characteristics of each region's climate and, most importantly, its grape varieties. It is also a valuable tool for consumers, particularly if wine from a certain region is preferred.

More information on the Geographical Indication system can be found here.

Grape varieties

The Australian wine industry is relatively new compared to some other nations, yet the grape growing landscape is as varied as any on the planet. It might come as a surprise to learn that Australia is home to some of the oldest vines in the world – some more than 150 years old!

Australia introduced Vitis vinifera (common grape vine) varieties from Europe and South Africa in the late 18th and early 19th centuries.

We now grow more than 100 different grape varieties in Australia. The top ten most common grape varieties in Australia are: Shiraz, Chardonnay, Cabernet, Merlot, Sauvignon Blanc, Pinot Gris/Grigio, Semillon, Muscat Gordo Blanco, Pinot Noir and Colombard (Varietal snapshots – wine grape types, 2021).

The top three most widely planted grape varieties in Australia are:

- Shiraz
- Chardonnay
- Cabernet

Shiraz

Shiraz is Australia's most widely planted red wine grape variety. It grows in almost every wine region of Australia; accounts for one-quarter of total wine production; and, is our most exported wine. Australia is home to the world's oldest continuously productive Shiraz vines, with vineyards believed to date back to 1843 (Langmeil, Barossa Valley in South Australia), 1847 (Turkey Flat, Barossa Valley in South Australia) and 1860 (Tahbilk, in the Nagambie Lakes region of central Victoria). Shiraz needs a warm to hot climate and growing season, however, flavoursome grapes are grown in regions with cool nights and high diurnal temperature ranges (variation between a high air temperature and a low temperature that occurs during the same day) – such as the Canberra District, Adelaide Hills, Mornington Peninsula and the Yarra Valley.

Chardonnay

Chardonnay is the fifth most planted wine grape variety in the world. It is Australia's most planted white grape variety, and accounts for half of Australia's white wine production. Australia has approximately 10 percent of the world's Chardonnay plantings and is the third largest grower of the variety after France and the USA. Chardonnay is an adaptable variety and can be grown in cool regions as well as warm areas. It is a productive, early budding and early ripening variety.

Cabernet Sauvignon

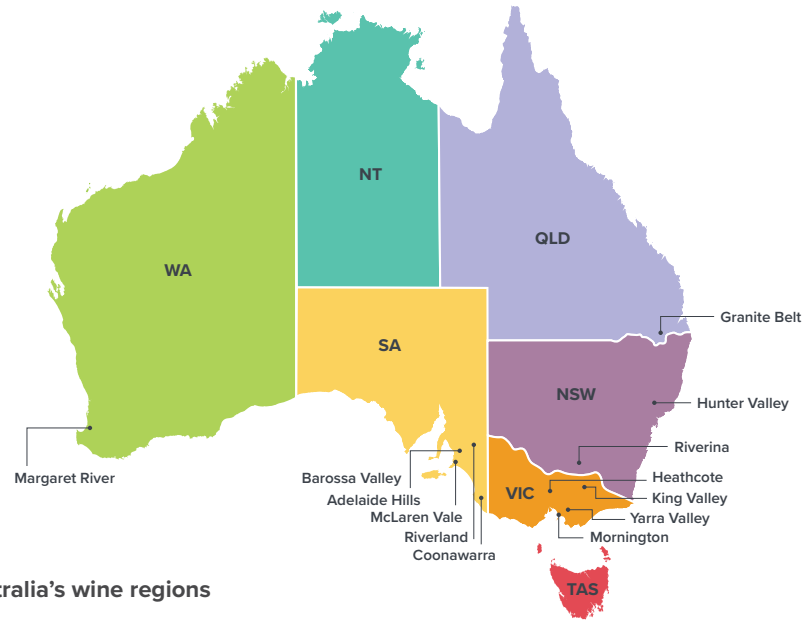
Cabernet Sauvignon is the world's most planted wine grape variety and it is the third most crushed variety in Australia. Cabernet Sauvignon has been grown since the mid-1800s, and very old Cabernet Sauvignon vines exist in Australia. Heat stress and drought stress affect Cabernet Sauvignon's success. It does best in moderate climate regions such as Coonawarra and Margaret River. Other major regions that grow this variety include the Riverland, Riverina and Murray Darling. It thrives on well drained soils – especially gravel-based soils in Margaret River and classic terra rossa soils of Coonawarra.

ACTIVITY 1B

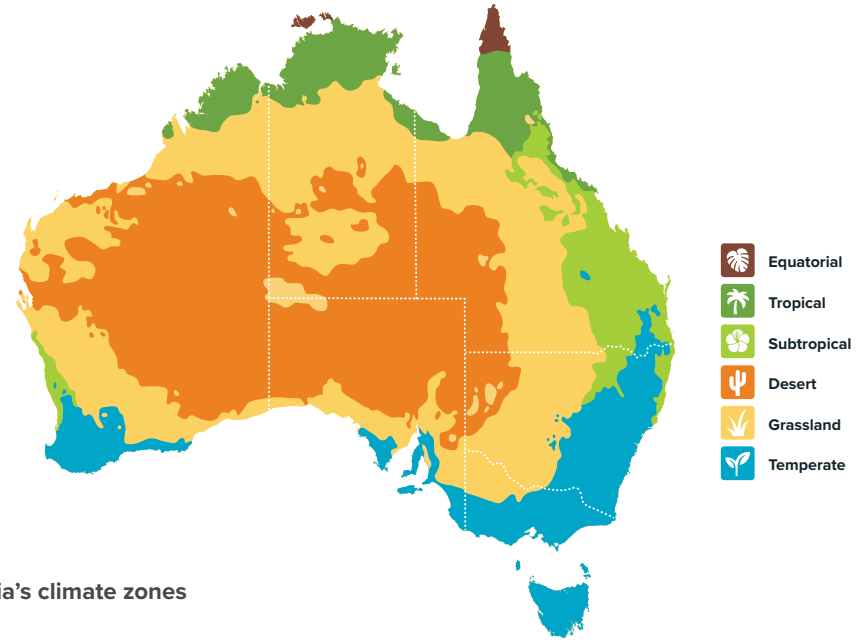
Wine regions and climate zones

Use the maps below or online at the following links to complete this activity.

- Wine Australia
- Geographical Indications
- Bureau of Meteorology Climate Zones



Australia's wine regions



Australia's climate zones

Answer the following questions:

1. Describe the geographic distribution of wine regions in Australia.

2. Identify the interconnections between regions and climate shown on the maps.

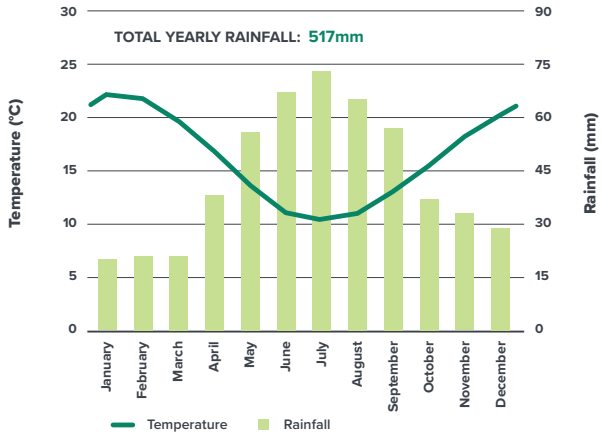
3. Explain why the climate may be favourable for growing wine grapes.

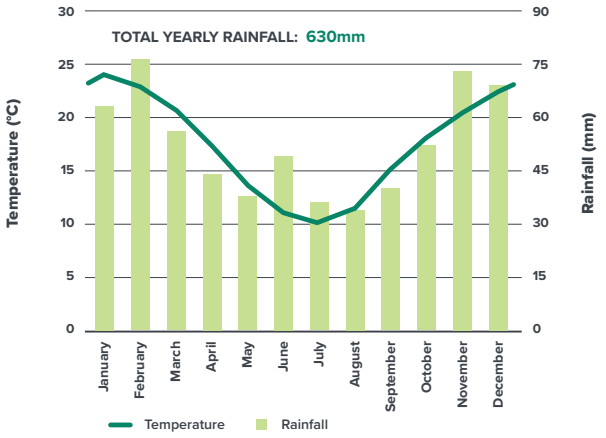
4. In what major climatic zone are most Australian wine regions located?

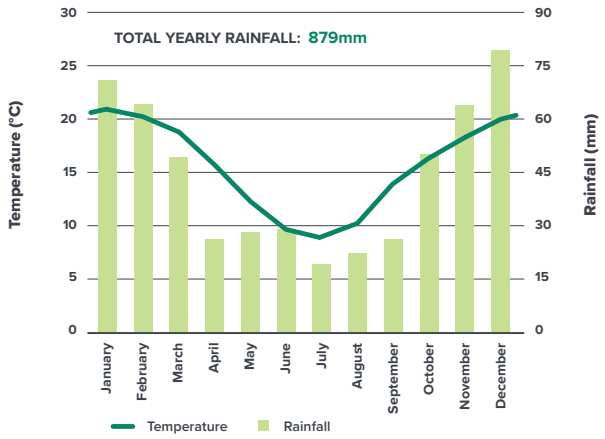
Climate graphs

Look at the three climatic graphs below. Compare them to the graphs found at climate-data.org to answer the following questions.

This will require you to do quite a few comparisons.







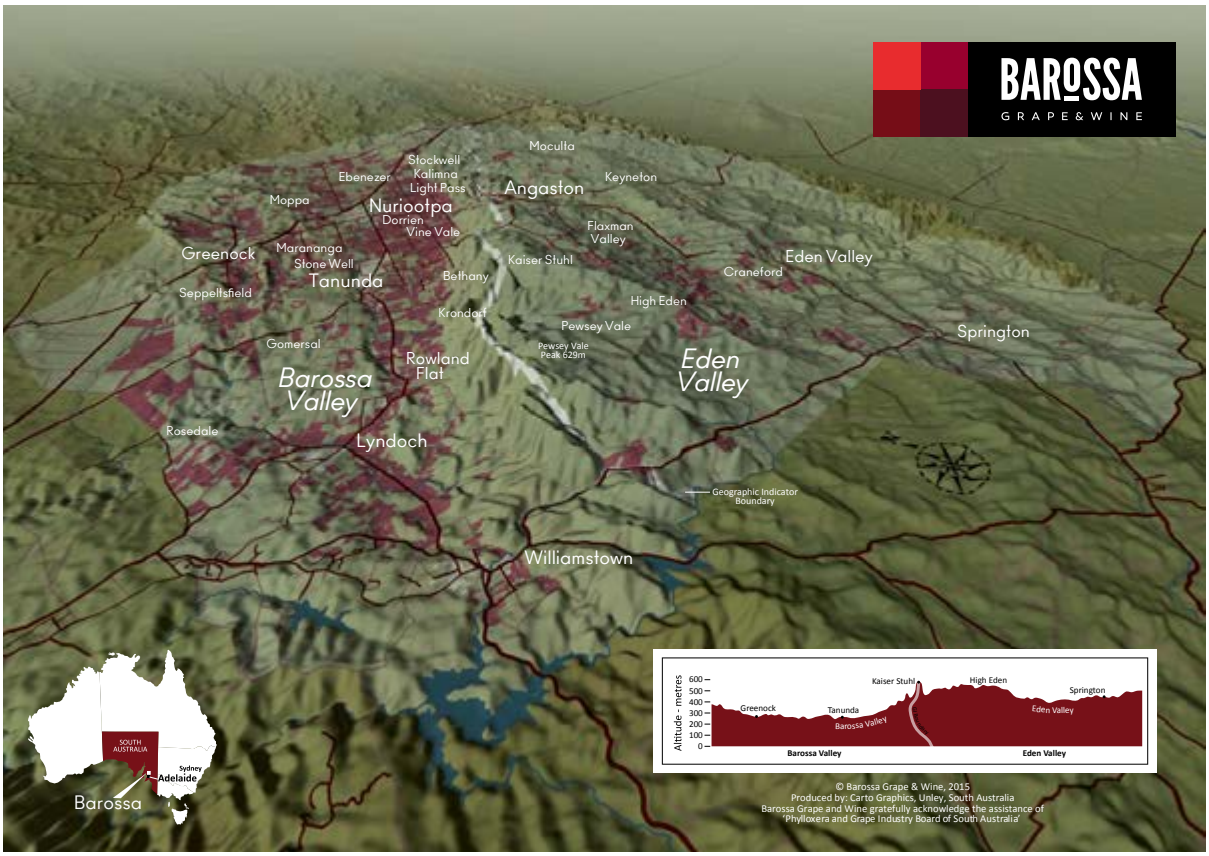
Adapted from: https://en.climate-data.org/oceania/australia-140/

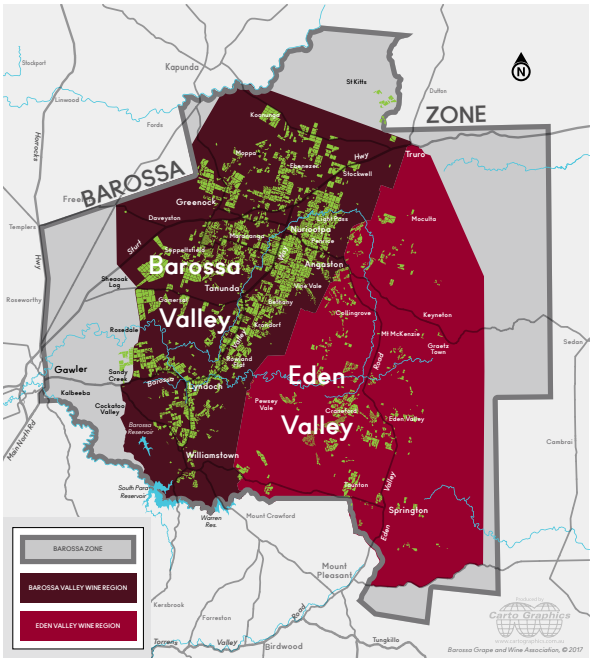
1. Based on the data shown on the graphs, work out and list the location they refer to.

2. What are the similarities and differences between these three graphs? Quote statistics in your answers and be mindful of the scale of each graph.

CASE STUDY ACTIVITIES

– Barossa Valley/Eden Valley





ACTIVITY 1C

In this case study, you will need to refer to the images on the previous page, plus read the information and watch the videos listed below. Once you have completed this initial background study, answer all of the questions in the tables below about the Barossa Wine Region.

Research information

- Barossa Wine Region (play up to the 2-minute mark)
- Climate description and graph
- The Wine Of The Barossa (play up to the 6-minute mark)
- The Barossa Valley Regional Snapshot 2020

Topic	Information *(Can contain written descriptions, images, etc.)**
Location (description and map)	
Climate	
History (place/land, family and/or region)	
Geographic characteristics (human and natural)	
Similar regions elsewhere in the world	
Varieties	
Any other interesting geographic facts	

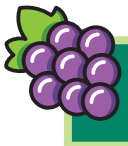
** This activity can be written in a separate word or powerpoint file and submitted to your teacher.*

ACTIVITY 1D

1. Using the information found at this site (Barossa Vineyards map), click on the relevant vineyards and complete the following table, noting their soil and elevation type.

Area	Soil	Elevation
Barossa Valley – Stockwell		
Barossa Valley – Greenock		
Barossa Valley – Tanunda		
Barossa Valley – Williamstown		
Eden Valley – Craneford		
Eden Valley – Keyneton		
High Eden		

2. From these findings, are you able to draw any conclusions? What are they?



ACTIVITY 1E

Select a winery from this list and create a profile.

Choose from Bethany, Krondorf, Jacobs Creek, Elderton or Kalleske wineries.

Single winery profile name: _____

Location:	
History of place:	
Topography:	
Annual rainfall:	
Soil type:	
Surrounding region use:	
Programs being used for sustainability, water use, and disease reduction:	

Lesson 2:
The Australian wine industry and export markets

Australia has a long history of exporting wine, however we started to do very well in the export markets in the 1980s. Since then, Australia has offered the world a range of vibrant and premium wines of exceptional quality.

Whether its pioneering techniques in the vineyards, pushing winemaking boundaries, or experimentation with non-traditional varieties, there is a definite trend towards innovation.

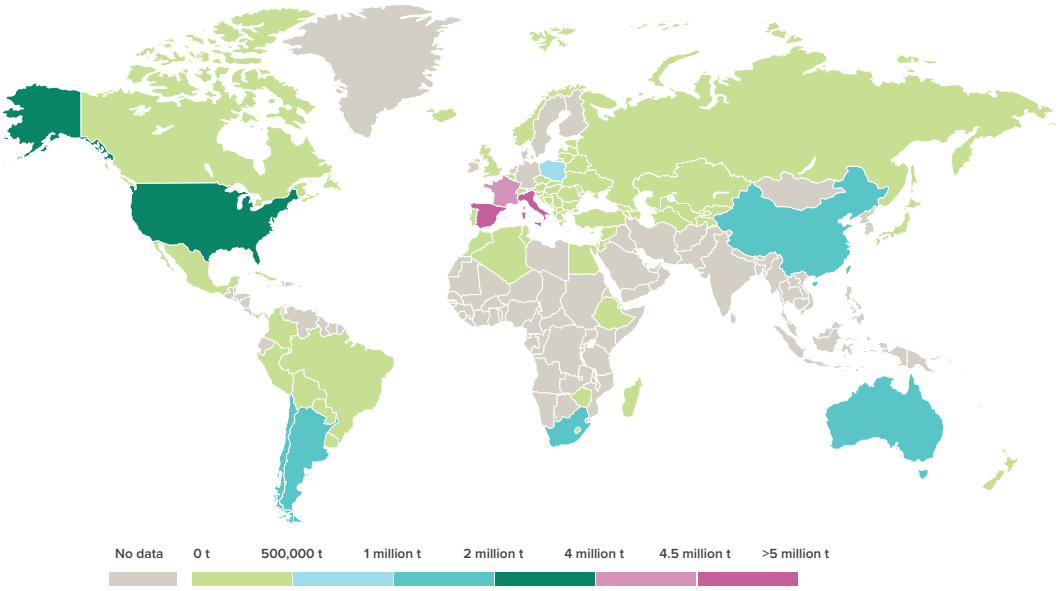
Australia currently has over 2000 wine exporters sending tens of thousands of different wines to 111 destinations worldwide.

The Australian domestic market consumes approximately 500 million litres of Australian wine per year – about 40 percent of the wine we produce, making it by far our largest wine market. Our own wines dominate local sales with imported wine from across the world having less than a 20 percent share. Australia only imports around 95 million litres of wine per year, with two-thirds of our imported wine coming from our closest neighbour, New Zealand.

ACTIVITY 2A

Wine regions around the world

This map might help you to describe the distribution of grape growing and wine producing regions of the world. You can also use these interactive maps: Wine Searcher Regions and Australian Wine Discovered Maps.



World annual wine production, measured in tonnes per year

Adapted from: UN Food and Agriculture Organization (FAO)

1. Out of general interest and by comparison, what industry do you think is worth the most, globally?

   - [ ] a) Supercar Industry
   - [ ] b) Video Game Industry
   - [ ] c) South Africa GDP
   - [ ] d) Wine Industry

2. Review these two webpages and answer the following questions:

   - Marketexplorer – wineaustralia
   - Marketexplorer – wineaustralia consumption

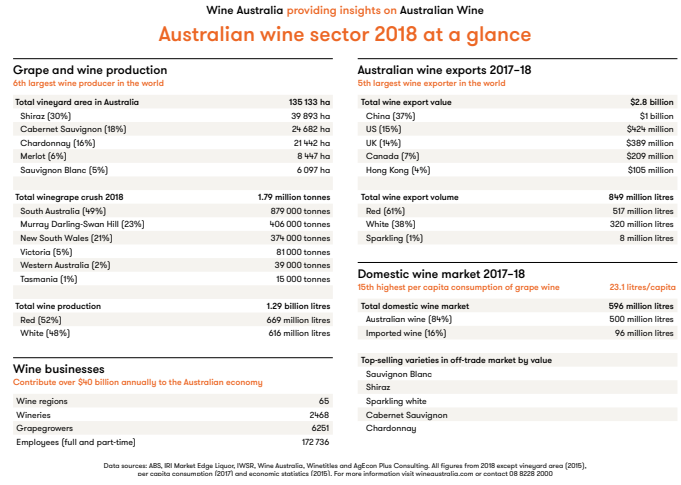
   a) Which country produces the most wine? _____

   b) Which country consumes the most wine? _____

ACTIVITY 2B

Australian wine markets

Using the Wine Australia website, choose two different snap-shot years from the PDF files in the right sidebar of the webpage, eg. 2018 and 2019. See examples below.



Wine Australia providing insights on Australian Wine

Australian wine sector 2018 at a glance

Grape and wine production
6th largest wine producer in the world

Total vineyard area in Australia	**135 133 ha**
Shiraz (30%)	39 893 ha
Cabernet Sauvignon (18%)	24 682 ha
Chardonnay (16%)	21 442 ha
Merlot (6%)	8 447 ha
Sauvignon Blanc (5%)	6 097 ha
Total winegrape crush 2018	**1.79 million tonnes**
South Australia (49%)	879 000 tonnes
Murray Darling-Swan Hill (23%)	406 000 tonnes
New South Wales (21%)	374 000 tonnes
Victoria (5%)	81 000 tonnes
Western Australia (2%)	39 000 tonnes
Tasmania (1%)	15 000 tonnes
Total wine production	**1.29 billion litres**
Red (52%)	669 million litres
White (48%)	616 million litres

Wine businesses
Contribute over $40 billion annually to the Australian economy

Wine regions	65
Wineries	2468
Grapegrowers	6251
Employees (full and part-time)	172 736

Australian wine exports 2017–18
5th largest wine exporter in the world

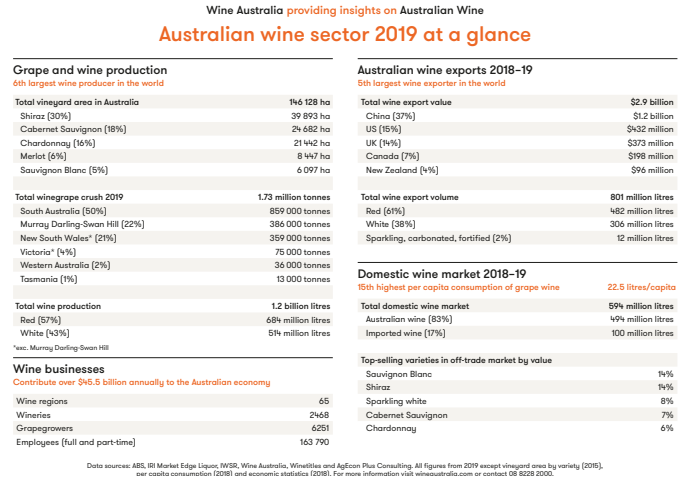
Total wine export value	**$2.8 billion**
China (37%)	$1 billion
US (15%)	$424 million
UK (14%)	$389 million
Canada (7%)	$209 million
Hong Kong (4%)	$105 million
Total wine export volume	**849 million litres**
Red (61%)	517 million litres
White (38%)	320 million litres
Sparkling (1%)	8 million litres

Domestic wine market 2017–18
15th highest per capita consumption of grape wine — 23.1 litres/capita

Total domestic wine market	**596 million litres**
Australian wine (84%)	500 million litres
Imported wine (16%)	96 million litres

Top-selling varieties in off-trade market by value
Sauvignon Blanc
Shiraz
Sparkling white
Cabernet Sauvignon
Chardonnay

Data sources: ABS, IRI Market Edge Liquor, IWSR, Wine Australia, Winetitles and AgEcon Plus Consulting. All figures from 2018 except vineyard area (2015), per capita consumption (2017) and economic statistics (2015). For more information visit wineaustralia.com or contact 08 8228 2000



Wine Australia providing insights on Australian Wine

Australian wine sector 2019 at a glance

Grape and wine production
6th largest wine producer in the world

Total vineyard area in Australia	**146 128 ha**
Shiraz (30%)	39 893 ha
Cabernet Sauvignon (18%)	24 682 ha
Chardonnay (16%)	21 442 ha
Merlot (6%)	8 447 ha
Sauvignon Blanc (5%)	6 097 ha
Total winegrape crush 2019	**1.73 million tonnes**
South Australia (50%)	859 000 tonnes
Murray Darling-Swan Hill (22%)	386 000 tonnes
New South Wales* (21%)	359 000 tonnes
Victoria* (4%)	75 000 tonnes
Western Australia (2%)	36 000 tonnes
Tasmania (1%)	13 000 tonnes
Total wine production	**1.2 billion litres**
Red (57%)	684 million litres
White (43%)	514 million litres

*exc. Murray Darling-Swan Hill

Wine businesses
Contribute over $45.5 billion annually to the Australian economy

Wine regions	65
Wineries	2468
Grapegrowers	6251
Employees (full and part-time)	163 790

Australian wine exports 2018–19
5th largest wine exporter in the world

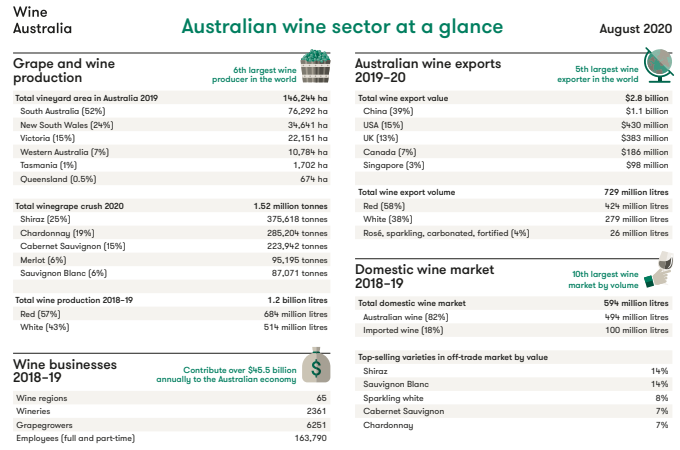
Total wine export value	**$2.9 billion**
China (37%)	$1.2 billion
US (15%)	$432 million
UK (14%)	$373 million
Canada (7%)	$198 million
New Zealand (4%)	$96 million
Total wine export volume	**801 million litres**
Red (61%)	482 million litres
White (38%)	306 million litres
Sparkling, carbonated, fortified (2%)	12 million litres

Domestic wine market 2018–19
15th highest per capita consumption of grape wine — 22.5 litres/capita

Total domestic wine market	**594 million litres**
Australian wine (83%)	494 million litres
Imported wine (17%)	100 million litres

Top-selling varieties in off-trade market by value	
Sauvignon Blanc	14%
Shiraz	14%
Sparkling white	8%
Cabernet Sauvignon	7%
Chardonnay	6%

Data sources: ABS, IRI Market Edge Liquor, IWSR, Wine Australia, Winetitles and AgEcon Plus Consulting. All figures from 2019 except vineyard area by variety (2015), per capita consumption (2018) and economic statistics (2018). For more information visit wineaustralia.com or contact 08 8228 2000.



Wine Australia

Australian wine sector at a glance

August 2020

Grape and wine production
6th largest wine producer in the world

Total vineyard area in Australia 2019	**146,244 ha**
South Australia (52%)	76,292 ha
New South Wales (24%)	34,641 ha
Victoria (15%)	22,151 ha
Western Australia (7%)	10,784 ha
Tasmania (1%)	1,702 ha
Queensland (0.5%)	674 ha
Total winegrape crush 2020	**1.52 million tonnes**
Shiraz (25%)	375,618 tonnes
Chardonnay (19%)	285,204 tonnes
Cabernet Sauvignon (15%)	223,942 tonnes
Merlot (6%)	95,195 tonnes
Sauvignon Blanc (6%)	87,071 tonnes
Total wine production 2018–19	**1.2 billion litres**
Red (57%)	684 million litres
White (43%)	514 million litres

Wine businesses 2018–19
Contribute over $45.5 billion annually to the Australian economy

Wine regions	65
Wineries	2361
Grapegrowers	6251
Employees (full and part-time)	163,790

Australian wine exports 2019–20
5th largest wine exporter in the world

Total wine export value	**$2.8 billion**
China (39%)	$1.1 billion
USA (15%)	$430 million
UK (13%)	$383 million
Canada (7%)	$186 million
Singapore (3%)	$98 million
Total wine export volume	**729 million litres**
Red (58%)	424 million litres
White (38%)	279 million litres
Rosé, sparkling, carbonated, fortified (4%)	26 million litres

Domestic wine market 2018–19
10th largest wine market by volume

Total domestic wine market	**594 million litres**
Australian wine (82%)	494 million litres
Imported wine (18%)	100 million litres

Top-selling varieties in off-trade market by value	
Shiraz	14%
Sauvignon Blanc	14%
Sparkling white	8%
Cabernet Sauvignon	7%
Chardonnay	7%

Data sources: ABS, AgEcon Plus Consulting, Department of Agriculture, Water and Environment, IRI Market Edge Liquor, IWSR and Wine Australia. For more information visit wineaustralia.com or contact 08 8228 2000.

Answer the following questions:

1. Describe the distribution of grape and wine production areas in Australia.

2. Compare the wine grape crush data between the two chosen PDF snap-shots (identify and then discuss similarities and differences – and quote statistics).

   a) What changes do you observe in the amount of sparkling wine produced between the years (remember to quote statistics)?

   b) What factors may have influenced this trend?

3. Create a graph showing both sets of data for Australian wine exports to China, US, UK, Canada and New Zealand (remember to label your axes fully and give a clear title).*

   ** Note: This graph will need to be created in an excel file and submitted separately.*

4. Describe the patterns and trends that are present in the graph.

ACTIVITY 2C

CASE STUDY ACTIVITIES

– China as an export market

China is one of the largest consumers of premium wine in the world, and as the market develops, they are continuing to import high quality wines at accessible prices.

The Chinese population who drink imported wine is estimated to be over 52 million people, which is almost double the size it was only a few years ago (early-mid 2000's). Due to this increased interest, it is a growing market for wine producers throughout the world.

Of interest, most of the wine consumed in China is non-grape wine (traditionally made from rice, sorghum and mead) with almost all of that produced locally.

When it comes to grape wine, around 40 per cent of the volume consumed is imported. Per capita consumption of grape-based wine in China is currently 0.9 litres per head (2018), which is significantly less than other markets such as Hong Kong at 5.0 litres per person and the United States of America with 9.9 litres per head.

While China has at times performed strongly from a market attractiveness perspective, the tariffs imposed on Australian wine exports since November 2020 have led to increased uncertainty for Australian wine businesses.

CASE STUDY Worksheet

PART A:

Review this: Market Explorer to research your answers to the following questions:

1. China imports _____ % of its consumed wine. Australian wine makes up _____ % of that. In what year were these statistics compiled? _____

2. Complete the table:

Country	Wine consumption per capita (litres)

3. As a main supplier of wine to China, what price are wine producers able to obtain per litre?

_____

4. Describe how the Australian wine market in China could grow?

5. Identify and explain any challenges the Australian wine industry may face with exports to China?

PART B:

Recorded in 2017, Landline explored the wine market in China and Australia's position within the complex and growing Chinese wine market.

Watch this video (China Wine, Landline). Using the information that is presented in the video, answer the following questions:

1. UK is the greatest _____ . The US is the _____ .

2. China _____ $ _____ billion _____ .

3. China is the world's _____ grape grower, the _____ producer of _____ wine, and is the world's _____ biggest market.

4. Importing wine into China has grown because _____ .

5. Explain the growth of the wine industry in China as described in the documentary.

6. What challenges is the wine industry in China facing (employment, supply vs demand, government policy, etc.)?

7. Tourism is key to the success of many vineyards and wineries in both Australia and China. In the documentary, a few examples are mentioned. Explain how tourism helps the sale of wine.

8. What techniques and tools have been developed to help the Australian wine market in China?

9. According to the documentary, what 'hope' is there for the Australian wine industry in China's market? And what associated challenges does the local Chinese wine industry face?

PART C:

China's wine importing situation has rapidly changed in 2020. Read this article and answer the following questions:

1. What changes have occurred in the wine trade with China?

2. What reasons are given for these changes?

Lesson 3:
Growing wine grapes – climate and conditions

Viticulturists carry a heavy responsibility – their work in the vineyard defines all resulting wines and has the greatest impact on the land they are the custodians of.

A number of factors are needed to ensure successful grape production in the vineyard. The environment; healthy soils; topography; available water use; pollination; and, managing pest and diseases all play a critical role.

Two of the main issues affecting Australian grape and wine production include climate change and water availability.

Climate change

Global warming is predicted to have notable consequences on Australia's grape-growing regions in the future. This is because average temperatures will change across regions, along with the amount of rainfall and heat and cold extremes.

Drought and bushfire risk may also become more of a concern.

As one example, climate change may increase the risk of disease, such as a grape fungus species (*Botrytis cinerea*), which is caused by an increase in high humidity and temperature.

To understand the impacts of seasonal climate variability and longer-term climate trends on the wine sector, the industry produced a Climate Atlas. This is a free online resource of climate information for all Australian wine regions, providing detailed information about how the climate may change in the near-, mid- and long-term time horizons (out to 2100).

Consequences of global warming are predicted to increasingly affect Australia's grape-growing regions

The atlas helps to answer the question: what will my region's climate look like in the future? This is essential knowledge for making good management decisions in the vineyard. For example, different grape varieties – suited to drier, hotter conditions – may be grown more widely and become more popular.

Water availability

Water is a valuable and limited resource for grape growers.

Water management is important in the vineyard – and grape growers use the term 'vineyard water use efficiency' to describe the relationship between production, eg. tonnes of grapes, and the amount of water used to grow the crop, eg. megalitres.

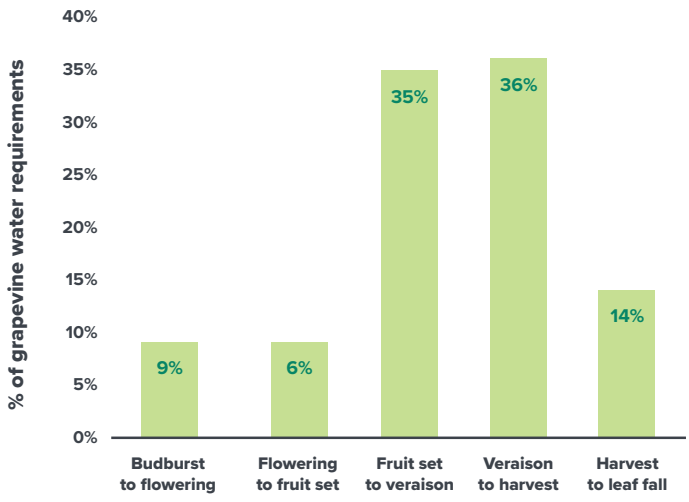
Reducing water use without compromising yield (quantity of grapes produced) or quality will increase water use efficiency and improve total vineyard profitability. Developing and maintaining a water management plan, as well as using a seasonal water budget, will help growers optimise water. A successful water management plan provides information about current and projected (5–10 years) water use and water security (such as availability, quality and costs). It also provides information about where water use efficiency improvements can be made to help growers prioritise and allocate funding to the activities.

Different regions in Australia are suited to different types of grape varieties, and therefore, require varying amounts of irrigation. Generally, the formula for water needs in viticulture is linked to the different stages of vine growth (see graph). But when and how much to irrigate depends on complex systems of soil moisture, rainfall, rootstock and water needs.

Note: One glass of wine can take up to approximately 150 litres of water to produce.

(Source: Australian Wine Research Institute)

Vineyards may use irrigation systems that use rainwater, dam water or are connected to recycled water, as opposed to relying on rainfall or groundwater. Irrigation scheduling is a key vineyard management tool to effectively manage and reduce the amount of water used by a vineyard.



Water requirements of grapevines at different stages of growth

ACTIVITY 3A

Water use in viticulture

Consider the following questions and answer accordingly:

1. What conditions are needed for high yield at a vineyard?

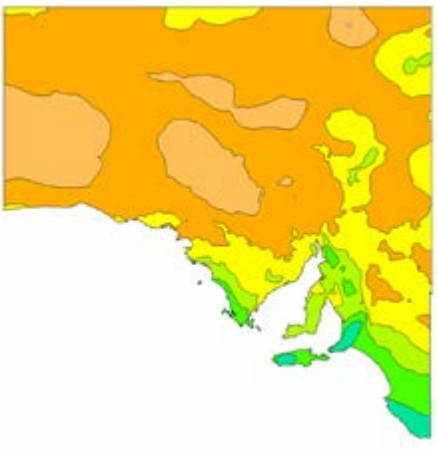
2. How important is rainfall to successful viticulture?

3. Compare the change in annual rainfall for South Australia between the two sets of data presented below, and be sure to quote statistics in your response.

Note: while there is always substantial variation in the rainfall in Australia, the variation is increasing.

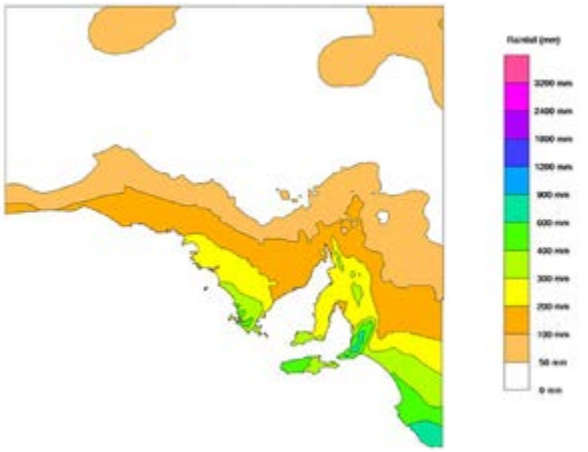
South Australian rainfall totals (mm)
1 January to 31 December 2012

Source: National Climate Centre



South Australian rainfall totals (mm)
1 January to 31 December 2019

Source: Australian Bureau of Meteorology



4. What is irrigation?

5. Why is irrigation necessary in most wine areas?

6. How is water usually delivered to vines?

7. Watch Grape Production Using Drip Irrigation. What are the advantages of this method of delivery? *(Note: the video relates to the USA but is relevant to Australia.)*

8. Where is irrigation water in Australia sourced from?

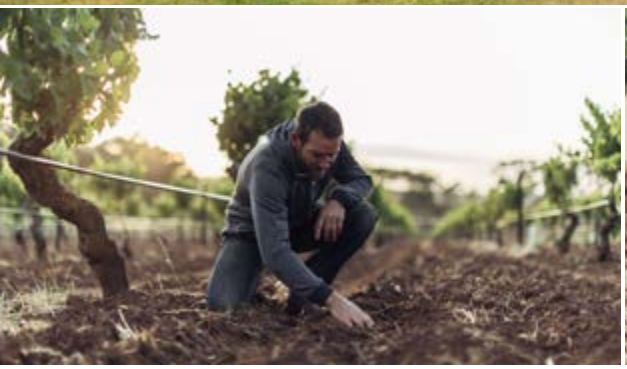
Soils, topography and terroir

Topography and climate play a vital role in viticulture. Both have a significant impact on the soils in Australian regions, including their texture, drainage and fertility, with some Australian regions naturally better suited for grape growing. A single wine region can produce very different wines, and some of this can be attributed to the topography as well as the soil types of different vineyards.

Australia also offers an incredible range of climate zones, from cold to hot, coastal or inland, mountainous or flat.

Terroir is a French term, used to reflect the impact of the conditions under which grapes are grown and wines are made, and the taste and smell of those wines. There is no precise English translation, but 'sense of place' comes very close. Factors that impact on terroir, and so make different wines unique, include climate, soil, landscape, geology, viticultural and winemaking practices, and in some places, other social factors (such as laws based on historical practice).

So, for example, Shiraz wines from the Barossa Valley and Hunter Valley may taste quite different due to differences in terroir factors between the different regions, i.e. different soils and climate, and possibly different grape growing and winemaking practices.



ACTIVITY 3B

Soils

Read this FAO article on the importance of soil in food production and answer the following questions:

1. What impact does soil have on food production?

2. Explain how poor soil may impact on wine grape yields

3. What other issues may arise from nutrient depletion in soils?

Pests and diseases

Grape yield, berry and wine quality can be severely affected by vineyard pests and diseases and managing these in a changing climate can be challenging.

Many advances have been made in understanding the extent of, and developing management strategies for, pests and diseases in Australian vineyards.

Grapevine trunk diseases such as eutypa dieback and botryosphaeria dieback (bot canker) can cause significant yield reduction and threaten the sustainability of vineyards.

Powdery mildew, downy mildew and botrytis bunch rot are considered to be the top three disease concerns in Australian vineyards. There are others including phomopsis, and viral diseases, such as grapevine fleck, grapevine leafroll, Australian grapevine yellows and rugose wood.

Australia's isolation and strict quarantine processes have protected the sector from many diseases and pests that have had a major impact in other wine producing countries around the world.

Phylloxera (pronounced *fi-locks-erra*) is an example of an exotic pest.

Grape phylloxera (*Daktulosphaira vitifoliae*) is a tiny insect pest, akin to aphids, that destroys grapevines by feeding on their roots and/or leaves. There are now 115 genotypes of phylloxera present in Australia and impacts are dependent on the strain and vine host. *Vitis vinifera* cultivars, commonly known as 'own roots', die within six years once vines are infested and effects on yields are felt much sooner. Once infested, the only solution is to replant on resistant rootstocks, selected based on site conditions and the individual phylloxera genetic strain.

Phylloxera's arrival in Europe from North America in the 1850s wiped out millions of hectares of vineyards within years. The pest is found in eight quarantine zones in Australia, but good fortune and strict quarantine regulations have limited further spread. However, Australia's wine sector remains vulnerable to phylloxera because the susceptible, own-rooted vines make up the majority of the nation's vineyards – including some of the oldest vines in the world. This means the stakes are extreme should phylloxera spread outside the current phylloxera-infested zones.

Eutypa dieback

Powdery mildew

Grape phylloxera

ACTIVITY 3C

Pests and diseases

Read this Vinehealth article and watch this video on Phylloxera and answer the following questions:

1. Explain what Phylloxera is.

2. Why is it such a major threat to the viticulture industry?

3. What can be done to fight disease?

4. Explain some of the rules and regulations that are in place for combating the disease.

Pollination — flowering

Pollination is important for any plant that produces fruit.

Grape vines are considered to be self-fertile, meaning they can fertilise themselves from their own flowers.

Pollination happens when pollen is transferred from one grape flower to another grape flower on a different grape vine.

The timing of flowering is determined by air temperature, soil temperature, grape variety and other factors.

The average daily temperature at the start of flowering can vary in Australia.

Generally, flowering starts in early November in Queensland and New South Wales and runs through to late December in Tasmania.

ACTIVITY 3D

Pests and diseases

Watch these two short videos: Pollination in the vineyard, How grapevines bloom and fruit develops and conduct any additional online research needed to respond to the following questions:

1. Describe how pollination takes place in vineyards.

2. What makes the pollination successful?

3. Write a 300-word article to discuss the value insects provide to the growth and health of vineyards.

EXTENSION ACTIVITY

– Chronic and acute climate events

Climate events facing grape growers

Farmers face a range of challenges that include:

- **Chronic climate challenges** from global warming with shifting climate zones.
- **Acute climate challenges** from increased frequency and intensity of flood, drought and bushfire.

Read and watch the information in this viticulture focus story.

1. With the conditions needed for viticulture in mind, what types of challenges may wine regions and other businesses in those regions face?

Chronic climate events

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has predicted that the mean temperature in Australia is likely to increase by as much as 1.5 degrees celsius by 2030 (compared with 2014).

These projections and the possible effects have uncertainty associated with them, specifically when subsequent changes will become noticeable and how severe they will be.

Detail for Australia is in the State of the Climate Report for 2020.

Impacts

It is widely agreed that the likely future effects of climate change in southern Australia, where most grape growing regions are located, will include:

- More hot and very hot days and warmer nights
- Reductions in average annual rainfall
- An increase in the frequency and severity of droughts
- An increase in the frequency and severity of floods
- An increase in the frequency and severity of storms, including hail
- An increase in the risk of bushfires
- Rising sea levels
- Increased evaporation, and
- More restricted water supplies.

1. How many of these have you already experienced? _____

ACTIVITY 3E

Use the resources on this page What is climate change and what can we do and the Climate Atlas to gain a clearer understanding of what climate change is.

1. Describe the difference between weather and climate.

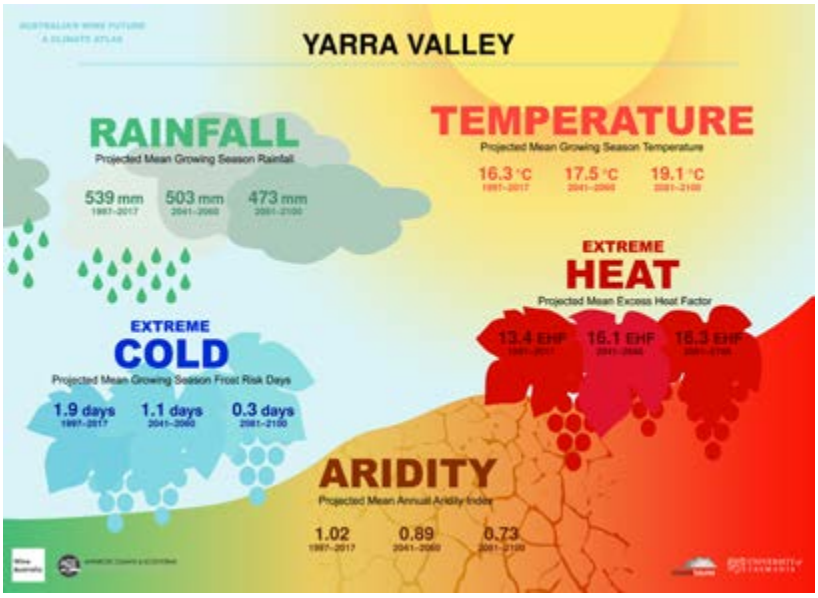
2. What is the enhanced greenhouse effect? What other names is it known by?

3. Explain the process of climate change.

4. Read what a climate projection is and suggest how they could be used to predict climate change.

ACTIVITY 3F

Acute climate events



Yarra Valley climatic data

1. Using this resource Yarra Valley Climate Change Atlas, describe the change in projected climate for the Yarra Valley between the 1997–2017 period and the 2081–2100 period.

2. Suggest some challenges that may arise due to the warming climate.

3. What impact would these challenges have on businesses in the wine regions?

ACTIVITY 3G

The map below shows the impact area of the South Australian Cudlee Creek fire of 2020.

Research the impact of bushfires on wine regions and on specific vineyards. Wine Australia's Fire and Smoke Assessment has useful resources, and also watch this video on 'Climate Wines' to answer the following questions:

1. What is the impact of bushfires on wine regions?

2. What is the impact of bushfires on yields/grapes?

3. How can wine businesses meet any of these challenges?

ACTIVITY 3H

Watch this Landline video on **Vintage Recovery** to answer the following questions:

1. What three issues have been causing 'doom and gloom' for the Australian wine industry?

2. What natural geographic characteristics at the Robert Oakley Vineyard Winery in the Mudgee region make the area ideal for wine making?

3. Describe the location of Mudgee, New South Wales in relation to active bushfires and fire danger ratings during November 2019.

Affected vineyards after the South Australian Cudlee Creek fire, 2020

Lesson 4:
Response to a changing climate

Climate change is already impacting the grape and wine community, as evidenced by changes in grape phenology and harvest dates, and this has led to compressed harvests and greater pressure on vineyard and winery infrastructure.

Vulnerability to the impacts of climate change varies along the value chain, with the vineyard being the most vulnerable.

The ability to manage the impact of heatwaves, drought, increased fire risk and salinity to mitigate their effect on grapevine physiology, and grape and wine quality, has become an integral part of vineyard management.

Australian grape growers are adapting to changes in the climate in varied and creative ways.

Some of the adaptation responses in Australian vineyards have included:

- Increased irrigation efficiency
- Modified irrigation practices in response to heatwaves and frosts
- Vineyard floor management practices aimed at retaining soil moisture
- Use of alternative varieties and/or rootstocks
- Modified canopy management practices
- Establishment of vineyards in cooler regions and/or sourcing cooler climate fruit
- Delayed pruning practices to manipulate harvest dates.

ACTIVITY 4A

In the McLaren Vale region, the climate is generally cool, with a long growing season from late November to early February. This means that Chardonnay can be harvested at its peak ripeness levels, and results in an excellent quality wine variety for the area. Climate change means that more heatwaves with prolonged periods of excessively warm weather, are occurring in the region.

Using information from this fact sheet: Managing vines during a heatwave, complete the following activity.

1. Expand on each of the topics in the table below:

   - Identify the impacts of heatwaves.
   - Discuss what the McLaren Vale region could do as a result of an increase in heatwaves.
   - identify at least two ways to potentially combat each of the issues, either something you have researched that is already being used or a new idea of your own.

Overall impact of heatwaves	
Variety choice	
Water management	
Soil depletion	
Diseases and pests	
Add your own: _____	

ACTIVITY 4B

Watch this video on Climate Wines and complete the below worksheet as you watch.

From the table below, choose two responses to challenges faced by the wine industry.

☐	Mulching for weed control	☐	Change variety of grapes
☐	Cover crops	☐	Location changes
☐	Companion planting	☐	Irrigation and water management
☐	Use of Geographic Information Systems (GIS) to monitor vineyard	☐	Diversification of grape varieties

Answer the questions below for both responses.

Response 1.

1. What is the challenge name? _____

2. What issue is this responding to? _____

3. Explain the response.

4. Assess how effective the response may be.

5. Using one of the following criteria, evaluate the sustainability of the response.

   Criteria: *Sustainability, Affordability, Flexibility, Fairness, Incentives, Environment, Timeframe (see more detail on page 41).*

Response 2.

1. What is the challenge name? _____

2. What issue is this responding to? _____

3. Explain the response.

4. Assess how effective the response may be.

5. Using one of the following criteria, evaluate the sustainability of the response.

   Criteria: *Sustainability, Affordability, Flexibility, Fairness, Incentives, Environment, Timeframe (see more detail on page 41).*

Evaluating the effectiveness of a response

The acronym **SAFFEIT** is sometimes used to help create criteria to evaluate a response.

The letters stand for:

S – Sustainability

A – Affordability

F – Flexibility

F – Fairness

E – Effective

I – Incentive

T – Time frame

For each of the above words, we must decide whether a response/policy/strategy fits all or most of the evaluation categories. So, we ask some questions per criteria.

- **S – Sustainability**
  Is the response sustainable? What makes it sustainable? Can it continue long term?
- **A – Affordability**
  Is the response accessible to the majority of people? Is the cost worth the reward/is it cost effective?
- **F – Flexibility**
  Is the policy/strategy able to fit different budgets? Can it be applied in various situations? Can it be adjusted to fit different sized business?
- **F – Fair**
  Is the response fair on the business? Will there be an alternative for every household/region/business?
- **E – Effective**
  How can the effectiveness of the response be measured? Is the method of evaluating realistic and measurable?
- **I – Incentive**
  Is there an incentive for people to co-operate or adopt this response?
- **T – Time frame**
  Is there a timeframe attached to implementation of the response? Is the time frame realistic? Are there both long- and short-term time frames for the response?

ACTIVITY 4C

CASE STUDY ACTIVITY

– Tahbilk Winery

Established in 1860, Tahbilk is one of Australia's most beautiful and historic family-owned wineries.

It is located in the Nagambie Lakes region of central Victoria (120kms north of Melbourne) – one of Australia's premium viticultural areas.

The property comprises some 1,214 hectares of rich river flats with a frontage to the Goulburn River.

Purchased by the Purbrick family in 1925, Tahbilk is home to five generations.

In 2013, Tahbilk became carbon neutral. An extension of the work already completed to restore the delicate balance once known by the Daung-wurrung clans.

Tahbilk has approximately 200 hectares of vineyards, specialising in grape varieties from the Rhone, including white varietals: Marsanne, Viognier and Roussanne, and red varietals: Shiraz, Grenache and Mourvedre. They also grow Cabernet Sauvignon, Merlot, Cabernet Franc, Chardonnay, Riesling, Pinot Gris, Sauvignon Blanc and Verdelho grapes.

Find out more here.

Research information

1. Follow each of the links below to learn how Tahbilk is regenerating the local wetlands and how it impacts their winery:

   - Our journey to environmental sustainability
   - A beautiful place
   - Tahbilk wetlands experience
   - Family winemaking heritage
   - Map of Indigenous Australia

2. Complete the following table using information contained in the links on the previous page.*

Topic	Information *(Can contain written descriptions, images, etc.)*
Location (description and map)	
Climate	
History (place/land, family and/or region)	
Geographic characteristics (human and natural)	
Issues and challenges for the location	
Responses to the issues and challenges	
Sustainability	
Regional diversity What is also occurring within the same region?	
Traditional owners of the land	

** This activity can be written in a separate word or powerpoint file and submitted to your teacher.*

Lesson 5:
Diversification of wine regions

Although a primary industry in a region may be a drawcard and support a healthy economy, a challenge that regions face in Australia is an ever-changing economic and business climate. This can be unpredictable. So, diversifying a region's economy helps ensure jobs and sustainable growth for the whole area.

Some examples of complementary businesses that may be established in a region are: government works and services; tourism; adventure activities; accommodation; food and beverages; and other forms of horticulture.

Tourism in wine regions is a popular option. Each day, tourists travel to wineries to sample wine and other products, as well as visit and shop at the other businesses located nearby. They may stay in local accommodation and visit local restaurants. In addition to local tourism, tourists may come from around Australia or from around the world to visit Australia's famous wine regions.

ACTIVITY 5A

Yarra Valley tourism

The locations of Australia's wine regions are often within reasonable drive from major cities and have agreeable climates. As the popularity of wineries and touring of these regions has grown, so too has the variety of businesses that operate in the wine regions of Australia.

The Yarra Valley is a phenomenal corner of Victoria, set between the High Country and the Dandenong Ranges. It has great food, great wine and many things to see and do. The valley itself boasts not only world-class wineries and cellar doors, but also cider houses, dairy farms, flower farms, fruit picking, and a chocolaterie and ice creamery.

These attractions draw people to the region for day trips and the varied accommodation options in the beautiful local towns encourage overnight stays.

1. Create a large list (at least 20) of the different businesses and activities available in the Yarra Valley. Start by visiting this webpage: www.visityarravalley.com.au

2. What other businesses do you think might flourish in wine regions?

3. Why do you think they may do well?

ACTIVITY 5B

Barossa Valley region

The Barossa Valley is well known as one of Australia's oldest and foremost wine producing regions. There's a rich wine heritage in the Barossa Valley, with sixth-generation grape growers, fiercely proud winemakers and some of the oldest grapevines in the world. But there is much more to this region than Shiraz grapes and oak barrels.

The valley floor is flat and is about at sea level, surrounded by the steep hills of the Mount Lofty Ranges. The Barossa Valley has a mediterranean climate with warm-climate vineyards on the valley floor and cooler vineyards up in the surrounding hills. This diversity is what allows the region to produce a variety of wine styles.

Geographical Indication (GI) is an official description of an Australian wine zone, region or sub-region. The GI system is designed to protect the use of the regional name under international law and is governed by the Geographical Indications Committee, overseen by Wine Australia. The Barossa (zone) is located north of the city of Adelaide in South Australia. It comprises two distinct and complementary regions, Barossa Valley and Eden Valley, which were formalised in 1997. High Eden is the only officially declared sub-region.

In 2018, the Barossa Zone has 13,989 hectares under vine. A region is an area of land with unique and homogenous grape-growing attributes that produces at least 500 tonnes of wine grapes in a year, comprises at least five independently owned vineyards of at least five hectares each. In 2018, the Barossa Valley Region had 11,645 hectares under vine. In 2017 the Eden Valley Region had 2,335 hectares under vine.

The land that today we call the Barossa, has for tens of thousands of years been the home of the Peramangk, Ngadjuri and Kaurna people.

Conduct your own research into the Barossa Valley region and answer the questions on the following pages.

Some useful resources are:

- Barossa Maps and Videos
- Barossa Grounds Project
- Barossa Food Story
- Barossa Valley History in Evolution

1. What makes the Barossa unique?

2. Is the region seen as individual businesses or a collective?

3. The region was settled by whom?

4. What types of businesses were originally set up in the Barossa region?

5. The Angus family were originally diverse in their farming. What types of produce did they produce?

6. The concept of the Barossa region is to use all of what is available. Has this continued as the region has developed?

7. Why did viticulture take hold?

8. The Langmeil vineyard was moved. Why?

9. The first commercial vineyard in the region was planted in _____

by _____ . The wines were _____ grapes.

10. The new type of fermentation used was called _____

This began the _____ .

11. Collin Gramp travelled to the continent in 1954, mostly in Germany. When he returned, he created the Barossa Pearl. What was different about this wine?

12. Why is the wine auction important?

a) From your research, and information available here: Barossa Maps and Videos, take notes on the description of three different wineries and what attracts tourists to the region:

Winery: _____	
Winery: _____	
Winery: _____	

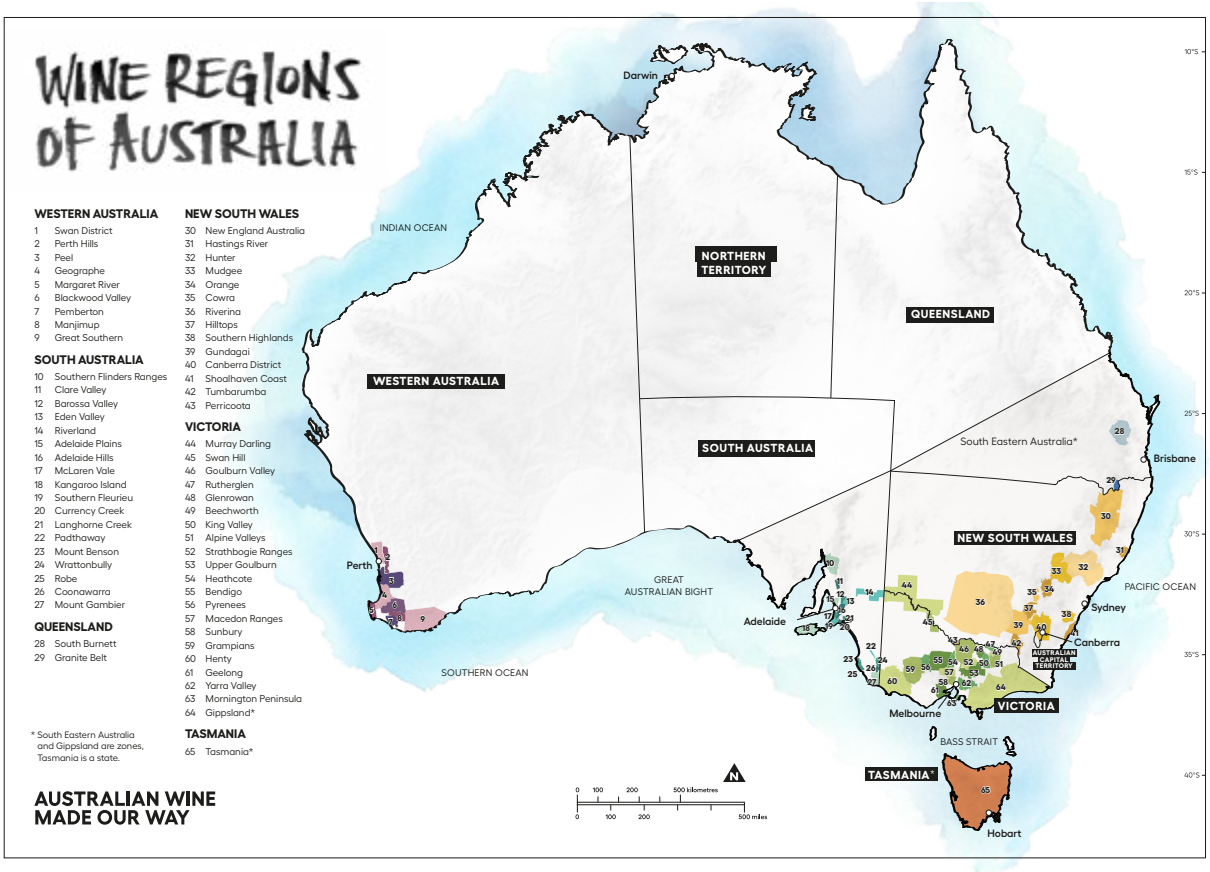
b) Describe at least two businesses or other attractions that are not wine related from the Barossa region:

Other business: _____	
Other business: _____	

Lesson 6:
Research into a wine region

In this lesson, you will need to complete a research project into Australia's wine regions – Australian Wine Regions.

Note: The following activities can be completed virtually (using online resources) or via a school-based field trip. Answer the questions and complete research tasks.



Source: www.wineaustralia.com/australian-wine-discovered-maps

ACTIVITY 6A

Research into a wine region

Investigate the sustainability of two wine regions using research or fieldwork. You will need to repeat the questions below for each region you investigate. Triangulate all information from multiple sources.

Prepare two separate reports containing your answers to the below criteria.

Wine Region One

1. Draw a localised map of the wine region showing all wineries, tourism businesses and related businesses.*

   ** This answer will need to be prepared and attached as a separate document.*

2. Describe the history of the region in approximately 200 words.

3. Using Google Maps and Google Earth, work out how to get to your chosen wine region from your current location. Make a list that includes all major towns, stops, stays and methods of travel.

4. How long would it take to travel to your wine region? _____

5. Describe the landscape of the region (try using Google Street View).

6. Pick one local winery in the region to focus on:

   - What is its name and location? _____
   - How do they use their land?

7. What challenges may the winery face?

8. What types of programs/responses/plans does the winery have to combat any challenges they face?

9. What evidence can you find of sustainability initiatives at the location or local area (list any you see and plot these on your map*)?

** Mark plots on your map constructed in Question 1 and attach as a separate document.*

10. What could the location implement to ensure future sustainability?

11. What industries do you see as you 'travel' through the region?

12. Why may these businesses have chosen to set up here?

13. Using your new knowledge of this wine region, its challenges and responses to those challenges, how sustainable do you think the local wine industry is?

14. Based on the information from the two selected locations, discuss the current sustainability of the two regions.

15. What factors make viticulture a sustainable industry?

Wine Region Two

1. Draw a localised map of the wine region showing all wineries, tourism businesses and related businesses.*

   ** This answer will need to be prepared and attached as a separate document.*

2. Describe the history of the region in approximately 200 words.

3. Using Google Maps and Google Earth, work out how to get to your chosen wine region from your current location. Make a list that includes all major towns, stops, stays and methods of travel.

4. How long would it take to travel to your wine region? _____

5. Describe the landscape of the region (try using Google Street View).

6. Pick one local winery in the region to focus on:

   - What is its name and location? _____
   - How do they use their land?

7. What challenges may the winery face?

8. What types of programs/responses/plans does the winery have to combat any challenges they face?

9. What evidence can you find of sustainability initiatives at the location or local area (list any you see and plot these on your map*)?

** Mark plots on your map constructed in Question 1 and attach as a separate document.*

10. What could the location implement to ensure future sustainability?

11. What industries do you see as you 'travel' through the region?

12. Why may these businesses have chosen to set up here?

13. Using your new knowledge of this wine region, its challenges and responses to those challenges, how sustainable do you think the local wine industry is?

14. Based on the information from the two selected locations, discuss the current sustainability of the two regions.

15. What factors make viticulture a sustainable industry?