climate change in the MALLEE

Climate change is one of the most important challenges facing us today. Without action to reduce greenhouse gas emissions and prepare for a changing climate, the direct and indirect impacts will have major adverse effects on the environment, our society and our economy.

Without effective global action to reduce greenhouse gas emissions, by the end of the 21st century concentrations of greenhouse gases in the atmosphere are expected to be two or three times higher than pre-industrial levels (280 parts per million).

Because of the inertia in the climate system and the lifetime of greenhouse gases in the atmosphere, past human activities and greenhouse gas emissions are affecting us now, and today's decisions and actions will have impacts far into the future.

We are already committed to global warming of at least 0.6°C (relative to 1990) by 2030. Thereafter, we have a choice – the extent of climate change we experience will depend on emissions we release over the next couple of decades and beyond. A global emissions reduction target of 60% by 2050 still commits us to global warming of at least 2°C from pre-industrial (1750) levels. Beyond 2°C warming, the risk of dangerous and rapid climate change increases significantly and the costs of adaptation also rise.

Over the past 17 years, observations of carbon dioxide concentrations, global mean temperatures and sea level rise have been tracking close to the upper limit of projections from the Intergovernmental Panel on Climate Change (IPCC). While further evidence is required, these reservations suggest that the mid to low range of projections may be less likely than the upper limits of projections.

→ This document is a summary of how the climate of the Mallee is expected to change during the 21st century based on a r ange of greenhouse gas emissions scenarios.

The climate change projections have been collated by CSIRO on behalf of the Victorian Government. The projections are consistent with the Australian climate change projections released in late 2007, incorporating results from the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007). Further information from the Australian Bureau of Meteorology and other peer-reviewed scientific studies have also been included.

This brochure is one of a series of regional climate change profiles that are available online from **www.climatechange.vic.gov.au**

This summary is not intended for impact analysis or developing adaptation responses, which will require more specific information.

→ HOUSEHOLD ENERGY USE

Energy generation and use accounts for around 70% of Victoria's greenhouse gas emissions.

By using less energy you will lower emissions and help to reduce the impacts of climate change.

The Victorian Government's energy saving campaign uses a black balloon to represent greenhouse gas emissions. A balloon holds 50 grams of greenhouse gas and an average Victorian household produces over 12 tonnes or 240,000 black balloons of greenhouse gas emissions each year.

For further information about how you can save energy and reduce greenhouse gas emissions phone 1300 363 744 or visit www.SaveEnergy.vic.gov.au

the Victorian
climate change
adaptation program

A Victorian
Government
initiative

Victoria
The Place To Be

MALLEE

→ PROFILE

The Mallee is a semi-arid region of approximately 39,000 square kilometres which is home to 78,000 people. The largest centre is Mildura but other significant centres include Robinvale, Ouyen, Hopetoun, Murrayville and Birchip. The area covered by Swan Hill Rural City Council is largely inside the Mallee region, although the City of Swan Hill itself is not. The Mallee is bordered in the north by the River Murray, and includes the Mallee basin and sections of the Wimmera, Avoca and Millicent coastal basin in the south and east.

The economy of the region is largely dependent on agriculture – both from irrigated horticulture along the River Murray and from dryland production of wheat, barley and sheep. Nearly a quarter of all employed people work in the agricultural sector and much of the other employment is in food processing which also depends on farming.

The Mallee is home to five distinct bioregions* three along the floodplain of the Murray River and two covering the large dryland areas away from the river. A series of major parks cover 1.2 million hectares, which is nearly 40% of the region's area. The region is significant for its unique species, particularly reptiles and birds. A significant number of flora and fauna in the Mallee region are classified as threatened within Victoria.

*http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html

current climate

Although we can no longer expect that past climate is an adequate description of the future climate, it is useful to examine the region's historical climate to help understand the spatial variation in temperature and rainfall. It is difficult to describe the 'average' climate, given its variability. However, based on international convention, the average climate described in **Figure 1** and **Figure 2** is based on the 30 year period from 1961 to 1990.

The region has hot summers with average maximum temperatures of 30˚C. Winters are mild with an average daily temperature around 10˚C, but frosts are common. **Figure 1** shows how annual average temperatures vary across the region. The semi-arid nature of the region is evident from the high levels of evaporation (seven times the average rainfall). Annual average rainfall is only 331 millimetres which mainly falls in the spring and winter (**Figure 2**). On average there are only 61 days each year where at least 1 millimetre of rain falls.

Table 1
Seasonal and annual average temperatures and rainfall in the Mallee (1961 to 1990)

	Average daily temperature (˚C)	Average daily maximum temperature (˚C)	Average daily minimum temperature (˚C)	Average rainfall (mm)
ANNUAL	16.3	23.3	9.4	331
SPRING	16	23.3	8.8	92
SUMMER	22.7	30.9	14.5	63
AUTUMN	16.6	23.3	10	81
WINTER	10	15.5	4.5	95

Figure 1
How average annual **temperature** varies across the Mallee (based on average daily temperature between 1961 to 1990)

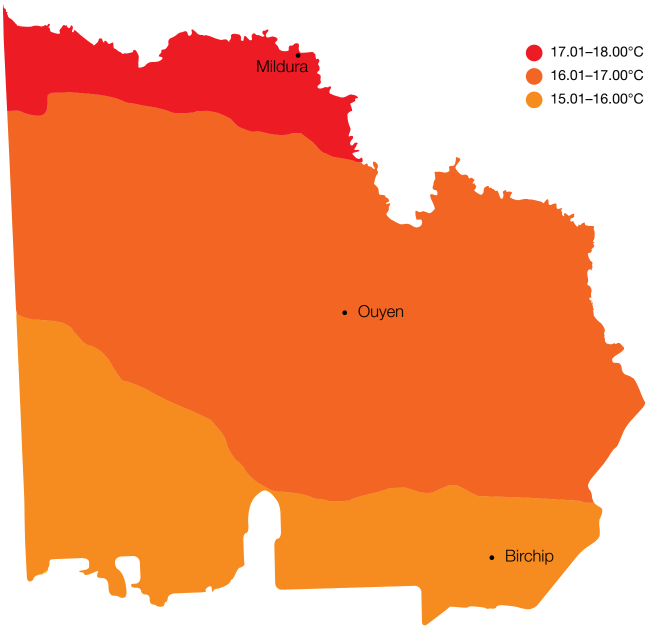
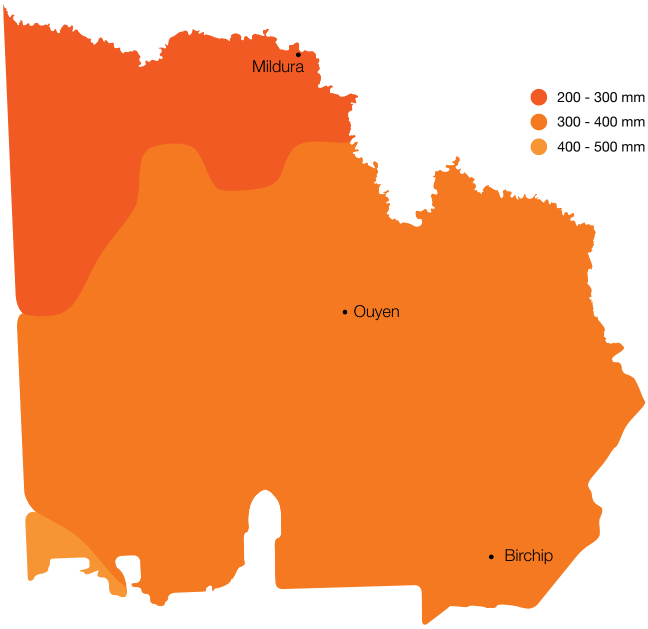


Figure 2
How average annual **rainfall** varies across the Mallee (based on average daily rainfall between 1961 to 1990)



climate trends

During the last decade (1998 to 2007) average annual temperatures in the region were 0.4˚C warmer than the 30 year (1961 to 1990) average. Average maximum temperatures increased nearly twice as much (0.7˚C), while there was no overall change in the average daily minimum. Summer shows the greatest increase in average temperature (0.6˚C), while maximum temperatures increased the most in summer and spring (0.9˚C and 0.8˚C respectively). Minimum temperatures increased the most in summer (0.3˚C), but showed a large decrease in autumn (0.6˚C).

Between 1998 and 2007, the average annual number of days over 30˚C increased (by 8 days) as did the number of days over 35˚C (by 6 days) and there were 3 additional days over 40˚C. During this same period there were 4 more cold nights (minimum temperature below 5˚C) and frosts on average per year. This may be a result of changes in cloud cover associated with the drought.

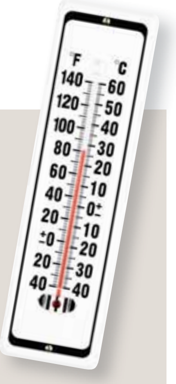
There has been a decline in the region's rainfall over the past decade. Between 1998 and 2007 the region's average rainfall was 13% below the 1961 to 1990 average. Decreases were greatest in autumn and winter, while average summer rainfall actually increased (18%). There were 8 fewer rainy days each year on average.

These trends provide a benchmark against which we can measure future climate change. It also allows us to determine whether the trends we have already seen agree with the future direction of climate change.

While the observed warming is likely to be mostly due to increases in greenhouse gas emissions, it is not yet possible to say the same about the observed changes in rainfall. However, because the recent drought has occurred during these periods of increased temperatures, it is possible to say that climate change has exacerbated the impacts of these low rainfall periods.

→ FACT

During the last ice age (20,000 – 100,000 years ago) the global average temperature was only 5ºC cooler than the current global average of 15ºC.



PROJECTING FUTURE CLIMATE

CSIRO and the Australian Bureau of Meteorology have assessed future climate change from the results of 23 global climate models used in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007) and different IPCC scenarios for greenhouse gas emissions. The emissions scenarios, which project emissions growth from 1990 to the end of this century, consider a range of assumptions about demographic change, economic growth and technological developments which are likely to influence future emissions. National results were published in *Climate Change in Australia* (2007) **www.climatechangeinaustralia.gov.au**

Long-term temperature increases depend on how much and how quickly heat trapping greenhouse gases accumulate in the atmosphere and how the climate system responds to the increased concentrations. For this report, three different emissions scenarios have been used to calculate climate projections:

- The **B1** scenario is a lower emissions growth scenario ↑ and assumes that there is a rapid shift to less fossil-fuel intensive industries. Under this scenario, it is expected that there will be a weak growth in CO_2 emissions until 2040, and then a decline. CO_2 concentrations approximately double, relative to pre-industrial levels, by 2100. A global temperature increase relative to 1990 of 1.8°C (1.1 to 2.9°C) is likely.
- The **A1B** scenario is a medium emissions growth scenario ⇈ where there is a balanced use of different energy sources – not just fossil fuels. CO_2 emissions increase moderately until 2030, but decline by the middle of the 21st century. By 2100 a global temperature increase of 2.8°C (1.7 to 4.4°C) is likely.
- The **A1FI** is a higher emissions growth scenario ⤊ and assumes a continuation of strong economic growth based on continued dependence on fossil fuels. CO_2 concentrations more than triple, relative to pre-industrial levels, by 2100. A global temperature increase of 4.0°C (2.4 to 6.4°C) is likely. This scenario represents the highest level of late 21st century emissions that were thought to be plausible back in 2000. However, recent evidence indicates that CO_2 emissions have been growing at a more rapid rate than this scenario.

A fourth emissions scenario is shown in Figure 3: the **450** scenario assumes stabilisation of CO_2 concentrations at 450 ppm (approximately double pre-industrial levels) by 2100, requiring a reduction in global emissions of about 50% by 2050 and 70% by 2100.

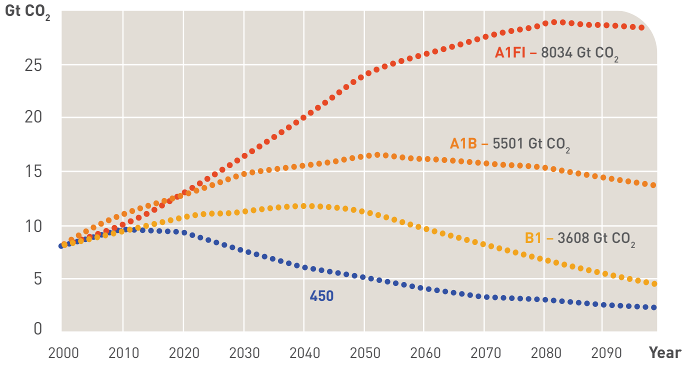


Figure 3
450, B1, A1B and A1FI scenarios showing annual CO_2 emissions out to 2100 in gigatonnes.

→ The projections in this document update those prepared in 2004 by CSIRO for the Victorian Government. While these projections are consistent with earlier work, the new projections indicate a narrower range of warming. This is largely due to improvements in modelling. For rainfall, there is a stronger trend towards precipitation decreases – particularly for annual average rainfall and autumn rainfall.

Projections for 2030 are based on the medium emissions scenario since it is similar to the other scenarios at this time. Beyond 2030, the emission scenarios diverge. Projections for 2070 are given for the lower and higher emissions scenarios. For each emissions scenario, ranges of uncertainty are given, reflecting different results from up to 23 climate models. All projections are relative to a 30-year period centred on 1990.

→ WHAT IS THE IPCC?

In 1988, the United Nations and the World Meteorological Organization set up the Intergovernmental Panel on Climate Change (IPCC), a body comprising governments and many of the world's experts on climate change. The IPCC was established to provide the decision-makers and others interested in climate change with an objective source of information about climate change. The IPCC does not conduct any research nor does it monitor climate related data or parameters.

Its role is to assess the latest scientific, technological and socio-economic peer-reviewed literature relating to the risk of climate change, its observed and potential impacts and options for adaptation and mitigation.

For more information, visit **www.ipcc.ch**

PROJECTIONS OF FUTURE CLIMATE CHANGE

→ SUMMARY

The future climate of the Mallee is expected to be hotter and drier than it is today.

By 2070, under a higher emissions growth scenario, both temperature and annual rainfall in Mildura would resemble those of present day Wilcannia in New South Wales.

By 2030, average annual temperatures will be around 0.9˚C warmer but the greatest increases are expected in summer (1˚C). The number of hot days (days over 30˚C) is also expected to increase. Reductions in the total average annual rainfall of around 4% are expected, with the greatest reductions occurring in spring (7%). Increases in potential evaporation and reductions in relative humidity are expected to contribute to drier conditions. At the same time, small increases (0.5%) in solar radiation are expected. There will be little change in average wind speeds, but any decreases are likely to occur in autumn. Projected changes are in comparison with 1990 figures.

By 2070, further increases in temperature are expected even under a lower emissions growth scenario (1.4˚C). Under a higher emissions growth scenario, these increases double (2.8˚C). At the same time, the number of hot days will continue to increase. Rainfall totals will continue to drop. With both lower and higher emissions growth, warming is likely to be greatest in the summer, while greatest reductions in rainfall are likely to occur in the spring. Conditions will become increasingly drier as potential evaporation continues to increase and relative humidity decreases. Changes in wind speed will continue to be negligible.

Further details of changes in future climate for the region are described in the tables and figures that follow. The projections comprise a central estimate (the median) and a range of uncertainty (10th and 90th percentiles) derived from the various global climate models.

+0.7˚C

Observed increase in average global temperature over the last century

+0.9˚C

Mid-range warming in the Mallee by 2030

Table 2

Summary of projected annual and seasonal climate changes for the Mallee relative to 1990 (80% confidence range)

		EMISSIONS GROWTH SCENARIOS		
		2030	**2070**	
		MEDIUM EMISSIONS	**LOWER EMISSIONS**	**HIGHER EMISSIONS**
ANNUAL	**Average temperature**	0.9°C (0.6 to 1.2°C)	1.4°C (1.0 to 2°C)	2.8°C (1.9 to 4°C)
	Average rainfall (%)	-4% (-10% to +2%)	-6% (-16% to +4%)	-11% (-28 to +7%)
	Potential evaporation (%)	2% (no change to +5%)	4% (1 to 8%)	7% (1 to 15%)
	Wind speed (%)	No change (-5 to +4%)	No change (-8 to +7%)	No change (-15 to +13%)
	Relative humidity (%)	-0.7% (-1.5% to no change)	-1.1% (-2.5 to -0.1%)	-2.2% (-4.8 to -0.1%)
	Solar radiation (%)	0.5% (-0.1 to +1.3%)	0.8% (-0.2 to +2.2%)	1.6% (-0.4 to +4.3%)
SPRING	**Average temperature**	0.9°C (0.6 to 1.3°C)	1.5°C (1.0 to 2.2°C)	2.9°C (1.9 to 4.2°C)
	Average rainfall (%)	-7% (-18% to +2%)	-11% (-27% to +3%)	-20% (-46 to +5%)
	Potential evaporation (%)	1% (-1 to +4%)	2% (-2 to +7%)	4% (-4 to +13%)
	Wind speed (%)	No change (-7 to +6%)	No change (-11 to +10%)	No change (-22 to +20%)
	Relative humidity (%)	-1% (-2 to -0.2%)	-1.7% (-3.4 to -0.4%)	-3.4% (-6.5 to -0.8%)
	Solar radiation (%)	0.7% (-0.1 to +1.7%)	1.2% (-0.1 to +2.9%)	2.3% (-0.2 to +5.6%)
SUMMER	**Average temperature**	1.0°C (0.6 to 1.4°C)	1.6°C (1.0 to 2.3°C)	3.1°C (2.0 to 4.5°C)
	Average rainfall (%)	-1% (-12 to +12%)	-2% (-20 to +19%)	-3% (-35 to +38%)
	Potential evaporation (%)	2% (no change to +5%)	3% (no change to +8%)	7% (no change to +15%)
	Wind speed (%)	2% (-3 to +6%)	3% (-4 to +11%)	6% (-8 to +20%)
	Relative humidity (%)	-0.5% (-1.8 to +0.3%)	-0.9% (-2.3 to +0.5%)	-1.7% (-4.5 to +1%)
	Solar radiation (%)	0.2% (-0.5 to +0.9%)	0.3% (-0.8 to +1.6%)	0.6% (-1.6 to +3%)
AUTUMN	**Average temperature**	0.9°C (0.6 to 1.3°C)	1.4°C (0.9 to 2.1°C)	2.8°C (1.8 to 4.1°C)
	Average rainfall (%)	-1% (-10 to +8%)	-2% (-16 to +13%)	-3% (-28 to +25%)
	Potential evaporation (%)	3% (1 to 6%)	5% (2 to 9%)	10% (4 to 18%)
	Wind speed (%)	-1% (-8 to +5%)	-2% (-13 to +8%)	-4% (-25 to +15%)
	Relative humidity (%)	-0.5% (-1.6 to +0.5%)	-0.8% (-2.7 to +0.9%)	-1.6% (-5.2 to +1.7%)
	Solar radiation (%)	0.1% (-0.8 to +1.2%)	0.2% (-1.3 to +2%)	0.5% (-2.5 to +3.9%)
WINTER	**Average temperature**	0.7°C (0.5 to 1.1°C)	1.2°C (0.8 to 1.8°C)	2.3°C (1.5 to 3.5°C)
	Average rainfall (%)	-5% (-16 to +2%)	-8% (-21 to +4%)	-16% (-36 to +7%)
	Potential evaporation (%)	6% (1 to 13%)	10% (1 to 22%)	19% (2 to 42%)
	Wind speed (%)	-1% (-7 to +5%)	-1% (-12 to +8%)	-2% (-22 to +16%)
	Relative humidity (%)	-0.7% (-2.7 to +0.5%)	-1.1% (-3.7 to +0.8%)	-2.2% (-7.1 to +1.5%)
	Solar radiation (%)	1.5% (-0.6 to +4.5%)	2.5% (-0.9 to +7.4%)	4.9% (-1.8 to +14.4%)

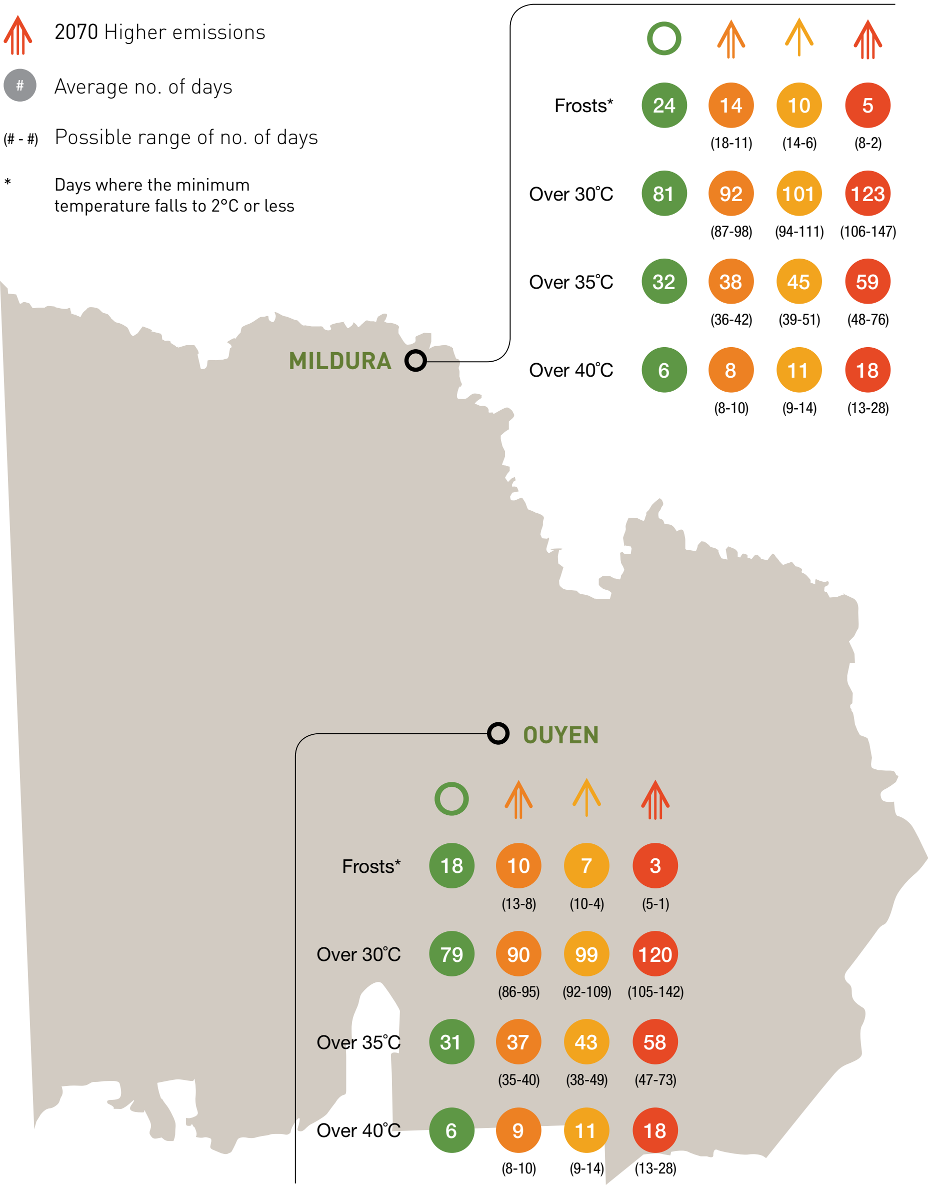
hot & cold

Although average changes in temperature, rainfall and evaporation will have long term consequences for the region, the impacts of climate change are more likely to be felt through extreme events such as the number of hot days, reductions in the number of frosts (**Figure** 4) and changes in daily rainfall patterns (**Table** 3).

Bushfire risk is also expected to increase. In Mildura, the number of 'extreme' fire danger days is expected to increase by between 10% and 38% by 2020, and by between 18% and 119% by 2050.

Figure 4
Current and projected average number of hot days and frost days in Mildura and Ouyen per year

○ Current
↑ 2030 Medium emissions
↑ 2070 Lower emissions
↑ 2070 Higher emissions
\# Average no. of days
(# - #) Possible range of no. of days
* Days where the minimum temperature falls to 2°C or less



	○	↑	↑	↑
Frosts*	24	14 (18-11)	10 (14-6)	5 (8-2)
Over 30˚C	81	92 (87-98)	101 (94-111)	123 (106-147)
Over 35˚C	32	38 (36-42)	45 (39-51)	59 (48-76)
Over 40˚C	6	8 (8-10)	11 (9-14)	18 (13-28)

	○	↑	↑	↑
Frosts*	18	10 (13-8)	7 (10-4)	3 (5-1)
Over 30˚C	79	90 (86-95)	99 (92-109)	120 (105-142)
Over 35˚C	31	37 (35-40)	43 (38-49)	58 (47-73)
Over 40˚C	6	9 (8-10)	11 (9-14)	18 (13-28)

wet & dry

Average annual and seasonal total rainfall is expected to decline, but intensity of heavy daily rainfall is likely to rise in some seasons and decrease in others (Table 3).

Table 3
Projected percentage changes in heavy rainfall intensity (99th percentile) and number of rainy days (>1 mm) for Mildura and Ouyen per year relative to 1990 (80% confidence range).

			EMISSIONS GROWTH SCENARIOS		
			2030	**2070**	
			MEDIUM EMISSIONS	LOWER EMISSIONS	HIGHER EMISSIONS
RAINFALL INTENSITY	Mildura	ANNUAL	-0.3% (-11.1 to +16.1%)	-1.1% (-18.5 to +26.8%)	-2.0% (-35.7 to +51.8%)
		SPRING	-0.1% (-13.3 to +11.8%)	-0.2% (-22.1 to +19.7%)	-0.4% (-42.8 to +38.1%)
		SUMMER	1.8% (-20.9 to +27.6%)	6.0% (-34.9 to +46.1%)	11.5% (-67.5 to +89.1%)
		AUTUMN	0.8% (-9.1 to +25.5%)	2.6% (-15.1 to +42.4%)	4.9% (-29.2 to +82.0%)
		WINTER	-1.1% (-13.7 to +20.5%)	-3.5% (-22.8 to +34.1%)	-6.8% (-44.0 to +66.0%)
	Ouyen	ANNUAL	-0.3% (-9.6 to +15.6%)	-1.1% (-16.0 to +25.9%)	-2.1% (-31.0 to +50.2%)
		SPRING	0.2% (-16.5 to +16.3%)	0.6% (-27.6 to +27.2%)	1.2% (-53.3 to 52.6%)
		SUMMER	1.9% (-22.2 to +28.7%)	6.2% (-37.0 to +47.9%)	12.0% (-71.6 to +92.6%)
		AUTUMN	0.5% (-5.2 to +23.8%)	1.6% (-8.7 to +39.6%)	3.1% (-16.8 to +76.6%)
		WINTER	-0.7% (-13.4 to +22.4%)	-2.4% (-22.4 to +37.3%)	-4.6% (-43.3 to +72.0%)
NUMBER OF RAINY DAYS	Mildura	ANNUAL	-6% (-21% to no change)	-10% (-35 to +1%)	-19% (-68 to +2%)
		SPRING	-8% (-23 to +2%)	-14% (-39 to +3%)	-26% (-75 to +5%)
		SUMMER	-5% (-13% to no change)	-8% (-22 to +1%)	-16% (-43 to +1%)
		AUTUMN	-3% (-26 to +10%)	-5% (-43 to +16%)	-10% (-83 to +31%)
		WINTER	-9% (-30 to +4%)	-15% (-49 to +7%)	-30% (-95 to +14%)
	Ouyen	ANNUAL	-7% (-20 to -1%)	-11% (-33 to -1%)	-21% (-64 to -2%)
		SPRING	-9% (-24% to no change)	-14% (-41% to no change)	-28% (-78% to no change)
		SUMMER	-4% (-15 to -1%)	-7% (-25 to -1%)	-13% (-48 to -2%)
		AUTUMN	-3% (-22 to +4%)	-5% (-37 to +7%)	-10% (-72 to +13%)
		WINTER	-10% (-25 to +1%)	-17% (-41 to +2%)	-32% (-80 to +3%)

THE IMPACTS OF CLIMATE CHANGE

Changes in climate will have a range of impacts – for example on water resources, bushfire frequency and intensity, primary production and infrastructure. It will also affect the richness of our biodiversity and the health of our landscapes. As well as the direct environmental impacts of climate change it will interact with other drivers of change such as population growth and advancements in technology.

While Victoria already experiences a variable climate, climate change is expected to interact with and enhance this variability. Climate change is likely to have the following impacts on the Mallee.

water

Decreases in rainfall and higher evaporation rates will mean less soil moisture and less water for rivers. Our demand for water may also increase as a result of warmer temperatures and as our population grows. Therefore, our need to use water more efficiently will be even greater. Based on calculations for elsewhere in the Murray-Darling Basin, decreases in the amount of water available for irrigation from the lower Murray may decrease by up to 20% by 2030. By 2070, these decreases may be as much as 45%.

Lower flows and higher temperatures may also reduce water quality within the catchment and create a more favourable environment for potentially harmful algal blooms. Greater bushfire activity could temporarily contaminate water catchments with sediments and ash.

farms and primary production

Climate change will have both positive and negative impacts on the types of crops we grow and the productivity of our primary production systems. Higher levels of atmospheric carbon dioxide tend to enhance plant growth and water-use efficiency. However, changes in temperature and rainfall are likely to offset these benefits. Any reduction in rainfall will place most farms under stress, particularly when linked to higher temperatures. For dryland cropping, reductions in rainfall and increases in evaporation directly contribute to reductions in soil moisture. Meanwhile, irrigated agriculture is likely to be affected by tighter constraints on water allocations, possibly resulting in a more developed and competitive water market. In this sense, the unusually hot droughts of recent years may be a sign of things to come.

Some impact studies have already been carried out, and have identified:

- increased heat stress on dairy cattle, reducing milk production unless management measures such as shade sheds and sprinklers are adopted;
- inadequate winter chilling for some fruit trees, which may reduce fruit yield and quality, however, higher temperatures are likely to reduce the risk of damaging winter frosts for other crops;
- in viticulture, higher temperatures are likely to reduce grape quality, but there may be opportunities to shift production to varieties better adapted to warmer conditions.

Other climate change impacts such as heavy rains and winds from storm events will also contribute to crop damage and soil erosion. Indirect impacts due to changes in weeds, pests and international markets may also place farms under stress.

Victorian farmers have developed many useful adaptation skills from managing current climate variability, but they will need to plan for new challenges and opportunities associated with climate change.

biodiversity

The effects of climate change on biodiversity will occur at many different levels – from individuals to ecosystems. Species may alter distribution, abundance, behaviour and the timing of events such as migration or breeding. The most susceptible species will be those with restricted or specialised habitat requirements, poor dispersal abilities or small populations.

Climate change will also have indirect impacts on biodiversity. There may be increased pressure from competitors, predators, parasites, diseases and disturbances (such as bushfire or drought).

It will also influence the composition of ecosystems and their distribution by altering water flows in rivers and wetlands and the occurrence of bushfires, snow and floods. Climate change is likely to amplify existing threats such as habitat loss and invasive species, making their impacts considerably worse.

communities

Climate change has the potential to influence human health from direct effects such as heatwaves, or indirectly – such as bushfires leading to poor air quality and increased respiratory problems. Warmer winters are likely to reduce some cold-related illnesses, but warmer summers are likely to increase the risk of heat-related health problems. The increased frequency and intensity of heatwaves may cause deaths through heart attack, stroke and heat exhaustion. The most vulnerable are the elderly, people under intense physical stress and those with cardiovascular disease.

High temperatures are also linked to:

- increased hospital admissions and deaths (particularly among the elderly) relating to heat stress, sunburn and dehydration;
- more outdoor work-related accidents and reduced productivity;
- buckling of railway lines;
- greater peak electricity demand for air conditioners;
- reduced energy demand for heating in winter.

Changes in the average climate will affect the design and performance of our buildings and infrastructure – including shifting energy use from winter heating to summer cooling. More extreme events such as flash flooding and bushfires will also impact on the built environment and will need to be considered to minimise risk to property. The availability and cost of insurance may also change as a result of extreme events.

Essential infrastructure such as water, power, transport and telecommunications have also been identified as being at high risk at higher levels of projected warming by 2030 without action being taken to prepare for these changes.

PREPARING FOR CLIMATE CHANGE

The uncertainty over the precise scale and timing of climate change impacts should not be an excuse for postponing action. A precautionary approach is needed. Many of the decisions we make today will affect our vulnerability to climate change. We must start preparing for and adapting to these changes now.

In the context of climate change, adaptation refers to any action, either intentional or otherwise, taken to minimise the adverse effects of climate change or to take advantage of any beneficial effects. Adaptation is the primary means of dealing with the unavoidable impacts of climate change. It is a mechanism used to manage risks, adjust economic activity to reduce vulnerability and to improve business certainty. The Victorian Government is driving adaptation planning that recognises Victoria's specific regional vulnerabilities to climate change, and focuses on early planning to manage risks, avoid future costs and maximise potential benefits. The uncertainty about the nature and magnitude of climate change impacts means that ongoing investment in research will be critical in guiding appropriate and efficient responses. Also, applying policies and principles that help society to become more resilient to the range of future conditions will be increasingly important.

Some examples of current adaptation actions in Victoria include:

- supporting a program of research to better understand impacts of climate change, particularly for agriculture and biodiversity;
- incorporating climate change projections into sustainable water planning;
- improving water use efficiency;
- developing a heat wave response plan for Victoria;
- detailed mapping and assessment of potential climate change vulnerabilities along the coast, including the impacts of sea level rise, storm surge, erosion and flooding; and
- reviewing flood and bushfire management plans.

Adapting to climate change will never be a sufficient response on its own. At higher concentrations of greenhouse gases, adaptation becomes more difficult and more expensive. Therefore we will need to continue efforts to achieve deep cuts in greenhouse gas emissions.

The Victorian Government is committed to the challenge of climate change and its responsibility to lead Victorian efforts to reduce our greenhouse emissions by 60% by 2050 compared to 2000 levels.

→ INFO

Want to know more about climate change?

Contact the Department of Sustainability and Environment Customer Service Centre on 136 186 or visit our website at www.climatechange.vic.gov.au

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