2 Climate and Natural Environment

Overview

This chapter contains information about Victoria's natural environment and climate.

Physical features

Although Victoria is the second most populous State or Territory in the country, it is ranked sixth in terms of geographic size, and accounts for just 3% of Australia's total area (table 2.1).

2.1 AREA OF STATES AND TERRITORIES

State or Territory	Area km²	Length of coastline km	Percentage of total area	Percentage of total population (as at 30 June 1999)(a)
Western Australia	2 529 880	20 780	32.89	9.8
Queensland	1 730 650	13 350	22.50	18.5
Northern Territory	1 349 130	10 950	17.54	1.0
South Australia	983 480	5 070	12.79	7.9
New South Wales	800 640	2 140	10.41	33.8
Victoria	**227 420**	**2 510**	**2.96**	**24.8**
Tasmania	68 400	4 880	0.89	2.5
Australian Capital Territory	2 360	. .	0.03	1.6
Australia(b)	7 692 030	59 740	100.00	100.00

(a) Total includes estimates for Jervis Bay, Christmas Island and Cocos (Keeling) Island Territories. (b) Total includes Jervis Bay.

Source: AUSLIG, 100K Coastline database, 1993; Australian Demographic Statistics (Cat. no. 3101.0).

Location

Wilson's Promontory, latitude 39°08'S, longitude 146°22'30"E, is the southernmost point of mainland Victoria and similarly of mainland Australia; the northernmost point is where the western boundary of the State meets the Murray River, latitude 33°59'S, longitude 140°58'E; the point furthest east is Cape Howe, situated in latitude 37°31'S, longitude 149°58'E. The western boundary lies at longitude 140°58'E and extends from latitude 33°59'S to latitude 38°04'S, a distance of 451 kilometres.

Victoria's longest river is the Goulburn, which runs from Lake Eildon to the Murray River east of Echuca (table 2.2). The Goulburn is also the river with the greatest annual flow of water. (The Murray River flows in New South Wales, as the State boundary is the south bank of the river.)

2.2 SELECTED PHYSICAL FEATURES

Mountain	Height metres	River	Length km
Bogong	1 986	Goulburn	566
Feathertop	1 922	Glenelg	457
Nelse North	1 883	Loddon	381
Fainter South	1 877	Mitta Mitta	286
Loch	1 874	Hopkins	281

Source: E.S. Hills, The Physiography of Victoria, 4th edit.

Climate

The major topographical determinant of Victoria's climate is the Great Dividing Range, running east-west across the State, and rising to approximately 2,000 metres in the eastern half. This acts as a barrier to moist south-east and south-west winds, and together with its proximity to the coast, causes the south of the State to receive more rain than the north.

To the south of Victoria, except for Tasmania and its islands, there is no land for 3,000 kilometres. This vast area of ocean has a moderating influence on Victoria's climate in winter. Snow, which is a common winter occurrence at similar latitudes on the eastern seaboard of the great land masses of the northern hemisphere, is rare in Victoria below elevations of 600 metres. To the north of Victoria, the land mass of Australia becomes very hot in summer, and on several days at this time of year the temperature over the State may rise to between 35°C and 40°C, often with a strong northerly wind.

Across Victoria, the average number of days of rain in a year varies considerably. In the Otway Ranges there are over 200 days of rain, compared with an average 100 wet days a year experienced in regions approximately 160 kilometres inland from the coast. Average rainfall ranges from 250 millimetres for the driest parts of the Mallee to 2,600 millimetres at Falls Creek in the Alps. District rainfall in Victoria is shown in table 2.3.

2.3 RAINFALL IN DISTRICTS

	Year						
	1993	1994	1995	1996	1997	1998	
District	mm	mm	mm	mm	mm	mm	Average(a)
North Mallee	374	177	355	308	241	263	316
South Mallee	411	175	333	376	243	317	373
North Wimmera	448	221	432	431	292	358	424
South Wimmera	604	336	488	580	390	481	514
Lower North	541	268	462	425	284	388	443
Upper North	645	288	572	556	376	446	533
Lower Northeast	1 083	574	986	1 014	547	803	795
Upper Northeast	1 526	754	1 225	1 384	799	1 251	1 119
East Gippsland	771	698	862	747	551	856	764
West Gippsland	931	785	959	904	592	865	923
East Central	1 041	593	1 028	997	534	778	890
West Central	794	429	711	643	419	536	631
North Central	922	458	780	850	514	648	754
Western Plains	699	454	636	626	441	557	633
West Coast	794	687	762	838	633	650	783

(a) Average for 85 years 1913 to 1998.

Source: Bureau of Meteorology.

Melbourne's weather

Melbourne's climate is temperate and variable, and moderate rainfall is received in most months. In summer, daytime temperatures average from 24°C to 26°C. In autumn and spring, they average near 20°C; while in winter, they average from 13°C to 15°C (table 2.4).

Situated about 60 kilometres from open ocean, the city has a climate midway between maritime and continental, although the extensive landlocked Port Phillip Bay has a moderating effect on temperatures in bayside areas. To illustrate, the bayside suburb of Black Rock has an average summer maximum temperature of 24.3°C. By contrast, the outer north eastern suburb of Watsonia has an average summer maximum of 26.1°C.

2.4 AVERAGE MONTHLY TEMPERATURE, Melbourne

	Maximum	Minimum
	°C	°C
January	25.9	15.1
February	26.0	15.5
March	24.1	14.1
April	20.6	11.8
May	17.1	9.5
June	14.3	7.2
July	13.7	6.5
August	15.1	7.4
September	17.2	8.7
October	19.7	10.3
November	21.8	12.0
December	24.1	11.0

Source: Bureau of Meteorology.

The hottest months in Melbourne are normally January and February, when the average maximum temperature is 26ºC (table 2.5). The hottest day on record in Melbourne was 13 January 1939, when the temperature reached 45.6ºC.

Nights are coldest at places a considerable distance from the sea, and away from the city where heat retention by buildings, roads, and pavements may maintain the air at a slightly higher temperature. This 'heat island' effect, which is a consequence of asphalt and concrete absorbing daytime warmth and radiating it back into the environment during night, is largely confined to the Central Business District (CBD). In the CBD, minimum temperatures are now mostly between 1ºC and 2ºC above those of most metropolitan locations.

The frequency of very low air temperatures varies widely across the Melbourne metropolitan area. For example, there are approximately 10 annual occurrences of 2ºC or less around the Bay, but the frequency increases to over 20 in outer suburbs and to more than 30 a year in the more frost susceptible areas.

2.5 TEMPERATURE, Melbourne

	Air temperature daily readings (ºC)			Extreme air temperature			
				Highest max.		Lowest min.	
	Mean max.	Mean min.	Mean	ºC	Date of occurrence	ºC	Date of occurence
January	25.9	15.1	20.5	45.6	13/1/1939	5.6	28/1/1895
February	26.0	15.5	20.7	43.2	8/2/1983	4.6	24/2/1924
March	24.1	14.1	19.1	41.7	11/2/1940	2.8	17/3/1884
April	20.6	11.8	16.2	34.9	5/4/1938	1.6	24/4/1888
May	17.1	9.5	13.3	28.7	7/5/1905	–1.2	29/5/1916
June	14.3	7.2	10.7	22.4	2/6/1957	–2.2	11/6/1866
July	13.7	6.5	10.1	23.1	30/7/1975	–2.8	21/7/1869
August	15.1	7.4	11.3	26.5	29/8/1982	–2.1	11/8/1863
September	17.2	8.7	12.9	31.4	28/9/1928	–0.6	3/9/1940
October	19.7	10.3	15.0	36.9	24/10/1914	0.1	3/10/1871
November	21.8	12.0	16.9	40.9	27/11/1894	2.4	2/11/1896
December	24.1	13.7	18.9	43.7	15/12/1976	4.4	4/12/1870
Averages	20.0	11.0	15.5	. .	. .	. .	. .
Extremes	. .	. .	. .	45.6	13/1/1939	–6.7	30/6/1829
	no.	no.	no.	no.		no.	
Years of record	30	30	30	144		144	

Source: Bureau of Meteorology.

In Melbourne, rainfall is fairly evenly distributed throughout the year, averaging about 55 millimetres per month with an annual average rainfall of 639 millimetres, falling over 143 days (table 2.6). Spring is slightly wetter than other seasons. Although the total amount of rain received is about the same for winter and summer, it falls on twice as many days in winter than it does in summer.

2.6 RAINFALL AND FOG, Melbourne

	Rainfall (mm)								
			Greatest monthly		Least monthly		Greatest in one day		Fog
Month	Mean monthly	Mean days no.	Amount	Year of occurrence	Amount	Year of occurrence	Amount	Date of occurrence	Mean days no.
January	47.1	7.9	176	1963	—	1932	108	29/1/1963	0.0
February	45.8	6.8	238	1972	—	1965	87	26/2/1946	0.3
March	43.5	9.4	191	1911	4	1934	90	5/3/1919	0.4
April	52.7	10.7	195	1960	—	1923	80	23/4/1960	1.1
May	67.8	14.5	142	1942	4	1934	51	15/5/1974	1.7
June	42.5	13.2	117	1991	8	1858	44	22/6/1904	2.3
July	48.8	14.8	178	1891	9	1979	74	12/7/1891	2.2
August	57.4	15.9	111	1939	12	1903	54	17/8/1881	1.2
September	53.0	14.0	201	1916	13	1907	59	23/9/1916	0.8
October	65.2	13.9	193	1869	7	1914	61	21/10/1953	0.5
November	56.9	11.8	206	1954	6	1895	73	21/11/1954	0.9
December	58.1	10.4	197	1993	2	1972	100	4/12/1954	0.2
Totals	638.8	143.3	. .	. .	. .	. .	. .	. .	11.1
Extremes	. .	. .	967	1916	332	1967	108	29/1/1963	. .
	no.	no.	no.		no.		no.		no.
Years of record	30	30	144	. .	144	. .	144	. .	30

Source: Bureau of Meteorology.

The eastern suburbs are significantly wetter than the western suburbs. For example, Scoresby has an average annual rainfall of 901 millimetres, in contrast to Laverton's 569 millimetres. The relatively low rainfall to the west of the city is due to a combination of 'rain shadow' effects of the Otway Ranges and ranges in the Ballarat region. The relatively high rainfall to the east of the city is due to moisture in the predominant westerly wind stream condensing, as the stream approaches the foothills of the Dandenong Ranges.

Thunderstorms are more frequent during late spring and summer, when there is adequate surface heating to provide energy for convection, than at other times of the year. In February 1972, 78 millimetres fell in one hour during a thunderstorm. Hail is observed more often during winter and spring.

The wind varies from day to night, and from season to season. Wind speed is usually lowest during the night and early hours of the morning prior to sunrise. It increases during the day as heating of the earth's surface induces turbulence in the wind stream. Examples of daily variation are the sea breeze, which brings relief on many hot days; and the valley or katabatic breeze, which brings cold air from inland Victoria down valleys during the night and early morning towards Melbourne. These breezes are responsible for winds being more often from the north during winter, particularly during the morning; and from the south during summer, particularly during the afternoon. There is a marked tendency for the strongest winds to occur during late winter and early spring months. Dust storms and tornados are rare. However, on 8 February 1983, a dust storm reduced visibility in the city to 100 metres.

Environment

This section has been provided by the EPA.

Recognition is increasing of the interdependency between people and environment. The health of the environment not only affects the quality of life experienced by people; it also determines the availability of the basic resources: air, water and land, which are essential for life.

In 1998, an Australian Bureau of Statistics survey collected information about people's views on environmental problems and protection. In Victoria, 71% of people expressed concern about environmental problems, the same proportion as when the survey was previously conducted in 1996. Air pollution remains the environmental problem of greatest concern (32%), followed by destruction of trees/ecosystems (23%), freshwater pollution (21%) and ocean/sea pollution (21%).

Air

The EPA began monitoring air quality in Victoria in the early 1970s. Pollutants monitored include ozone, sulphur dioxide, nitrogen dioxide and fine particles, with more than 2 million measurements being made in 1998. For ozone (a major contributor to smog in summer) and particles (a major contributor to smog in autumn and winter) 99.97% and 99.84% of the analyses complied with the criteria set down in the State environment protection policy. For the remaining indicators, no measurements exceeding the criteria were recorded.

Melbourne's air quality rates well against international standards for cities of similar size. Motor vehicle emissions are a major contributor to smog, although fuel reduction burning and solid fuel combustion are also significant contributors to particle pollution during the cooler months.

Water

From the upper reaches of catchments to the open coast, quality water is essential to human health and the maintenance of natural ecosystems. Urban, industrial and agricultural activities in our catchments can have a direct impact on the water quality of streams, rivers and coastal waters. The EPA, in conjunction with other State agencies, monitors the quality of water both in freshwater and marine environments throughout Victoria. A range of parameters are routinely measured to assess the key threats to water quality: excessive nutrients, sediments, toxicants and microbiological indicators. This data is benchmarked against attainment criteria set out in the State Environment Protection Policy (Waters of Victoria) and its schedules.

Overall, the attainment for most of these indicators in 1998 was similar to those for 1997. In freshwater environments, urban waterways such as the lower reaches of the Yarra and Maribyrnong Rivers, Kororoit Creek and the Dandenong Creek system continued to show the lowest levels of attainment. Nitrogen and phosphorus concentrations reached attainment levels at many sites. Increasing salinity continued to be a significant issue in many rivers and streams throughout Victoria. Heavy metal concentrations were generally low except at localised hotspots in urban waterways. Despite a wetter year in 1998 sediment levels were below attainment criteria.

Marine water quality in Port Phillip Bay, Western Port and Gippsland Lakes was generally good. The long-term improvement in nutrient concentrations and water concentrations has been maintained throughout 1998. In Port Phillip Bay attainment for heavy metal concentrations rated only as medium due to persistent high concentrations of arsenic, that is most probably of natural origin. The suitability of waters at beaches around Port Phillip Bay was overall very good, with only a few short-term excessive measurements following significant rainfall.

Land

Land is a vital element of the environment. It provides the base for food production, homes, industrial and commercial developments, and a range of other social and recreational activities. Land-use practices are important in maintaining and improving the quality of the environment whilst also meeting the economic and social needs of the community.

As a consequence of changing land use, an increasing number of contaminated sites are being identified and remediated. Much or this has resulted from the redevelopment of inner urban industrial areas for residential use. Sites that are found to threaten the health of people using them, or which have off-site impacts, are monitored by the EPA. The Priority Sites Register lists sites that may be subject to clean-up under Environment Protection Authority direction. At July 1999, there were 12 such sites registered in Victoria.

The EPA also administers a system for independent audit of contaminated sites. Suitably qualified and experienced professionals are appointed as Environmental Auditors (Contaminated Land) under Section 57 of the *Environmental Protection Act 1970* ('the Act'). These auditors conduct independent reviews of the environmental quality of sites in accordance with Section 57AA of the Act. At the completion of a statutory audit, an auditor may issue either a Certificate of Environmental Audit, or a Statement of Environmental Audit. These documents contain advice relating to the suitability of land for its current and intended future use. Copies of these documents are retained by the EPA and are also provided to the relevant planning authority for use in planning amendments and related approvals. Table 2.7 provides data relating to the number of Certificates and Statements of Environmental Audits issued since the commencement of the environmental audit system in 1990.

2.7 SECTION 57AA ENVIRONMENT AUDITS (CONTAMINATED LAND)

	1994	1995	1996	1997	1998
	no.	no.	no.	no.	no.
Certificates issued	53	47	44	60	52
Statements issued	30	53	47	81	81
Total audits finalised	83	100	91	141	133

Source: Environment Protection Authority.

Deforestation and agricultural practices can have a significant impact on the environment, contributing to soil salinity, erosion and to turbidity, through siltation, in our waterways. The Department of Natural Resources and Environment are implementing education and revegetation programs, along with changes to agricultural practices to redress these problems.

Waste management

Governments in Australia are committed to reducing waste through avoidance, reuse and recycling. Local government is responsible for provision of domestic waste management services such as garbage collection, and also provides local recycling programs. The Environment Protection Authority is working with local councils and other bodies to promote waste reduction, and in conjunction with EcoRecycle Victoria to improve the efficiency of kerbside recycling collections.

Improvements are also being made to the planning and management of landfill sites in Victoria through rationalisation of waste management across the State. As from May 1997, all municipalities are members of regional waste management groups responsible for regional waste planning and coordination. Table 2.8 shows the total waste to landfill in Victoria.

2.8 TOTAL WASTE TO LANDFILL

	'000 tonnes
1992–93	3 558
1993–94	3 620
1994–95	3 589
1995–96	3 508
1996–97	3 504
1997–98(a)	5 532

(a) The 1997–98 figure is for all of Victoria, whereas the previous years figures are for the Melbourne metropolitan area and major provincial centres.

Source: Environment Protection Authority.

In Victoria a strong emphasis is placed on avoiding the generation of and promoting the recycling of wastes. Programs sponsored by the EPA, EcoRecycle Victoria, Business Victoria and Energy Efficiency Victoria are aimed at demonstrating the environmental and economic benefits of waste avoidance and recycling to industry. The average household garbage put out over the last five years has varied, from a low of 11kg in 1994, to 13.9kg in 1998 (table 2.9). In contrast, the average household recycling put out has shown a steady increase, from 2.2kg in 1993 and 1994, to 4.6kg in 1998.

2.9 HOUSEHOLD WASTE(a)

	Average household garbage put out	Average household recycling put out
	kg.	kg.
1993	12.4	2.2
1994	11.0	2.2
1995	12.8	3.3
1996	12.4	4.0
1997	11.9	4.3
1998	13.9	4.6

(a) Data are for average put out per presentation. Data is calculated per presentation, as garbage collection methods vary across municipalities, making weekly, fortnightly calculations of put out difficult.

Source: Beverage Industry Environment Council.

To bolster the recycling of post consumer packaging waste, Victoria led the development of the National Packaging Covenant and supporting the National Environment Protection Measure for used packaging, both of which were signed off by government and the packaging industry in 1999.

References

ABS sources

Australian Demographic Statistics (Cat. no. 3101.0)

Environmental Issues: People's Views and Practices (Cat. no. 4602.0)

Non-ABS sources

AUSLIG, *100K Coastline Database*, 1993

Beverage Industry Environment Council.

Bureau of Meteorology.

Environment Protection Authority.

E.S. Hills, *The Physiography of Victoria*, 4th edition.