

# Victoria: An Environmental Overview



The health of the environment in which we live, and will pass on to our children, is of major concern to members of the Victorian community. In October 1990, the Australian Bureau of Statistics conducted a household survey in Victoria, which gathered information about the community's participation in energy conservation and its level of concern about environmental issues. Only 3 per cent of Victorian households said that they were not concerned about environmental problems. This chapter presents information, drawn from a wide range of sources, about those environmental issues that are of greatest concern to the Victorian community.

## WILDLIFE CONSERVATION

Victoria's natural environment has changed considerably since European settlement. In just 40 years, between 1866 and 1906, the percentage of Victorian land being used for agriculture increased from 12 per cent to 61 per cent, with major consequences for the State's native flora and fauna. More than two-thirds of Victoria's tree cover has disappeared since European settlement, and by 1989 only 6 per cent of privately owned land carried natural vegetation. Almost one-third of Victoria's native plants are either threatened with extinction (815 species) or have already been lost (36 species) from the State. Victoria's native animals have also been severely depleted: 26 vertebrate species have disappeared from the state entirely, and of those remaining, one in five is threatened with extinction. More than 80 per cent of freshwater fish originally found within Victoria are either threatened or extinct, while the corresponding proportion for mammals, and reptiles and amphibians, is approximately 40 per cent.

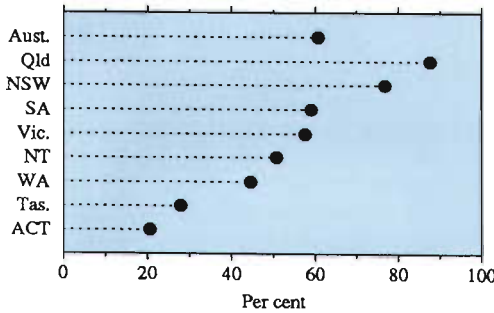
TABLE 1 NUMBER OF PLANTS AND ANIMALS EXTINCT OR THREATENED IN VICTORIA, 1991

Status in Victoria	Vertebrate animals (excluding marine fish)				Total	Vascular plants
	Mammals	Birds	Reptiles and amphibians	Fresh water fish		
Rare (a)	15	29	32	18	94	390
Vulnerable	2	18	11	6	37	315
Endangered	9	9	8	4	30	110
Total threatened	26	56	51	28	161	815
Extinct	20	2	2	2	26	36
Percentage of species in Victoria at settlement now threatened or extinct	41	12	37	88	25	39

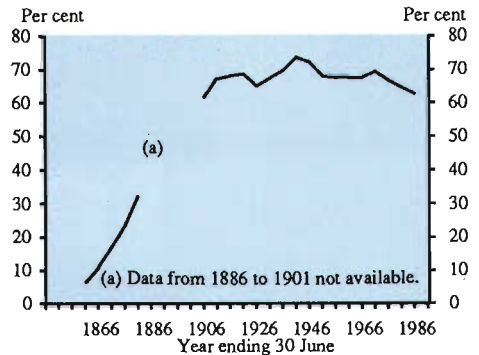
(a) Includes vertebrate taxa believed to be threatened but whose exact status is unknown.

Sources: List of threatened fauna in Victoria, Department of Conservation & Environment; *Rare or threatened plants in Victoria*, P.K.Gullan, D.C.Cheal, & N.G.Walsh, Department of Conservation & Environment, 1990; *Atlas of Victoria*, ed. J.S. Duncan, Victorian Government, 1982.

**PERCENTAGE OF LAND USED FOR AGRICULTURAL PURPOSES, AUSTRALIA, STATES AND TERRITORIES, MARCH 1989**



**PERCENTAGE OF LAND USED FOR AGRICULTURAL PURPOSES, VICTORIA, 1860-61 TO 1985-86**



**Loss of Species - Causes**

Although many different factors have led to the depletion of Victoria's native flora and fauna, habitat loss is probably the most significant. For example, Victoria's native grasslands and grassy woodlands, once widespread in western Victoria, were considered ideal for livestock by early settlers. Heavy grazing by stock (and European rabbits) led to a deterioration in both plant species and vegetation cover, followed by soil erosion and, ultimately, conversion to non-native pastures and crop land. Although it is difficult to document the extent of the loss, as "grasses" still cover the area, the impact on the State's fauna was immense. Of the 24 land animals that have become extinct within Victoria since European settlement, 22 originally made their home in the State's grasslands.

Habitat deterioration and loss is still occurring today, and the destruction of wetland habitats is currently of considerable concern. Apart from many of the State's wetlands being drained (for example, 60 per cent of fresh water marshes - see Table 3), rising salinity levels and pollution from agricultural runoff are major problems. Water storage dams have altered the flooding regime of many wetlands, particularly those along the Murray River, affecting both plant and animal species. In fact, of the 32 species of fresh-water fish currently living in Victorian waters, 28 are under threat of extinction. In an attempt to prevent further loss of wetland habitat, the Department of Conservation and Environment (DCE) has established a Wetlands Conservation Program, a function of which includes evaluating all wetlands within the State, raising community awareness, and educating and assisting private land owners.

The introduction into Victoria of non-Australian plants and animals has created another major threat to the State's wildlife. Currently, there are 980 species of non-native plant, 17 species of mammal, 14 birds, 11 fish and a wide range of non-native invertebrate animals naturalised within Victoria. These species not only compete with native wildlife, but can cause considerable damage to natural habitats (such as the erosion caused by rabbits) and severely deplete animal populations through predation.

**TABLE 2 NUMBER OF PLANTS THREATENED OR EXTINCT BY HABITAT TYPE, VICTORIA, 1987**

Status in Victoria	Mountain forests	Mallee	Shrubby open forests & heathland	Grasslands & grassy woodland	Sub-alpine bogs, herbfields & woodlands
Rare (incl. status uncertain)	4	13	49	5	39
Vulnerable	2	15	23	13	9
Endangered	-	11	6	20	3
<b>Total</b>	<b>6</b>	<b>39</b>	<b>78</b>	<b>38</b>	<b>51</b>
Extinct	-	3	6	1	2

Source: *Nature Conservation in Victoria*, Study Report, D. Frood & M. Calder, School of Botany, University of Melbourne, 1987

**TABLE 3 WETLAND TYPES: ESTIMATED AREA IN 1982, PERCENTAGE CHANGE IN AREA SINCE EUROPEAN SETTLEMENT, AND OWNERSHIP, VICTORIA**

<i>Wetlands in survey region</i>	<i>Fresh water meadow</i>	<i>Fresh water marsh</i>	<i>Permanent open fresh water</i>	<i>Semi permanent saline</i>	<i>Permanent saline</i>	<i>Sewerage or salt evapora. basin</i>	<i>Total wetland area</i>
East Gippsland (ha)	-	554	28	190	4,817	-	5,589
Percentage change	-	-	-	-	-	-	-
Gippsland lakes (ha)	320	14,960	16,920	14,770	24,750	320	72,040
Percentage change	45	-48	958	1	-	n.a.	3
South Gippsland (ha)	-	570	1,720	4,970	68,700	5	75,965
Percentage change	-	-99	n.a.	1	-	n.a.	-33
Far SW Victoria (ha)	5,584	14,846	9,064	385	871	9	30,759
Percentage change	-3	-73	390	20	-	n.a.	-52
Hopkins Basin (ha)	10,329	8,959	4,662	3,906	2,585	10	30,451
Percentage change	-46	-64	33	-11	6	n.a.	-44
Western Victoria (ha)	2,410	4,860	16,100	8,080	37,200	3,860	72,510
Percentage change	-22	-71	15	23	-17	n.a.	-15
Wimmera region (a) (ha)	14,985	32,731	38,333	6,181	5,348	17	97,595
Percentage change	16	-24	60	-1	-	n.a.	+6
Goulburn & Broken R. (a) (ha)	2,954	10,915	625	-	-	364	15,858
Percentage change	-55	-2	47	-	-	n.a.	-14
Victoria (b) (ha)	36,582	88,391	87,452	38,482	144,271	4,585	399,763
Percentage change	-33	-60	93	4	-5	n.a.	-22

**OWNERSHIP OF WETLANDS**

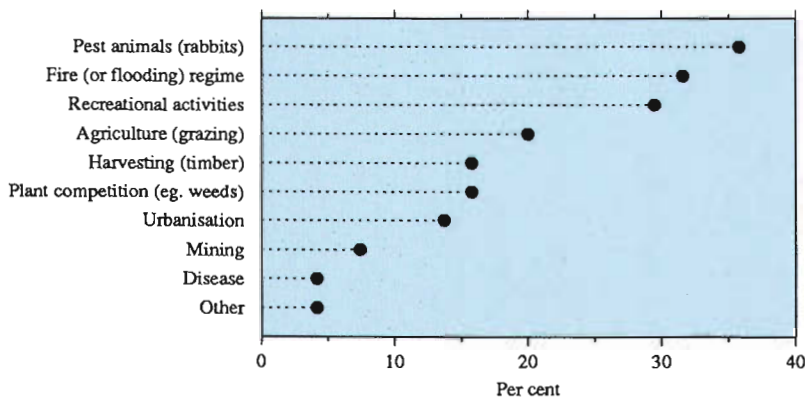
Number of wetlands in Victoria	1,141	1,576	682	380	92
	Per cent				
Privately owned	95	75	79	79	18
State owned	5	25	21	21	82
not reserved	4	19	19	16	52
reserved for conservation	1	6	2	5	30

(a) Data for region incomplete

(b) Victorian total based on regions surveyed only.

Source: Adapted from Victoria's Inland Waters, State of the Environment Report 1988, Office of the Commissioner for the Environment

**RARE AND THREATENED PLANTS WHOSE THREATS HAVE BEEN DOCUMENTED: PERCENTAGE THREATENED BY SELECTED FACTORS, (a) VICTORIA, 1991**



(a) A single plant species can be threatened by more than one factor.

Source: The Victorian Rare and Threatened Plant Database, Department of Conservation and Environment, Sept. 1991

**TABLE 4 NATURE CONSERVATION RESERVES: AREA AND PERCENTAGE OF TOTAL LAND AREA, BY STATE OR TERRITORY, 1988**

State or Territory	Total area (sq km)	Nature conservation reserve (sq km)	Percentage of State reserved			
			1968	1977	1984	1988
New South Wales	801,600	38,122	1.1	2.3	4.2	4.8
<b>Victoria</b>	<b>227,600</b>	<b>18,300</b>	<b>0.9</b>	<b>1.0</b>	<b>5.6</b>	<b>8.0</b>
Queensland	1,727,200	36,638	0.6	0.7	2.4	2.1
South Australia	984,000	111,172	1.2	3.2	4.6	11.3
Western Australia	2,525,500	152,522	0.5	1.5	5.6	6.0
Tasmania	67,900	9,670	4.2	9.9	13.9	14.3
Northern Territory	1,346,200	40,236	3.5	3.7	1.5	3.0
Australian Capital Territory	2,400	1,122	1.9	4.1	30.2	46.8
<b>Australia</b>	<b>7,682,400</b>	<b>407,809</b>	<b>1.2</b>	<b>2.1</b>	<b>3.9</b>	<b>5.3</b>

Source: *Nature Conservation Reserves in Australia*, Occasional papers: No. 10 J.L. Wilson (ed.), 1984 & No. 19 C.J. Mobbs (ed.), 1988, Australian National Parks and Wildlife Service

### Conservation Reserves

The amount of land dedicated to conservation reserves in Victoria has been increasing steadily in recent years: between 1981 and 1991 the area of Victoria's National and Other Parks increased more than three-fold (Table 5). In June 1991, almost 3 million hectares, or 12.4 per cent of Victoria, was reserved, and 85 per cent of this reserved land was designated National Park - the highest level of protection offered within the State. However, a study commissioned by the Victorian National Parks Association in 1987 found that a number of Victorian habitat types were not represented within the State's reserves. Those plant communities most urgently in need of protection included lowland grasslands and grassy woodlands, mallee communities, and the plant communities of wetlands, lower altitude snowplains and montane bogs and plateaus.

Due to the complexity of natural ecosystems, simply designating an area a National Park does not guarantee the preservation of its wildlife. Isolated patches of native vegetation, which is often all that remains of a particular habitat type, are subject to many problems. Because the movement of wildlife into and out of the park is curtailed, the genetic diversity of the species contained within the reserve becomes reduced, and if localised extinctions take place due to bushfire or disease, recolonization from surviving populations cannot occur. Small isolated patches of natural vegetation are also prone to invasion by weeds and introduced animals and support fewer species than areas of equivalent size within continuous habitat.

**TABLE 5 NUMBER AND AREA OF NATIONAL AND OTHER PARKS IN VICTORIA, 1981 TO 1991**

Year ended	National Parks		Other parks(a)		Other reserves	Total
	No.	'000 ha	No.	'000 ha	'000 ha	'000 ha
30 June						
1981	28	497.8	27	294.5	1.1	793.4
1982	30	685.8	27	298.1	1.2	985.1
1983	30	685.8	27	298.1	1.6	985.5
1984	31	853.4	27	298.6	0.9	1,153.0
1985	31	853.5	27	298.6	2.5	1,154.5
1986	30	960.3	35	325.3	50.8	1,336.5
1987	30	975.4	37	331.8	50.7	1,357.9
1988	30	1,073.6	47	459.7	50.9	1,584.1
1989	33	1,240.1	45	443.9	51.2	1,735.2
1990	31	1,526.2	46	432.2	51.3	2,009.6
1991	32	2,390.7	45	380.4	51.4	2,822.5

(a) Includes Wilderness Parks, State Parks and other Schedule 3 parks.

Source: Annual Reports on the National Parks Act, Department of Conservation and Environment.



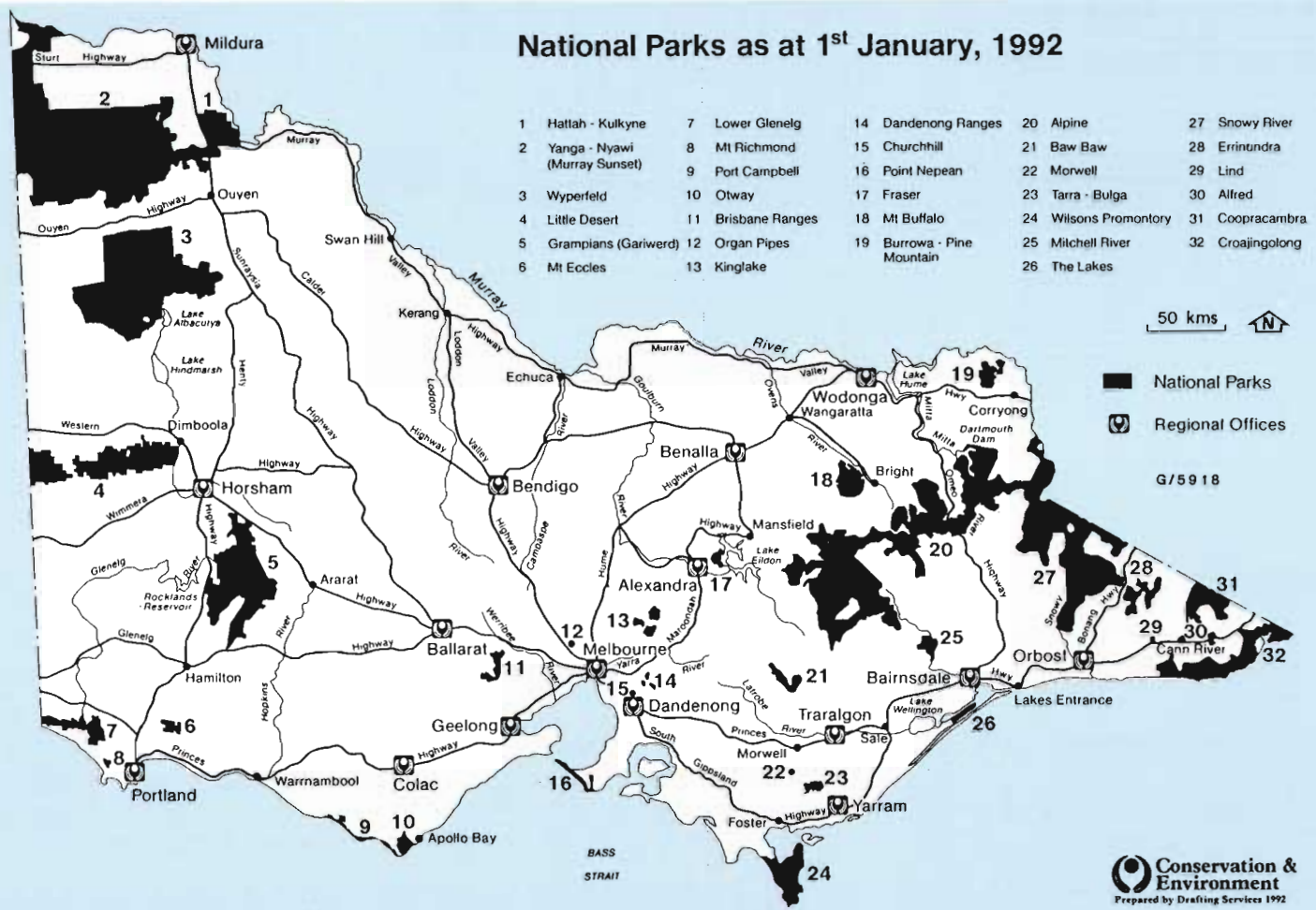
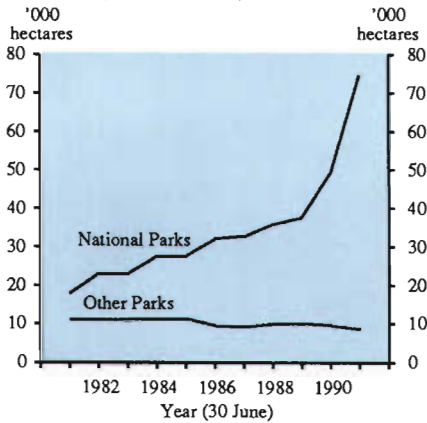


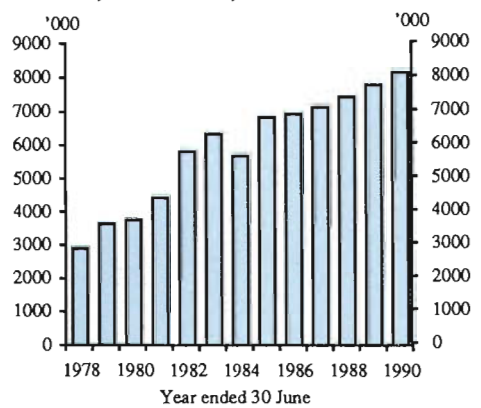
Figure 1. National Parks as at 1st January, 1992

**AVERAGE SIZE OF NATIONAL AND OTHER PARKS, VICTORIA, 1981 TO 1991**



Source: Annual Reports on the National Parks Act, Department of Conservation and Environment

**DAY VISITORS TO NATIONAL AND OTHER PARKS, VICTORIA, 1977-78 TO 1989-90**



Source: Annual Reports on the National Parks Act, Department of Conservation and Environment

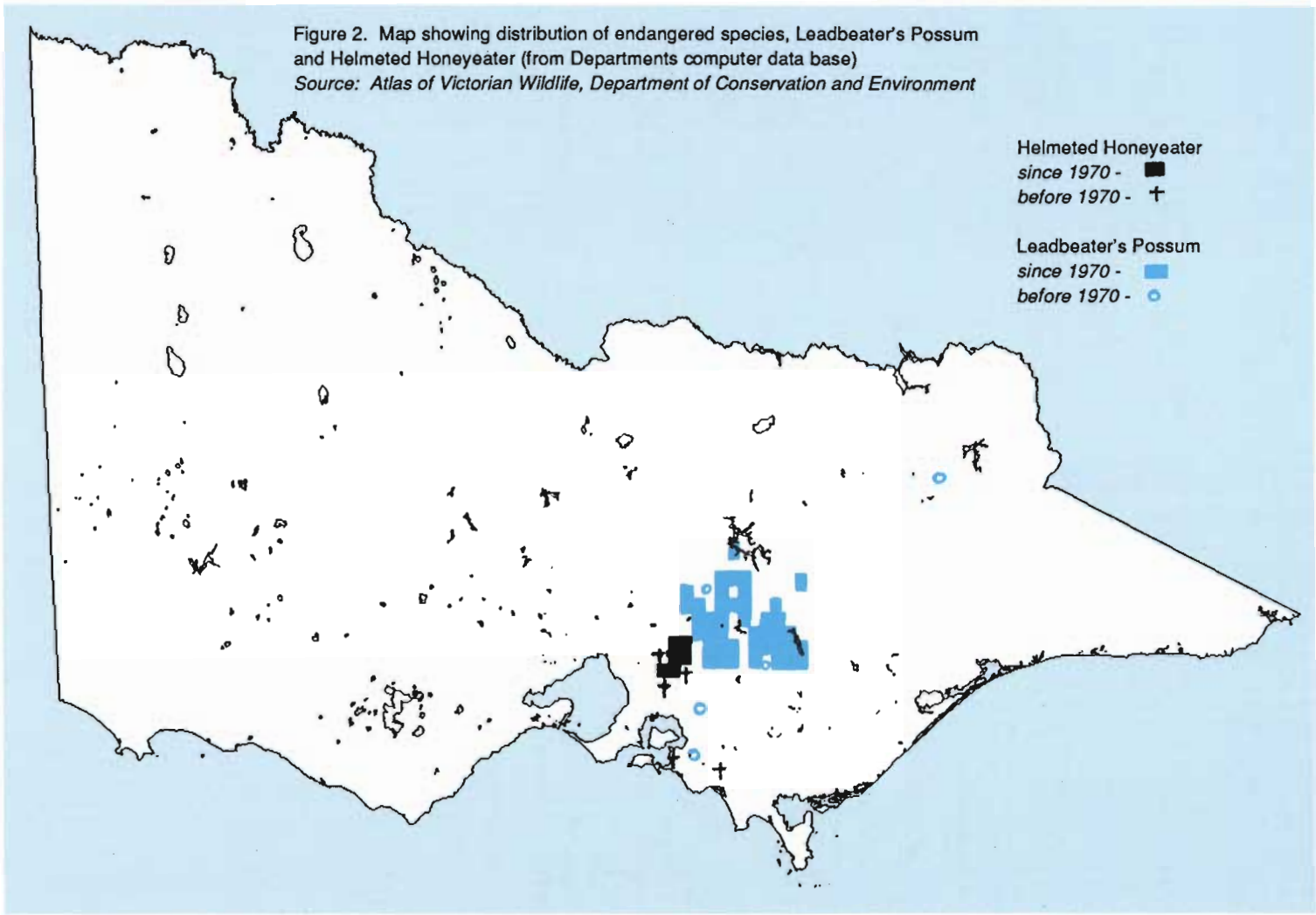
Effective park management, including the maintenance of appropriate fire regimes, is also important for species conservation. Some plant communities such as heathlands, lose species diversity in the absence of fire, while others such as rainforest, take long periods to recover after burning. Although many of Victoria's native plants require fire for seed germination, these species are quickly eliminated if burnt too frequently. Similarly, different animal species prefer different stages of habitat regeneration; some thrive best in plant communities at the early stages of regrowth, while others require mature vegetation for their survival. Tourism can also have an impact upon wildlife. In 1986, an ABS survey revealed that almost one-third of all Victorians over the age of 15 had visited a National Park during the preceding 12 months, and in 1989-90, there were more than 9 million visitors to Victorian parks. The provision of facilities for these visitors, and the recreational activities that they pursue can have adverse effects. For example, of the 68 bushfires which occurred within Victorian parks during 1989-90, 9 began as campfires and 26 were lit deliberately by members of the public.

### Unique Victorians

Considerable effort is being expended, by all levels of the community, to save Victoria's endangered wildlife. The type of work being undertaken to save individual species can be appreciated by looking at just a couple of examples; Victoria's two faunal emblems, the Helmeted Honeyeater and the Leadbeater's Possum. Both these animals are unique to Victoria, and both are highly endangered.

The Helmeted Honeyeater (*Lichenostomus melanops cassidix*) is an attractive yellow-crested bird which once lived in stream-side vegetation throughout western Gippsland. Clearing for agriculture affected its numbers severely and by the 1960's only one population, comprised of about 250 birds, survived. The Yellingbo State Nature Reserve was declared (in 1965) to protect this population, but numbers continued to dwindle and by 1988 only 40 breeding birds remained. In 1989, with the aid of a special grant provided in the State budget, an advisory group comprised of representatives from DCE, the Zoological Board of Victoria, La Trobe University and conservation groups, was set up to devise a strategy for saving the Helmeted Honeyeater. Since that time the honeyeater's population has been intensively monitored to identify factors affecting the bird's survival and breeding success. The information gained has led to supplementary food being provided during the winter and the management of competing Bell Miners (bellbirds). Additional habitat is being provided for the honeyeaters through a revegetation program; 90,000 trees and shrubs (propagated from seed collected in the Yellingbo reserve) have been planted. The community group "Friends of the Helmeted Honeyeater" provides direct assistance to local land owners wishing to restore such vegetation. A captive breeding colony of Helmeted Honeyeaters

Figure 2. Map showing distribution of endangered species, Leadbeater's Possum and Helmeted Honeyeater (from Departments computer data base)  
Source: Atlas of Victorian Wildlife, Department of Conservation and Environment



has been established at Healesville Sanctuary to provide birds for release into the wild and to ensure the species' survival in the event of a natural disaster (such as bushfire) befalling the wild population. Research into the genetic composition of the honeyeater population is also taking place to ensure diversity is maintained.

For many years the Leadbeater's Possum (*Gymnobelideus leadbeateri*), known only from a few specimens collected early in the century, was believed to be extinct. However in 1961 it was rediscovered in the mountain ash forests of Victoria's central highlands. This small possum cannot survive without large, old (more than 150 years of age), hollow-bearing trees in which to nest, and it is this fact which has led to considerable debate about the impact of timber harvesting. During 1989-90, DCE provided \$200,000 to fund a research and management program for the Leadbeater's Possum. Work on the program will include the mapping of the distribution and density of hollow-bearing trees in the central highlands to define conservation zones, assessment of how the possum utilises trees of different age and structure in its daily activities, and integration of data on the possum's range and habitat requirements into forest management planning.

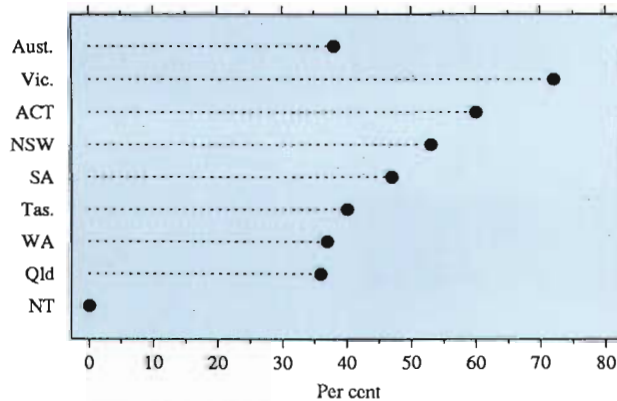
### DEFORESTATION

Currently Victoria has 5.4 million hectares of native forest. Eighty-nine per cent of this treed land (or 4.8 million hectares) is publicly owned, and almost one-third is protected in National Parks and reserves. By comparison, only one-sixth of all forests in Australia enjoy such protection (Table 7). Although Victoria comprises only 3 per cent of Australia's land mass, it carries 13 per cent of Australia's native forests and produces 30 per cent of the nation's total hardwood forest products (timber, pulpwood, etc.).

The clearing of forests and woodland, or *deforestation*, is an issue of growing concern to the community. An ABS survey conducted in 1990 revealed that two-thirds of Victorian households were concerned about deforestation, with the proportion rising to three-quarters among those aged between 25 and 44 years. Four years earlier, an ABS survey revealed that only one-sixth of Victorians were concerned about the loss of forests.

Deforestation can have a very significant impact upon the environment. Because trees absorb large amounts of water, deforestation can lead not only to a rise in the underground water table (causing soil salinity), but also increases surface water runoff, which in turn results in flooding, leaching of soil nutrients, soil erosion, and siltation of waterways and water storage facilities. Forests also provide an essential refuge for many species of native animals and plants and act as a major sink for carbon dioxide - one of the main greenhouse gases.

### PERCENTAGE DECLINE IN FOREST AND WOODLAND COVER SINCE EUROPEAN SETTLEMENT, BY STATE OR TERRITORY, 1984



Source: *State of the Environment: Source Book*,  
Department of Arts, Heritage and Environment, 1986



**TABLE 6 ESTIMATED DECLINE IN FOREST AND WOODLAND COVER, STATES, TERRITORIES AND AUSTRALIA**

	<i>NSW</i>	<i>Vic.</i>	<i>Qld</i>	<i>SA</i>	<i>WA</i>	<i>Tas.</i>	<i>NT</i>	<i>ACT</i>	<i>Aust.</i>
Forest cover -									
Prior to European settlement									
'000 ha	15,739	<b>8,591</b>	35,544	213	2,030	3,218	4,741	146	70,222
% of state	19.6	<b>37.7</b>	20.6	0.2	0.8	47.1	3.5	59.1	9.1
Current (a)									
'000 ha	4,725	<b>2,857</b>	18,704	72	1,049	1,696	4,733	65	33,852
% of state	5.9	<b>12.6</b>	10.8	0.1	0.4	24.8	3.5	26.3	4.4
Percentage of original forest lost									
	70.0	<b>66.7</b>	47.4	66.2	48.3	47.3	0.2	55.5	51.8
Woodland cover -									
Prior to European settlement									
'000 ha	45,776	<b>7,709</b>	48,283	5,432	34,565	2,110	29,610	93	173,657
% of state	57.1	<b>33.9</b>	27.9	5.5	13.7	30.9	21.9	37.7	22.6
Current (a)									
'000 ha	24,592	<b>1,868</b>	35,009	2,979	21,751	1,344	29,689	31	117,266
% of state	30.7	<b>8.2</b>	20.3	3.0	8.6	19.7	21.9	12.6	15.2
Percentage of original woodland lost									
	46.3	<b>75.8</b>	27.5	45.2	37.1	36.3	0.0	66.7	32.5

(a) 'Current' cover is mid point between the maximum and minimum cover estimated by source.

Source: Adapted from *State of the Environment: Source Book*, Department of Arts, Heritage and Environment, 1986.

**TABLE 7 OWNERSHIP OF FORESTS, BY STATES, TERRITORIES AND AUSTRALIA, 1990**

<i>Ownership</i>	<i>NSW</i>	<i>Vic.</i>	<i>Qld</i>	<i>SA (a)</i>	<i>WA</i>	<i>Tas.</i>	<i>NT</i>	<i>ACT</i>	<i>Aust.</i>
Native forest -									
Public (per cent)	65.3	<b>88.8</b>	87.4	-	81.3	76.6	25.7	100.0	73.4
- conserv. reserve	14.9	<b>31.1</b>	11.3	-	12.1	11.5	9.7	82.4	15.2
- other	50.4	<b>57.7</b>	76.1	-	69.2	65.1	16.0	17.6	58.3
Private (per cent)	34.7	<b>11.2</b>	12.6	-	18.7	23.4	74.3	-	26.6
<b>Total ('000 ha)</b>	<b>14,959</b>	<b>5,400</b>	<b>11,796</b>	-	<b>2,657</b>	<b>2,843</b>	<b>3,266</b>	<b>51</b>	<b>40,972</b>
Coniferous plantations -									
Public (per cent)	72.4	<b>51.7</b>	n.a.	72.4	79.8	55.9	n.a.	n.a.	72.5
Private (per cent)	27.6	<b>48.3</b>	n.a.	27.6	20.2	44.1	n.a.	n.a.	27.5
<b>Total ('000 ha)</b>	<b>248.2</b>	<b>204.9</b>	<b>167.0(b)</b>	<b>95.3</b>	<b>87.8</b>	<b>68.0</b>	<b>4.2(c)</b>	<b>16.5(b)</b>	<b>891.8</b>
Hardwood plantations -									
Public (per cent)	89.9	<b>53.8</b>	n.a.	n.a.	33.7	17.4	n.a.	n.a.	52.7
Private (per cent)	10.1	<b>46.2</b>	n.a.	n.a.	66.3	82.6	n.a.	n.a.	47.3
<b>Total ('000 ha)</b>	<b>27.7</b>	<b>17.9</b>	<b>n.a.</b>	<b>1.0(b)</b>	<b>14.8</b>	<b>23.0</b>	<b>0.2(c)</b>	<b>0.1(b)</b>	<b>84.6</b>

(a) South Australia does not support forest as defined by the Resource Assessment Commission's Forest Resource Survey.

(b) Excludes privately owned plantations.

(c) Excludes publicly owned plantations.

Source: Adapted from *Forest and Timber Inquiry Draft Report*, Resource Assessment Commission, 1991

### History of deforestation

Since settlement by Europeans, Victoria has lost two-thirds of its forests and three-quarters of its woodland (Table 6). It is estimated that 72 per cent of Victoria was once treed; now the proportion is 21 per cent. This loss is greater than that sustained by any other Australian state. The highest rates of deforestation occurred during the nineteenth century when large tracts of land were opened up for agriculture. The gold-rush of the 1850s created a huge demand for building materials and fuel, leading to the felling of stringy-bark forests throughout the gold-fields. In the 1870s, legislation was introduced requiring land selectors to clear and fence land to maintain tenure; forests in the Otways, Gippsland and the Mallee were severely affected. Timber harvesting increased considerably during the twentieth century. Between 1931 and 1955 the quantity of saw-logs removed from Victoria's forests increased seven-fold, before peaking in 1957 at 1.4 million cubic metres. Saw-log extraction from public forests has since decreased to approximately 1 million cubic metres per year. However, pulpwood extraction has been increasing steadily over the last 40 years, reaching 0.5 million cubic metres during the late 1980s.

### Current threats

Over the last 120 years, more than 1,000 sq. kms. of Victorian forest have disappeared every year. However current deforestation rates are much lower; between 1972 and 1987 the loss was 120 sq. km. annually. More than ninety-five per cent of forest lost during this 15 year period was cleared from privately owned land. Despite intensive publicity campaigns and restrictions imposed by many local councils, the clearing of native vegetation from private land continues to be a major threat. In 1989, when only 6 per cent of the State's privately owned land carried natural vegetation (amounting to 600,000 hectares of forest), the State Government introduced a state-wide planning scheme requiring land-owners to obtain a permit to clear more than ten hectares of their land.

The harvesting of forests for timber need not result in deforestation, provided that the areas felled are re-afforested, and that sustainable yields are not exceeded; that is, the amount of wood removed is no greater than that replaced by forest growth. Timber is an exceedingly valuable resource, being both totally renewable and energy-efficient to produce. The energy required to produce one tonne of building materials has been estimated at 1,800 kiloWatt hours (kwh) for timber, 2,200 kwh for concrete, 13,200 kwh for steel, 45,000 kwh for plastic and 91,000 kwh for aluminium. As in the past, timber production is currently an important function of Victoria's State Forests. Two-thirds of the timber used by the Victorian community is harvested from within the State, and the Victorian timber industry provides both Government revenue (\$53 million in timber royalties in 1989-90) and direct employment for 7,400 people (Table 9). Each year approximately 150 sq. km. of State-owned native forest is harvested; in 1989-90 1.06 million cubic metres of saw-logs and 0.54 million cubic metres of pulpwood were produced. After harvesting, this land (0.5 per cent of all unreserved State forests) is regenerated. However, there is considerable debate over whether this level of harvesting is sustainable in the long-term. Plantation forests, of which there are currently 0.2 million hectares, are likely to play a much greater role in the State's future timber production.

**TABLE 8 NATIVE FORESTS: AREA AND PROPORTION NEVER LOGGED, BY FOREST TYPE, VICTORIA, 1991**

Forest type	State forest		Conservation reserve		All public forest	
	'000 ha	Percentage unlogged	'000 ha	Percentage unlogged	'000 ha	Percentage unlogged
Southern rainforest	10	73	1	-	11	67
Swamp forest	-	-	2	48	2	48
SE dry eucalypt forest	-	-	10	-	10	-
SE wet eucalypt forest	2,899	35	981	57	3,880	41
SE coast eucalypt forest	210	57	212	44	422	50
River red gum forest	-	-	35	51	35	51
Dry woodland	3	-	102	47	105	46
<b>Total</b>	<b>3,122</b>	<b>37</b>	<b>1,343</b>	<b>54</b>	<b>4,465</b>	<b>42</b>

Source: *Forest and Timber Inquiry Draft Report*, Resource Assessment Commission, 1991

Other threats to Victoria's forests include the root-rot fungal diseases, *Phytophthora cinnamomi* and *Armillaria luteobubalina*, responsible for forest 'die back'. Bush fires can also damage forests, particularly young regrowth forests and fire-sensitive forest types such as rainforest and mountain ash. However improved fire-fighting equipment and techniques coupled with widespread fuel-reduction burning have gone a long way toward eliminating devastating forest fires such as those which swept the State in 1939.

TABLE 9 NUMBER OF PEOPLE EMPLOYED IN THE WOOD AND PAPER PRODUCTION INDUSTRIES, VICTORIA, 30 JUNE 1980 TO 1989

Year (30 June)	Log saw-milling (ASIC 2531)	Resawn & dressed timber (ASIC 2532)	Veneer & manufact. board (ASIC 2533)	Paper, pulp & paper board (ASIC 2631)	Total
1980	2,556	1,696	862	n.a.	n.a.
1981	2,507	1,905	782	3,570	8,764
1982	2,288	1,914	831	2,688	7,721
1983	2,036	1,830	824	n.a.	n.a.
1984	2,036	1,842	911	2,671	7,460
1985	2,011	1,931	967	2,803	7,712
1986	n.a.	n.a.	n.a.	n.a.	n.a.
1987	2,234	1,629	961	2,203	7,027
1988	2,278	1,600	860	2,356	7,094
1989	2,221	1,211	968	3,011	7,411

#### DEGRADATION OF AGRICULTURAL LAND

Although state-wide data is difficult to obtain, land degradation - in the form of soil erosion, salinity or declining soil quality - is believed to affect at least 60 per cent of Victorian farmland. The problem is severe, with the cost of lost production estimated at more than \$200 million per annum. Such losses not only threaten the viability of individual farms, but impact on whole rural communities, and ultimately, with the depletion of the State's soil resources, on all Victorians. A survey conducted by the ABS in 1990 revealed the community's growing concern over this problem: 63 per cent of Victorian households (61 per cent of those in the Melbourne Statistical Division and 69 per cent of those in the rest of the State) expressed concern about soil erosion and salinity.

TABLE 10 AGRICULTURAL LAND: TYPE OF LAND USE AND PERCENTAGE OF AREA DEGRADED, STATES, TERRITORIES AND AUSTRALIA, 1975

Land use	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Aust.
Cropping									
'000 ha	12,680	6,800	2,850	9,297	14,848	176	27	1	46,700
percentage degraded	93.0	59.7	75.1	32.2	66.1	7.4	88.9	35.0	66.0
Grazing (non-arid)									
'000 ha	17,600	10,100	75,200	3,700	6,600	2,400	18,000	110	133,700
percentage degraded	72.3	57.2	30.5	12.2	4.2	3.3	32.2	54.5	36.1
Arid land grazing									
'000 ha	33,500	-	84,000	44,100	111,400	-	62,600	-	335,600
percentage degraded	100.0	-	51.9	81.6	43.1	-	38.3	-	55.2
Total agricultural land									
'000 ha	63,800	16,800	62,000	57,100	132,900	2,600	80,600	110	516,000
percentage degraded	91.1	58.6	42.3	69.2	43.7	3.6	37.0	54.5	51.2

Source: Adapted from *State of the Environment: Source Book*, Department of Arts, Heritage and Environment, 1986.

TABLE 11 LAND DEGRADATION, VICTORIA, 1991

<i>Form of land degradation</i>	<i>Estimated area affected</i>	<i>% of susceptible land affected</i>	<i>Estimated annual cost of lost production</i>
	sq. km.	per cent	\$m
Salinity			
dryland	980	19.6	8.0
irrigated	1,400	36.4	68.0
Reduction in soil quality			
structural decline	50,000	52.6	48.0
fertility decline	40,000	67.8	(a)32.0
contamination	1,000	n.a.	n.a.
induced acidity	12,000	24.0	15.0
Soil erosion			
gully/tunnel erosion	350	n.a.	(b)4.5
sheet/rill erosion	13,000	41.9	16.0
wind erosion	7,000	2.5	3.0
Induced water-logging	18,000	78.3	36.0
Water repellence	200	57.1	1.5

(a) Cost of additional fertilizer application.

(b) Includes cost of reduced water storage and repair of public utilities.

Source: *Towards sustainable land use ...*, Victorian Decade of Landcare Steering Committee, 1991

### Soil Erosion

Soil erosion, or loss of soil through the actions of water or wind, is a widespread problem throughout Victoria; water erosion is particularly acute in Central Victoria while wind erosion is a problem in North-western Victoria.

#### *Types of erosion*

Sheet and rill erosion (the washing away of thin layers of top-soil from extensive areas) has reduced the productivity of 1.3 million hectares in Victoria, and another 1.8 million hectares are considered susceptible (Table 11). Gully and tunnel erosion (the loss of both top and sub-soil along water channels) reduces the amount of arable land available and often destroys roads, fences, bridges, etc. Sixty-five per cent of rivers and streams in cleared areas in Victoria suffer from heavy erosion. The action of water also contributes to mass soil movements such as landslides and mudflows, although tree clearing and construction work are usually the primary cause. All forms of water erosion lead to a deterioration in water quality, with many of the State's rivers carrying heavy loads of silt (Table 12). Sixteen per cent of rural Victorians are provided with drinking water which fails to meet World Health Organisation (WHO) standards for turbidity, due to the amount of suspended solids. The deposition of this water-borne soil is also a problem, particularly the siltation of the State's water-storage facilities. The removal of top-soil by the wind has reduced the productivity of 700,000 hectares in the Mallee and Northern Wimmera. Severe wind erosion, as occurs in drought years, can result in scalding (the exposure of saline or clayey sub-soils which will not support plant growth); 1,000 hectares in the Mallee region are scalded.

TABLE 12 QUALITY OF WATERWAYS, VICTORIA, 1985

<i>Type of stream</i>	<i>Total stream length</i>	<i>Excellent/good (in natural state or slightly altered, good habitat)</i>	<i>Moderate (signific. alterations, moderate habitat, stable)</i>	<i>Poor/very poor (badly degraded, erosion problems, low habitat value)</i>
	(km)	(%)	(%)	(%)
Rivers and major streams	7,300	21	51	29
Tributaries	7,500	35	20	45
Minor streams	49,200	70	7	24
<b>Total</b>	<b>64,000</b>	<b>60</b>	<b>13</b>	<b>27</b>
All streams in cleared areas	27,000	5	30	65

Source: *Towards sustainable land use ...*, Victorian Decade of Landcare Steering Committee, 1991



*History of erosion*

Soil erosion, which occurs when the soil's surface is exposed to the elements, has been a problem in Victoria for a long time. Even prior to the turn of the century, heavy grazing pressure had denuded large areas of pasture leaving the soil vulnerable to erosion. The clearing of native vegetation, particularly from steep slopes and water-courses, and the adoption, in the early 1900s, of prolonged bare fallow wheat-growing techniques resulted in severe erosion. Rabbits, whose populations had reached plague proportions by the 1920s, overgrazed soil-protecting vegetation and dramatically hastened erosion with their burrowing. By the 1930s erosion had become a serious threat to Victorian agriculture. In the Mallee, for example, roads and railways became impassable under drifts of eroded sand.

However, during the past 50 years there has been considerable improvement. The prosperity of the post-war years allowed farmers to adopt newly developed pasture species and ley farming (the alternating of crops with clover pasture), both of which significantly reduced the soil's exposure. During the 1950s the introduction of myxomatosis decimated the State's rabbit population. Structural methods of stabilising gully erosion have been developed and widely employed, together with the planting of trees and restoration of native vegetation. The Tree Victoria program currently provides community grants from both State and Federal funds for the planting of trees on land affected by erosion or salinity: during 1989-90, grants totalled \$1 million and 600,000 trees were planted.

*And now...*

Perhaps the most important development in recent years has been the increase in conservation attitudes of rural land-holders and the proliferation of farmer-groups dedicated to land-conservation issues. However the declining market price of agricultural produce has prevented many land-holders from adopting more sustainable farming practices. Current methods of crop cultivation still leave the soil vulnerable to erosion but the machinery required for minimum tillage techniques is costly. Similarly, a reduction in grazing pressure means a reduction in financial returns. LandCare, a community based program introduced in 1986, aims to improve land management and sustainable productivity through co-operative effort, with the State Government providing technical and financial support to community groups. In June 1990 there were sixty-nine Landcare groups in Victoria, covering 1.5 million hectares (11 per cent) of the State's farmland, and involving more than 3,000 land-holders. The Victorian Landcare program has since been adopted as a model by the Federal Government, and the 1990s has been declared the National Decade of Landcare.

**TABLE 13 TREES(a) ON FARMLAND, BY STATISTICAL DIVISION, VICTORIA, 1989-90**

<i>Statistical division</i>	<i>Woodlots or other treed land</i>		<i>Farms with treed land</i>	
	<i>Area (ha)</i>	<i>Percentage of agric. land</i>	<i>Number</i>	<i>Percentage of all farms</i>
Melbourne	9,802	5.7	258	16.3
Barwon	13,813	3.0	590	35.2
South Western	19,963	1.1	1,805	36.0
Central Highlands	7,757	1.0	637	33.6
Wimmera	17,388	0.7	867	26.1
Northern Mallee	14,240	0.6	536	14.9
Loddon-Campaspe	11,628	0.8	924	27.7
Goulburn	11,514	0.9	1,104	21.6
North Eastern	6,717	1.0	440	22.2
East Gippsland	9,616	1.1	367	28.0
Central Gippsland	10,171	1.8	1,057	29.5
East Central Gippsland	1,350	1.3	207	22.5
<b>Total Victoria</b>	<b>133,959</b>	<b>1.0</b>	<b>8,792</b>	<b>26.4</b>

(a) Comprised of trees from which stock are excluded; used as wind breaks, erosion control, timber production, wildlife habitat, etc.

## Salinity

Salinity is considered to be the single greatest threat to Victorian agriculture. Excessive salt in the soil and water has already damaged 2,400 square kilometres and threatens an area more than twice that size. The estimated cost of lost production is \$76 million per annum. Between 1983-84 and 1988-89 the area of salt affected farmland in Victoria, as reported by farmers in Agricultural Censuses, increased by 67 per cent, and the proportion of Victorian farms affected rose from 6 per cent of all farming establishments to 9 per cent (2,711 farms in 1989-90) (Table 14).

Salinity is caused by ground-water rising to within two metres of the soil's surface. As the underground water rises, it dissolves salts, and when this salty water makes contact with plant roots, vegetation dies and the land becomes unproductive. In some areas the ground-water seeps out on to the surface, evaporating to leave salt encrusted soil on which virtually nothing will grow. Salt also washes into the waterways, harming both aquatic animals and wetland habitats, and affecting the quality of drinking water.

### Types of salinity

There are two types of salinity in Victoria. *Dryland salinity* is brought about by the clearing of native vegetation, particularly deep-rooted trees which keep the ground-water levels low through the absorption of large amounts of water. The salt load of the Avoca river, for example, increased ten-fold after the clearing of surrounding land for agriculture. Dryland salinity currently affects 98,000 hectares in the Western parts of Victoria, with damage occurring to low-lying bushland as well as farmland. Almost 2,000 of the State's farms reported dryland salinity in 1988-89. *Irrigation salinity* occurs when irrigation water seeps down too deeply into the soil causing a build up in ground-water. It is estimated that irrigation salinity has damaged 140,000 hectares in the Murray-Goulburn irrigation district, and, according to the 1988-89 Agricultural Census, affects one farm in ten in the Loddon-Campaspe Statistical Division.

### Solving the problem

Although the solution to salinity is simple - lower ground-water levels - this is often very difficult to achieve. For dryland salinity it is important to plant water-absorbing vegetation, such as trees or deep-

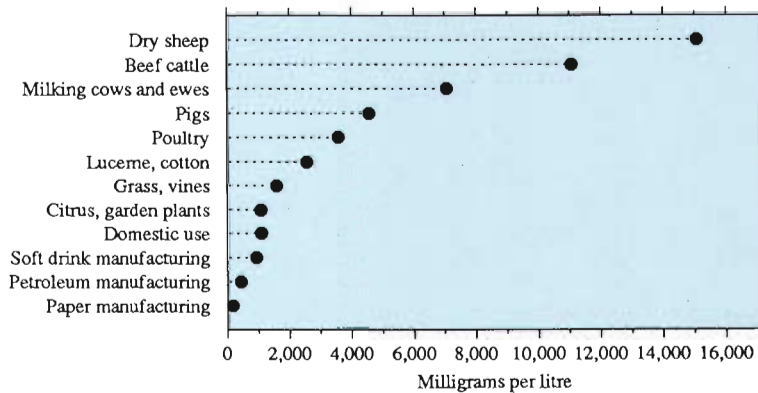
**TABLE 14 SALT AFFECTED FARMLAND(a), BY STATISTICAL DIVISION, VICTORIA, 1983-84 AND 1988-89**

Statistical division	Area of salted land (sq km)			Percentage of farmland affected in 1988-89	Farms with salt (no.)			Percentage of all farms with salt		
	1988-89				1988-89			1983-84	1988-89	
	1983-84	Irrigated	Dryland	Total	1983-84	Irrigated	Dryland	1983-84	1988-89	
Melbourne	2.9	1.8	1.2	3.0	0.2	35	15	16	1.1	2.1
Barwon	19.9	0.3	29.5	29.8	0.7	146	4	130	5.8	8.3
South Western	51.2	1.5	83.2	84.7	0.5	321	9	408	5.0	8.6
Central Highlands	47.9	4.6	65.6	70.2	0.9	246	10	249	8.7	14.5
Wimmera	42.5	13.4	85.9	99.3	0.4	284	15	266	7.1	8.6
Northern Mallee	166.4	162.4	106.9	269.3	1.1	565	217	291	12.9	14.4
Loddon-Campaspe	120.4	113.5	61.6	175.1	1.2	542	332	249	11.4	18.2
Goulburn	27.2	23.3	38.0	61.3	0.5	278	167	164	4.0	6.8
North Eastern	0.4	1.1	4.5	5.6	0.1	12	6	24	0.4	1.6
East Gippsland	8.9	2.7	12.1	14.8	0.2	51	28	37	2.5	5.4
Central Gippsland	6.3	3.5	10.6	14.1	0.2	41	11	44	0.8	1.6
East Central	2.7	0.1	1.9	2.0	0.2	23	1	18	1.7	2.1
<b>Total</b>	<b>496.7</b>	<b>328.2</b>	<b>501.0</b>	<b>829.2</b>	<b>0.6</b>	<b>2,544</b>	<b>815</b>	<b>1,896</b>	<b>5.5</b>	<b>8.5</b>

(a) As reported by farming establishments.

rooted, perennial pasture species, in those areas where water is infiltrating the soil too deeply (termed *recharge* areas). However recharge areas are often located far from the low-lying regions where salinity is occurring, and so problems of ownership arise. For irrigation salinity it is necessary to control water usage and improve drainage and watering systems, so water excess to the needs of the crop does not soak deeply into the soil; these are costly modifications. The pumping of ground-water is also beneficial but difficult to perform without raising the salinity of river systems and wetlands. The Department of Conservation and Environment, in consultation with local communities, is currently developing salinity management plans for catchment areas throughout Victoria.

### WATER SALINITY: HIGHEST LEVELS TOLERATED BY USE



Source: *Victoria's Inland Waters, State of the Environment Report 1988*, Office of the Commissioner of the Environment

### Other problems

Victoria's farmland is subject to a number of other problems. The most widespread problem is loss of productivity due to deteriorating soil structure (affecting 40 per cent of the State's agricultural land) and soil fertility (30 per cent). The use of artificial fertilizers (754,000 tonnes were applied to Victorian farmland in 1989-90) alleviates low soil fertility, but leads to water quality problems. Soil contamination, by pesticide residues, and arsenic and heavy metals from historic gold-mining activities, is also an issue. It has been estimated that up to 100,000 hectares may be affected, although only 1,200 hectares of Victorian land were listed on the EPA's Contaminated Sites Register in 1990. Other problems include the infestation of weeds, the proliferation of pest animals (mainly introduced or feral species) and the loss of prime agricultural land to urbanisation. In just six years, between 1983 and 1989, Victoria lost almost 2,000 ha of high quality farmland to urban development.

### QUALITY OF LIFE

The existence of humans on earth is dependent upon the health of the natural environment. Without clean water to drink, clean air to breath and uncontaminated food to eat, man cannot survive. Yet many of our activities are jeopardising these natural life support systems. The maintenance of a world in which we can live comfortably is an issue of concern to many Victorians, particularly those of child-rearing age (25 to 44 years), and people with children (Table 15).

**TABLE 15 PERCENTAGE OF HOUSEHOLDS WHO WERE CONCERNED ABOUT SELECTED ENVIRONMENTAL ISSUES BY AGE, HOUSEHOLD TYPE AND LABOUR FORCE REGION, VICTORIA, 1990**

	Percentage of households who were concerned about							
	Greenhouse effect	Water pollution	Pollution from waste disposal	Hole in ozone layer	Destruction of forests	Nuclear issues, uranium	Soil erosion, salinity	None of these
Age of household's reference person - (a)								
15-24 years	81.3	87.8	88.4	78.5	66.8	59.5	50.1	3.3
25-34 years	88.1	92.3	91.9	83.5	74.3	66.2	60.9	2.3
35-44 years	88.7	93.4	93.7	83.8	74.8	66.8	68.1	1.3
45-54 years	82.4	90.2	90.7	76.4	69.5	58.4	65.6	2.6
55-64 years	76.9	90.1	87.5	68.6	62.3	57.7	62.4	4.1
65 years or more	66.9	82.5	81.5	57.1	57.6	52.6	61.0	7.4
Household type -								
Person living alone	72.0	84.2	82.8	63.5	64.4	55.7	61.1	5.7
Couple only	80.2	90.5	90.1	71.5	64.6	57.2	66.8	3.5
Couple & child(ren)	85.4	92.1	92.0	80.7	70.3	64.7	64.3	2.2
Single parent	82.2	88.7	88.9	76.4	69.2	59.8	58.1	3.9
Other	81.3	88.9	88.4	76.4	72.6	62.5	58.1	4.1
Labour force region -								
Melbourne Stat. Div.								
Inner Melb.	77.0	88.4	88.6	75.2	75.5	64.5	61.7	4.1
Southern Melb.	83.9	88.5	90.6	75.6	74.2	65.5	67.0	3.4
Inner Eastern Melb.	85.3	88.7	92.1	77.3	70.7	65.5	66.6	1.9
Nth Eastern Melb.	76.5	89.6	86.6	73.0	65.7	63.2	57.3	6.3
Nth Western Melb.	76.2	87.4	87.4	69.4	68.0	63.1	55.9	5.7
Western Melb.	81.6	88.3	83.0	78.6	57.5	56.2	46.1	4.1
Mornington Peninsula	79.5	90.2	89.2	75.1	67.8	56.1	60.8	4.0
Outer Eastern Melb.	84.7	92.8	94.1	81.1	76.4	63.1	67.4	2.0
Rest of Victoria								
Sth Western Victoria	82.2	89.9	89.6	71.0	69.6	59.8	62.2	3.6
Nth Western Victoria	83.3	89.3	87.1	73.3	64.4	59.1	72.0	2.8
Northern Victoria	80.1	89.1	88.9	70.2	66.0	57.4	74.3	3.2
Eastern Victoria	77.4	92.5	92.1	68.6	60.3	56.8	67.4	-
<b>Victoria</b>	<b>81.0</b>	<b>89.6</b>	<b>89.2</b>	<b>74.5</b>	<b>68.1</b>	<b>60.7</b>	<b>63.1</b>	<b>3.5</b>

(a) The person responding on behalf of the household.

### Enhanced greenhouse effect

The greenhouse effect is a natural process essential for the continuance of life on earth. Incoming sunlight warms the earth, which then radiates this heat back into space. Some of the out-going heat is trapped by gases in the atmosphere, and it is this blanketing *greenhouse effect* of the atmospheric gases which maintains the earth's temperature within a desirable range. *Greenhouse gases* is the name applied to those gases which trap heat most effectively. Unfortunately, the activities of man have greatly increased the quantity of greenhouse gases in the atmosphere, and it is thought that with more heat being trapped by the atmosphere, global temperatures will rise. Even a small increase in temperatures could have devastating effects due to changes in weather patterns and rises in sea level.

The main greenhouse gases produced by man are carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide. Australia produces almost 300 million tonnes of carbon dioxide annually (Table 16), four-fifths of which comes from the burning of fossil fuels. This gas is responsible for more than half of Australia's contribution to the enhanced greenhouse effect. Although the other three greenhouse gases are produced in much smaller quantities (totalling about 8 million tonnes annually), they trap heat much more efficiently than carbon dioxide and as a consequence are each responsible for about 15 per cent of





### *VICTORIA - AN ENVIRONMENTAL OVERVIEW*

Above: Image generated by the Australian Centre for Remote Environmental Sensing, using data from the Japanese Geostationary Meteorological Satellite, - *Bureau of Meteorology*

Below: Coranderrk Creek in Corankerrk Park. A supplier of water to Melbourne since 1908, it now supplies up to 110 megalitres of water a day to Silvan Reservoir - *Melbourne Water*







Above: Grass trees in the Little Desert National Park -  
*Department of Conservation and Environment*  
(Photo: Noel Ryan)



Left: Leadbeater's Possum, one of our faunal  
emblems, endangered by loss and fragmentation of its  
habitat. - *Department of Conservation and Environment*

Below: Helmeted Honeyeater, bird emblem of Victoria,  
and one of the rarest birds in the world - *Photo: Len  
Robinson*





EPA monitoring water quality off shore from St. Kilda - Environment Protection Authority



Testing for water quality at the Water Sciences Laboratory, Mount Waverley - Melbourne Water



One of the floating litter booms on the Yarra River - Melbourne Water



**OVERLEAF:**  
Australia Paper Manufacturers is Australia's largest private plantation forester.







Australia's contribution to the greenhouse effect. Overall, Australia's annual greenhouse gas production equals 30 tonnes of carbon dioxide for every Australian; three times the world average. Energy use - industrial, domestic and for transportation - is responsible for approximately half of Australia's total greenhouse emissions, and another quarter is the result of agricultural activities.

**TABLE 16 ESTIMATED CARBON DIOXIDE EMISSIONS, BY STATE OR TERRITORY, 1987-88**

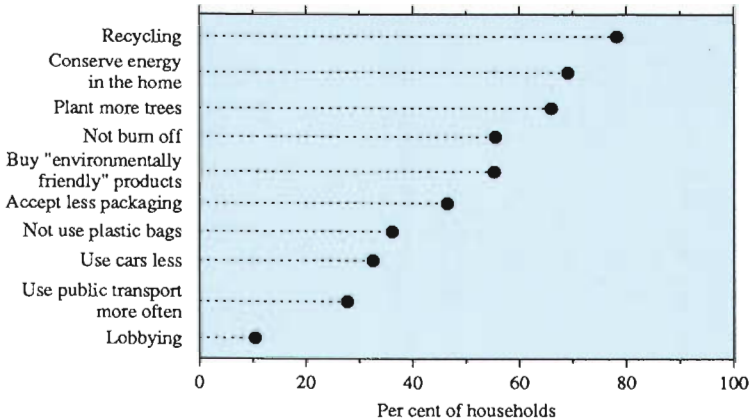
State	Total emissions		Emissions per capita
	million tonnes	per cent	tonnes
Northern Territory	4,091	1.5	2.6
Victoria	81,231	29.4	1.9
Queensland	52,080	18.9	1.8
Western Australia	27,953	10.1	1.8
New South Wales (a)	86,078	31.2	1.5
South Australia	20,169	7.3	1.4
Tasmania	4,643	1.7	1.0
<b>Australia</b>	<b>276,244</b>	<b>100.0</b>	<b>1.6</b>

(a) Includes the Australian Capital Territory.

Source: A National Inventory of Greenhouse Gas Emissions, July 1990, Australia and New Zealand Environment Council.

In 1988, Australia made a commitment to reduce greenhouse gas emissions by 20 per cent by the year 2005. This has led to the promotion of energy conservation measures at all levels, including extensive public awareness campaigns. In 1990, a survey conducted by the ABS revealed that four out of five Victorian households felt concerned about the greenhouse issue, and more than two-thirds were prepared to undertake energy conservation measures in their homes. Initiatives undertaken by the Victorian Government include the establishment of a Greenhouse Unit, and the monitoring of the effects of climate change on the State's fauna, forests and coastal regions.

**ACTIONS HOUSEHOLDS ARE PREPARED TO TAKE TO HELP THE ENVIRONMENT, VICTORIA 1990**



**Depletion of the ozone layer**

The ozone layer, located 30 km above the earth's surface, is responsible for the screening of harmful ultra-violet (UV) radiation from sunlight. However the ozone layer is becoming depleted, particularly in the Antarctic region (the hole in the ozone layer), with losses as high as 40 per cent since the late 1950s. With less ozone in the stratosphere, the amount of UV-B radiation reaching the earth's surface will increase, and exposure to such radiation is harmful to most living organisms. In humans it can lead to eye problems, skin cancer, and suppression of the immune system. Although the exact causes of ozone

depletion are not yet known, oxides of hydrogen, nitrogen and chlorine - such as those derived from the man-made pollutants chlorofluorocarbons (CFCs) and bromofluorocarbons (halons) - act as a catalyst in the breakdown of ozone. In 1989 the Australian Government passed the Ozone Protection Act, limiting or banning the import, export and manufacture of ozone depleting substances, as well as products which contain or use them. A commitment was made to reduce CFCs (currently used in refrigerators and air-conditioners, as aerosol propellants and in the manufacture of plastic foam) and Halons (used as fire-fighting chemicals) by 45 per cent by 1995, and to phase them out completely by 1998. Within Victoria, an Industrial Waste Management Policy was proclaimed in 1990 making the recovery and re-use of CFCs compulsory and regulating their labelling and handling. Regulations banning or restricting the sale of products containing or using ozone-depleting substances were also introduced.

### Air pollution

In 1973, the Environment Protection Agency began monitoring air quality in Victoria, assessing levels of the major pollutants ozone (smog), sulphur dioxide, nitrogen oxides, carbon monoxide, air-borne particles, hydrocarbons and lead. The State Environment Protection Policy (SEPP), promulgated in 1981, sets out air quality objectives, defining both the acceptable limit and detrimental level (based on health effects) for each of these pollutants. It is against these objectives that ambient conditions are evaluated.

The quality of Victoria's air is generally good except for occurrences of smog in Melbourne and Geelong, and periods of poor visibility in Melbourne, Geelong and the Latrobe Valley. Air-borne lead is a problem within the Melbourne region. Sulphur dioxide, a major pollutant in cities overseas, is not a problem in Victoria, as the State's main fuels - Bass Strait oil and gas, and Latrobe Valley brown coal - have a low sulphur content. Levels of nitrogen dioxide, although a potential problem, have not exceeded acceptable limits during the last three years. Except for smog, Melbourne's air pollution problems are not as severe as Sydney's; prevailing winds in Melbourne tend to disperse pollutants away from the city, and traffic densities are lower.

**TABLE 17 AIR POLLUTION: ESTIMATED EMISSIONS BY SOURCE, MELBOURNE, 1986**

Source	Carbon monoxide		Hydrocarbons		Nitrogen oxides		Sulphur dioxide	
	'000 tonnes	Per cent	'000 tonnes	Per cent	'000 tonnes	Per cent	'000 tonnes	Per cent
Motor vehicles	597.7	85.7	73.3	40.8	52.2	76.3	1.3	18.1
Other transport (rail, air)	16.8	2.4	2.8	1.6	3.2	4.7	0.3	4.2
Combustion of waste	8.3	1.2	2.4	1.3	0.1	0.1	-	0.4
Combustion of fuel -								
Domestic	57.8	8.3	19.5	10.9	2.5	3.7	0.3	4.2
Other	2.3	0.3	0.2	0.1	8.1	11.8	2.2	30.6
Petroleum/solvent								
plants, storage, etc.	0.7	0.1	66.7	37.1	1.6	2.3	3.1	43.1
Other	14.1	2.0	14.8	8.2	0.8	1.2	-	0.3
<b>Total</b>	<b>697.6</b>	<b>100.0</b>	<b>179.7</b>	<b>100.0</b>	<b>68.4</b>	<b>100.0</b>	<b>7.2</b>	<b>100.0</b>

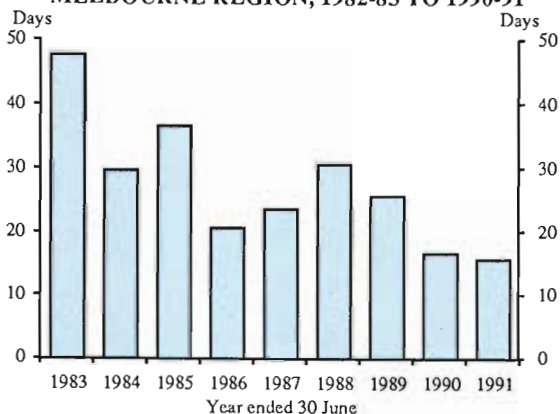
Source: *Air emission inventories (1985) for the Australian capital cities*, Australian Environment Council, Report No 22, AGPS, 1988

### Smog

Smog, also called photochemical oxidants, is produced by the action of sunlight on the pollutants nitrogen oxides and hydrocarbons, most of which come from motor vehicle emissions. Smog is therefore a secondary pollutant, made up primarily (more than 90 per cent) of ozone. It not only has serious health effects, attacking the nasal passages, eyes and respiratory system, but is also very damaging to plants. In Melbourne, episodes of heavy smog occur in calm weather during summer and autumn. Although Melbourne suffers worse smog than any other Australian city, levels have been

decreasing. During 1990-91 the acceptable limit for smog was exceeded on 16 days, compared with 48 days in 1982-83 (based on eight hour averages). This reduction is attributable to the use of catalytic converters in motor vehicles (enabled by the use of unleaded petrol), tighter restrictions for motor vehicle emissions, and regulations controlling the storage and handling of volatile liquids and industrial processes which emit hydrocarbons.

**SMOG: NUMBER OF DAYS ON WHICH LEVELS OF OZONE EXCEEDED THE ACCEPTABLE LEVEL (8 HOUR AVERAGE), MELBOURNE REGION, 1982-83 TO 1990-91**

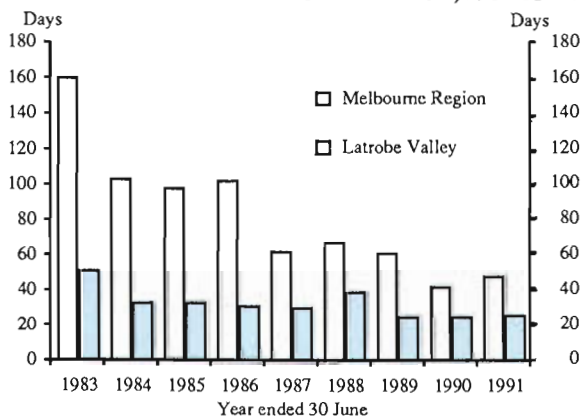


Source: Annual Report 1990-91, Environment Protection Authority

*Air-borne particles*

Air-borne particulate matter is not only aesthetically unpleasant, producing a brown haze which reduces visibility, but also aggravates respiratory diseases such as asthma and bronchitis. As the air-borne particles are often soaked in more harmful pollutants, such as sulphur dioxide and nitrogen oxides, the overall health effects are more severe. During 1990-91, concentrations of visibility-reducing particles in the Melbourne region exceeded acceptable limits on 49 days. However, there has been considerable improvement in recent years: in the drought year of 1982-83 acceptable limits were exceeded on 161

**AIR POLLUTION: NUMBER OF DAYS WHEN LEVELS OF VISIBILITY-REDUCING PARTICLES EXCEEDED ACCEPTABLE LEVELS (1 HOUR AVERAGE), MELBOURNE REGION AND LATROBE VALLEY, 1982-83 TO 1990-91**



Source: Annual Report 1990-91, Environment Protection Authority

days. The main sources of air-borne particles in Melbourne are dust, arising from cleared land and unmade roads, and smoke from domestic incinerators and open burning, such as fuel-reduction burning of forests and burning of agricultural stubble. With very tight controls governing industrial particulate emissions, the Environment Protection Authority is working to reduce domestic sources by conducting publicity campaigns which encourage householders to compost and recycle their waste. The agency is also encouraging Local Government Authorities to adopt more stringent by-laws for domestic incinerators; as of 1991 more than one-quarter of all Local Councils in the Melbourne, Geelong and Westernport regions did not have adequate controls in place.

### Lead

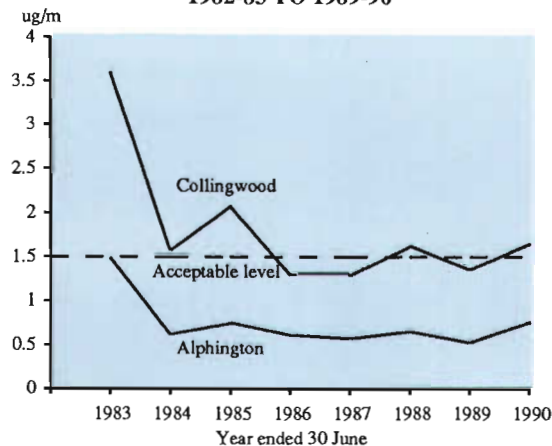
Lead is a heavy metal which acts as a cumulative poison in humans, attacking the central nervous system and kidneys; young children are particularly susceptible. Ninety per cent of Melbourne's lead emissions are generated by the combustion of leaded petrol in motor vehicle engines, and as a consequence, the concentration of air-borne lead particles varies considerably between localities, depending on traffic density. For example, the Environment Protection Authority's Collingwood monitoring station is located close to the exit of the Eastern Freeway and records considerably higher levels of lead than those recorded at Alphington. However, overall lead concentrations have fallen

**TABLE 18 ESTIMATED LEAD EMISSIONS BY SOURCE, AUSTRALIAN CAPITAL CITIES, 1986**  
(tonnes)

City	Motor vehicle petrol engines	Combustion of sump oil	Other sources	All sources	Total leaded petrol sources	Leaded petrol as percentage of total
Adelaide	361	15	30	406	386	95
Brisbane	470	12	27	509	496	97
Canberra	47	-	2	49	48	99
Darwin	21	2	2	25	24	93
Hobart	33	3	11	47	37	79
<b>Melbourne</b>	<b>440</b>	<b>1</b>	<b>64</b>	<b>506</b>	<b>457</b>	<b>90</b>
Perth	397	7	23	427	416	97
Sydney	620	1	88	709	640	90

Source: *Air emission inventories (1985) for the Australian capital cities*, Australian Environment Council, Report No 22, AGPS, 1988

**ATMOSPHERIC LEAD: MAXIMUM 3 MONTHLY MOVING MEAN LEVELS FOR TWO MELBOURNE LOCATIONS, 1982-83 TO 1989-90**



Source: *Annual Report 1989-90*, Environment Protection Authority



considerably since 1983 when the lead content of petrol was reduced by 30 per cent. The introduction of unleaded petrol (ULP) in 1985 and the requirement that all cars manufactured after February 1986 must run on ULP will significantly reduce levels of atmospheric lead in the future; currently about one-quarter of Melbourne's motor vehicles are fuelled by ULP.

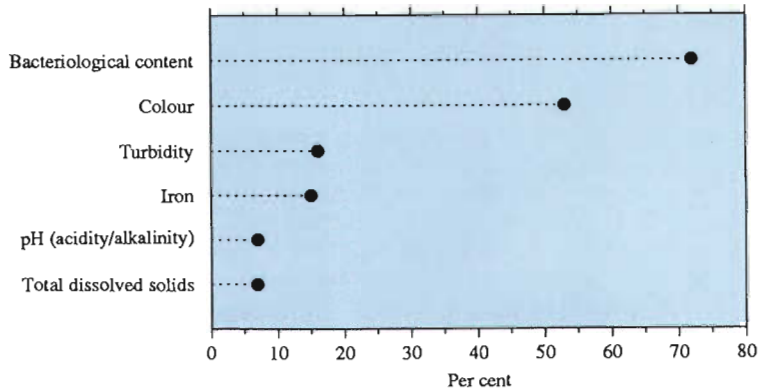
### Water pollution

A survey conducted by the ABS in 1990 revealed that water pollution was of greater concern to the Victorian public than any other environmental issue; nine out of ten Victorian households were concerned about this issue. Water pollution can be divided into two main types: the first is *point-source* pollution, in which the pollutant's source is localised and identifiable, for example the discharge drains of industrial or sewerage treatment plants. Effluent from industry often contains toxic substances, such as heavy metals, which can poison aquatic life or accumulate within the food chain, leading to the contamination of fish and other edible species. During 1990-91, levels of heavy metals were a problem in the lower Yarra River, and copper, chromium, cadmium and mercury exceeded acceptable limits in the Kororoit Creek. The discharge of heated water, after use for industrial cooling, can also be fatal to aquatic organisms. Sewage waste is the other main source of point-source pollution. In 1986-87 the Melbourne Metropolitan Board of Works (MMBW) received almost 300,000 megalitres of sewage for treatment. This waste, after treatment, is discharged into Bass Strait and Port Philip Bay at Werribee. Although raw sewage often contains high levels of bacteria and viruses which can cause disease, the most common pollutants in treated sewage waste are the water-enriching chemicals, nitrogen and phosphorous. High levels of these chemicals can result in highly detrimental algal blooms, such as those which have occurred in Lakes Colac and Burrumbeet and the Gippsland Lakes system. In 1985-86, up to 1.8 million kg of nitrogen and 0.6 million kg of phosphorous entered Victorian waterbodies from sewerage treatment plants.

Point-source pollution, however, is not a major problem in Victoria, because it is tightly controlled. Most effluent-producing industrial and sewage plants within the State are licensed and monitored by the Environment Protection Authority (EPA). Any breach of the licence, which specifies the maximum quantity and pollutant content of the discharge, can be prosecuted by law. Of much greater concern is *diffuse* water pollution, where the pollutant is derived from a large area, and is associated with land use practises. A major problem of this type within Victoria, is the high level of suspended solids (or silt) carried by the State's waterways; the Yarra River is notorious as an example. These suspended particles, which suffocate aquatic animals and kill aquatic plants by blocking out sunlight, are a product of the soil erosion occurring in cleared land and construction sites throughout Victoria. Water runoff from urban areas is also a problem as it is often contaminated by car oil, lead from petrol and seepage from septic tanks. Contaminated runoff of this sort is believed to be the cause of bacterial levels exceeding acceptable limits at several beaches in Port Philip Bay. Agricultural pesticides and herbicides, highly toxic to aquatic life, are also washed into Victorian waterways. The EPA is currently conducting a study of organochlorine pesticides, such as DDT and dieldrin, in the Ovens, King and upper Yarra Rivers. Similarly, agricultural fertilisers are a major contributor to the rising levels of nitrogen and phosphorous recorded in many of the State's water bodies.

Diffuse pollutants, are not only very difficult to control, but can also affect domestic water supplies. In 1987-88, eight per cent of Melbourne's population received drinking water which failed to meet the Australian Water Resources Council/National Health and Medical Research Council (AWRC/NHMRC) guide-lines for bacterial content. Yet by the more stringent World Health Organisation (WHO) standards, 92 per cent of Melbournians received water whose bacterial content was occasionally too high. Rural water supplies were even more severely affected; fewer than 7 per cent of people living in rural towns and cities, and only 6 per cent of all country towns, received drinking water which consistently met WHO standards for microbiological quality. Throughout rural Victoria there were also poor levels of compliance with WHO guide-lines for the physical and chemical parameters of drinking water.

**PERCENTAGE OF RURAL POPULATION WHO RECEIVED  
DRINKING WATER WHICH FAILED TO MEET WORLD HEALTH  
ORGANISATION GUIDELINES BY REASON, VICTORIA 1985-86**



*Source: Victoria's Inland Waters, State of the Environment Report 1988,  
Office of the Commissioner of the Environment*

### Resource conservation and waste disposal

Many of the products integral to our current way of life are produced from non-renewable resources, which may ultimately be exhausted. Fossil fuels are a prime example, with petrol, oil, gas and coal providing most of our energy. Often called the "throw-away society", the world's developed nations have been using non-renewable resources with little restraint, and in the process have polluted the environment with huge quantities of waste. In Victoria alone, 4.1 million tonnes of waste must be disposed of annually; almost one tonne for every man, woman and child. In 1990, eighty-nine per cent of Victorian households were concerned about pollution from the disposal of wastes. The re-use and recycling of waste materials not only reduces the amount of garbage produced (Victoria's waste could be halved by this means), but also helps to conserve resources.

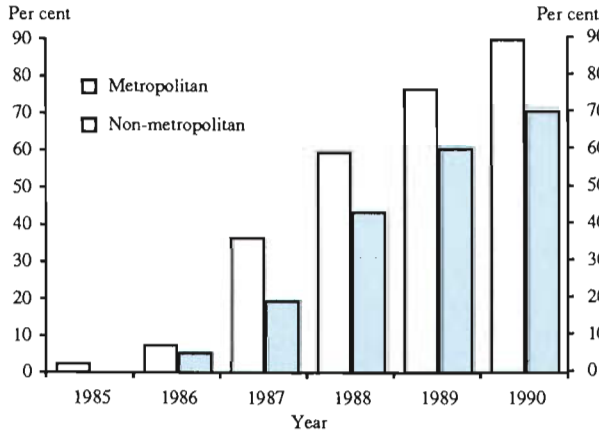
**TABLE 19 WASTE: CONTENT (BY WEIGHT) OF DOMESTIC GARBAGE AND  
LANDFILL, VICTORIA, 1990**

<i>Content of domestic garbage</i>		<i>Content of landfill</i>	
<i>Type of waste</i>	<i>Per cent</i>	<i>Type of waste</i>	<i>Per cent</i>
Food	36	Domestic garbage	35
Paper	21	Industrial waste	18
Glass	16	Garden waste	14
Plastic	10	Clean fill	11
Garden waste	7	Building rubble	11
Steel	5	Municipal waste	9
Aluminium	1	Large appliances, car bodies, tyres	1
Other	4		

*Source: Fourth Report, Victorian Recycling and Litter Advisory Committee, 1991*

In 1990, eighty-four per cent of the Victoria population had access to a kerbside collection of recyclable materials. An EPA survey of eight municipalities found that almost half the residents utilised this collection service. This level of participation (46 per cent) is higher than that of any other State. In October 1990, an ABS survey showed that 78 per cent of households were prepared to sort their rubbish for recycling, and 71 per cent actually did so at the time of the survey (Table 19). Half of the 1.1 million households who recycled their rubbish said that they did so to help the environment, with almost all (87 per cent) recycling glass, 58 per cent recycling paper, almost 40 per cent recycling cans and plastic and 29 per cent recycling garden waste. Of those who did not sort wastes, 10 per cent reported that they

**GARBAGE RECYCLING: PERCENTAGE OF VICTORIAN POPULATION WITH ACCESS TO A "KERBSIDE" COLLECTION, 1985 TO 1990**

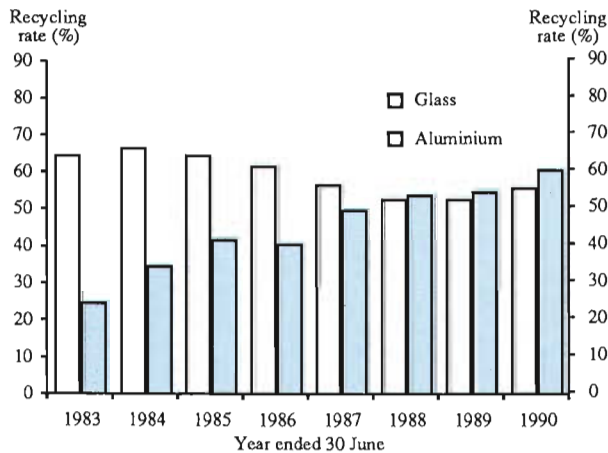


Source: Fourth Report, Victorian Recycling and Litter Advisory Committee, 1991

simply had not got around to doing it, and 18 per cent did not recycle because they did not have access to a kerbside collection service or did not know where to take the sorted material.

Currently, 61 per cent of all aluminium used within the State is recycled, as is 56 per cent of glass and 9 per cent of PET plastic. Paper recycling is more of a problem. Although the recycling of high-grade office paper has been very successful (in fact many Government Departments are now using recycled paper), the recycling of low-grade paper, particularly newsprint, has suffered due to a lack of profitable end market uses. The community's increased environmental awareness has led to the collection of large quantities of low-grade paper, and this glut of waste newsprint has caused the abandonment of many paper collection services. However, a commitment by the newspaper industry to build a de-inking plant at Albury-Wodonga will allow old newspapers to be used in the production of new ones, and provided that the scheme goes ahead, the future of low-grade paper recycling is assured.

**RECYCLING RATES FOR BEVERAGE CONTAINERS, VICTORIA 1982-83 TO 1989-90**



Source: Fourth Report, Victorian Recycling and Litter Advisory Committee, 1991

**TABLE 20 PERCENTAGE OF HOUSEHOLDS PRACTISING ENERGY CONSERVATION BY AGE AND HOUSEHOLD TYPE, VICTORIA, 1990**

	Percentage of households which							
	Have roof insulation	Have weather- seals on doors	Sort rubbish for recycling	Compost garden waste	Wash clothes in cold water	Have water- saving shower	Installed compact fluorescent bulbs	Have fluorescent tubes
Age of household's reference person - (a)								
15-24 years	22.2	22.6	52.9	26.3	48.2	5.5	3.0	53.0
25-34 years	53.4	35.1	67.3	45.1	58.1	13.2	3.9	60.6
35-44 years	72.6	38.2	74.0	56.5	51.5	16.2	5.5	66.6
45-54 years	74.0	35.4	72.9	57.7	49.1	18.4	6.8	70.1
55-64 years	73.3	37.1	74.6	61.0	44.6	19.6	5.0	76.9
65 years or more	65.5	36.7	71.8	55.8	35.9	11.1	2.2	72.7
Household type -								
Person living alone	47.8	32.8	61.7	34.8	34.2	9.4	3.1	62.4
Couple only	72.2	39.6	74.7	61.6	46.6	16.6	3.7	74.1
Couple & child(ren)	76.8	38.2	75.6	61.3	52.6	17.6	6.3	68.6
Single parent	58.0	35.4	63.6	46.0	54.9	12.0	3.2	63.8
Other	43.9	26.0	69.3	46.2	54.6	13.0	3.4	66.7
<b>Total</b>	<b>65.1</b>	<b>35.9</b>	<b>71.1</b>	<b>53.4</b>	<b>48.1</b>	<b>14.9</b>	<b>4.5</b>	<b>68.0</b>

(a) The person responding on behalf of the household.

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