

Phases of Ecological Impact of the European Occupation of Victoria.

Don Garden

Prepared for the Victorian National Parks Association

In the last 200 years the Victorian landscape and its ecosystems have been transformed by human action. More of Victoria has been cleared of its vegetation than any other Australian state, many species of flora and fauna have become extinct within its borders and many more are under threat. No region has evaded human impact, although some have suffered more than others. Environmental degradation has not stopped – rather, it has gathered pace in recent decades.ⁱ

The ecological impact of colonial and post-colonial exploitation can be seen to have occurred in a number of chronological phases. These phases essentially reflect four factors - not necessarily in order of significance they are: the number of humans inhabiting Victoria; the level/volume of their consumption; the principal economic activities they pursued; and the technologies available to them.

The phases were:

To the 1830s - Whaling and Sealing

1834 – 1851 - Pastoral Settlement

1851 – 1870 – Gold Era

1870-1901 – Selection Acts, Agriculture and Marvellous Melbourne

1901 – 1945 – Closer Settlement, Irrigation, Forestry

1945 - 1990 – Prosperity, People, Technology and Environmentalism

1990 – Present – Climate Change, Drought, Water and Fire

Aborigines and the Land

When the first permanent British colonists arrived in Victoria in the 1830s they did not find an empty and ‘pristine’ land, but one that had been occupied by humans for more than 40,000 years. The original settlers, the Aborigines, had not skimmed across the surface of the land leaving it untouched. Through fires, hunting, fostering the dingo and small-scale water engineering they had a considerable impact on species distribution and most likely contributed to the extinction of some species on the mainland such as the Tasmanian Devil and the Thylacine. Aborigines did not burn the temperate rainforests, and the full extent and frequency of their fires is somewhat debated, but they developed burning regimes in some habitat types

to clear land and pathways, to promote grasses that would attract game and to drive game. This burning contributed to the establishment and maintenance of the open wooded grasslands that occupied large areas of Victoria. In time, the Aborigines developed a sustainable economy that enabled them to survive for millennia.ⁱⁱ

Aboriginal environmental impacts were minimal compared with the transformations that have taken place in the Victorian landscape and biota since Europeans first landed upon its coastline. The new colonists introduced exploitative industries and a higher technology which, when fostered by a set of cultural attitudes that promoted ‘development’ and personal acquisition at the expense of the environment, have had a traumatic impact. Vegetation clearance, species loss, the degradation of water systems and atmospheric pollution are among the most obvious.

The Victorian Department of Primary Industries’ website divides the State into twenty-seven bioregions,ⁱⁱⁱ and in 2001 Traill and Porter designated nineteen Victorian bioregions.^{iv} Another scientifically-based and fine-scaled classification, the Interim Biogeographic Regionalisation of Australia (IBRA)^v is generally used by VNPA - it distinguishes twenty-eight terrestrial bioregions and five marine bioregions for Victoria. All these classifications use a range of attributes such as climate, geomorphology, geology, soils and vegetation to define areas. However, as an environmental historian I see Victoria as more simply and roughly divided into six main bioregions or vegetation and habitat types which are not only associated with vegetation and climatic zones, but also with the human industries that were established within them because of their environmental attributes and opportunities. These six regions shaped post-settlement economic and settlement patterns and are a good indicator of the relationship between bioregions and human settlement and exploitative patterns. However, for those who wish to associate what occurred historically with more scientifically-defined bioregions, I list the associated regions according to the DPI definitions.

The largest of my six regions was the temperate rainforest of the alpine and mountainous region of the Great Dividing Range that occupies the eastern third of Victoria, and includes majestic stands of alpine and mountain ash. Two other major outcrops of dense forest were found in the Grampians in the Western District and Otway Ranges on the western coast. All have relatively high rainfall, and the alpine regions have extensive seasonal snowfields. [The

main relevant parts of the DPI regions are: Victorian Alps, Highlands Northern Fall, Highlands Southern Fall, East Gippsland Uplands, Monaro Tablelands, Northern Inland Slopes, Central Victorian Uplands, Strzelecki Ranges, Greater Grampians and Otway Ranges.]

The central-northern part of Victoria containing the Goulburn Valley and Northern Plains is relatively flat open eucalypt woodland with a moderate-arid warm-hot climate. [The main relevant parts of the DPI regions are: Murray Fans, Victorian Riverina, Goldfields, and the eastern third of the Murray Mallee.]

The north-western corner, containing the Mallee and part of the Wimmera, is essentially flat, sandy country covered by low scrub and mallee eucalypts, and has a relatively hot and arid climate. [The main relevant parts of the DPI regions are: Murray Scroll belt, the western two-thirds of the Murray Mallee, the Lowan Mallee and the northern two-thirds of the Wimmera.]

The Murray River, Australia's largest river, forms the northern State boundary for these three zones.

The south-west, the Western District, has rolling volcanic hills interspersing flat woodlands, but more sandy and arid country in the far west. Because of relatively recent volcanic activity it has some of the best soils, and its proximity to the coast contributes to a reasonably reliable rainfall. [The main relevant parts of the DPI regions are: the southern third of the Wimmera; Glenelg Plain, Dundas Tableland, Victorian Volcanic Plain and the Otway Plain.]

The remaining terrestrial zone is a scattering of regions along the south coast where, behind the coastal dunes, there are significant patches of sandy soils and seasonal wetlands covered by low scrub and paperbark forests. These include Croajingolong, the Gippsland Lakes and parts of the shorelines of Western Port and Port Phillip Bay. These have an essentially temperate climate and a moderate rainfall. [The main relevant parts of the DPI regions are: the southern part of the Glenelg Plain, Warrnambool Plain, southern sections of the Gippsland Plain and the East Gippsland Lowlands.]

Finally, there is the oceanic or maritime zone along the coastline, including the two major bays – Port Phillip and Western Port.

One of the predominant climatic influences in Victoria is the El Niño Southern Oscillation whose extremes of El Niño and La Niña can result respectively in hot and dry periods (droughts) and cool and wet periods, in irregular cycles. El Niño influences are generally stronger and more damaging.

The combination of often dense and flammable vegetation with a climate that has periods of long drought and shorter periods of intense heat that are often driven by strong winds, has made Victoria one of the most combustible parts of the planet. Naturally occurring bushfires caused by lightning strikes happen periodically, but mainly it is human action, both deliberate and careless, that ignites and spreads the bushfires that dot most summers. At times these fires become major conflagrations that scar enormous areas of the landscape, causing death and destruction in both natural systems and human society. Among the largest have been Black Thursday (February 1851), central Victoria (February 1865), Red Tuesday (Gippsland, February 1898) Black Friday (January 1939), Ash Wednesday (February 1983), eastern Victoria (January and February 2003) and Black Saturday (February 2009).

Initial Responses

While some of the earliest explorers saw attractive elements in the Victorian landscape, many of the initial responses were quite negative as they were based on coastal observations made by naval explorers who were principally interested in the discovery of timber and the fertile soils and large rivers that would promote the sort of agriculture and trade that they knew in Britain, and had been fostered in the United States. The Victorian coast did not often present an attractive face to the ocean, being principally dense low forest or sandy coastal wetlands. The first settlement, at Sorrento in 1802-03, was abandoned after a few months because of the lack of good soil and water on the eastern side of Port Phillip Bay.^{vi}

The situation changed in the 1820s and 1830s when the expansion of sheep grazing in New South Wales and Van Diemen's Land brought a fresh evaluation of the landscape – what was now sought was the sort of open grassed woodland which covered much of inland Victoria, particularly the well-watered grassy volcanic plains that stretched westward from Port Phillip Bay to near the later South Australian border. The first inland exploration was by Hamilton

Hume and William Hovell who in 1824 crossed the Murray and travelled south towards Western Port and Port Phillip Bay, roughly along a line about fifty kilometres to the east of the present Hume Highway. Much of their time was spent struggling in difficult terrain, but they saw enough attractive land to give good reports.^{vii} Unfortunately, much of their praise was for what they thought was grasslands on the shores of Western Port; what they had actually seen was the Werribee plains on the western side of Port Phillip Bay. On this mistaken identification another government settlement was established at Western Port in 1826-27, but it was also short-lived because of the nature of the environment in that region.

Most responses to Victoria in the 1830s were much more positive because they involved men looking for and encountering open grassed woodlands. Reports by explorers such as the New South Wales Surveyor General, Sir Thomas Mitchell, who used the term 'Australia Felix' and potential pastoralists such as the Henty family, John Batman, John Pascoe Fawkner, Thomas Walker and Edward Curr, were generally very positive.^{viii} What they encountered was heavily grassed country (often of shoulder height) and water systems that had not been degraded and scattered trees and clumps of trees. Time after time, in Victoria and the other colonies, explorers and newcomers commented on the landscape as being like a gentleman's park in England. Their responses encouraged the rapid occupation of the region for sheep grazing.^{ix}

To the 1830s - Whaling and Sealing

The first European industries that impinged on Victoria involved the exploitation of marine life - the mammals and fish found along the southern Australian coastlines and the nearby Southern Ocean and Pacific Ocean. Exploitation commenced in the late eighteenth century with the discovery of large colonies of fur seals which occupied rocky outcrops along the coastlines. Their fur and body oils were highly valuable and parties of sealers from Sydney and Van Diemen's Land landed on the Victorian coast where they were easily able to club the semi-tame animals that were unused to predation. Their bodies were skinned, cut up and boiled down. The slaughter continued in and out of breeding season, some minor species were driven to extinction and others reduced to an insecure remnant. The industry had driven itself to extinction by the 1830s.

A similar pattern was followed by the whaling industry which exploited sperm and right whales that migrated each winter from Antarctica into warmer waters around the Australian coastline

and beyond. Whaling on southern Australian coasts grew into a major industry in the first three decades of the nineteenth century as local vessels joined dozens that came from Europe and North America. A number of whaling parties established shore bases in bays on the Victorian coast, venturing out to harpoon animals that were towed back for cutting up and boiling down. By the 1840s the wholesale slaughter had caused a population crash, and the industry died away, ceasing to exist in Victoria.^x

These industries had relatively little environmental impact on the continent apart from clearing small areas of land to grow crops, some hunting for food, timber cutting for fuel and construction and localised pollution from boiling down animal carcasses. The Aborigines did not fare so well, and many suffered from disease and exploitation.

1834 – 1851 - Pastoral Settlement

The inland settlement of the Port Phillip District of NSW was essentially brought about by the spread of sheep grazing for wool in the eastern Australian colonies in the 1830s and 1840s. High demand for wool by British textile industries neatly complemented the colonial need to find a suitable export product, and the availability of large areas of open grasslands and woodlands. The grasslands proved irresistible to colonists in New South Wales and Van Diemen's Land whose sheep in the 1820s rapidly occupied the most attractive and readily available land in those colonies. The export of wool became the major colonial industry, and from the early 1830s explorers and pastoralists began to move into the region that would become Victoria.

The first Victorian pastoralists and the first permanent settlers were the Henty family who came from VDL to establish themselves at Portland in 1834. In the following year John Batman, John Pascoe Fawkner and then others from VDL occupied the site of Melbourne and then Geelong and began to drive their flocks into the Victorian hinterland, particularly the Western District. From the north, across the Murray River, came overlanders from NSW who occupied a few grassy areas amid the forests of eastern Victoria, then much of the Northern Plains and Goulburn Valley and from there southward towards Melbourne.

The pastoral industry was set back by a drought and economic depression in the late 1830s and early 1840s but by the end of the 1840s sheep, and to a lesser extent cattle, were grazing over much of central and western Victoria. Only the arid country of the Wimmera and Mallee and the dense temperate rainforests of Gippsland and the Alps had not been effectively occupied and their Aborigines pushed aside. The Port Phillip District had a population of nearly 100,000 Europeans. There were a number of small ports and two principal export ports at Melbourne and Geelong, but there were no major inland towns and only a few small centres such as Hamilton, Buninyong and Seymour.^{xi}

This growth of the pastoral industry caused considerable environmental damage, although in this early phase it was relatively limited and was confined mainly to the areas that had been intensively grazed. In later decades, as the industry became more established, cleared more land, built dams and tanks, cut timber for fences and other constructions and introduced foreign grasses, the impact would be multiplied.

Sheep and cattle do great damage to vegetation, soils and water systems. Australian marsupials walk on soft pads which have far less impact on soils than the hard cloven hooves of sheep and cattle. The introduced animals numbered hundreds of thousands and they compressed, cut and churned the soil, opening the way for invasive species of vegetation, soil erosion and the siltation of streams. In such numbers, sheep and cattle also did great damage to indigenous vegetation. They tore at it rather than biting it cleanly, and ate preferred species so severely that they killed the plants or weakened their capacity to regenerate or withstand drought. This also opened the way for less favoured species and invasive plants, and reduced habitat for indigenous fauna.^{xii} Sheep and cattle naturally tend to gather along streams and near watering points, eating out neighbouring vegetation and churning the soil on the banks and in stream beds, all of which does considerable damage to the water systems. The washing of sheep to clean their wool before shearing or to attack disease also introduced quantities of soap and chemicals (including arsenic) into streams.

Early pastoralists periodically burned the land to clear it of scrub and to encourage the growth of fresh grasses. This alteration of fire regimes from those that Aborigines had used for thousands of years impacted on floral distribution and thereby altered faunal habitats. When such practices were introduced into the Australian Alps by later generations of cattlemen, they

were particularly damaging. Cattle trampling and feeding also contributed to the transformation of ecosystems and threatened the existence of some species of flora and fauna.^{xiii}

One of the most graphic accounts of the rapid damage from early sheep grazing was given in 1853 by John G. Robertson from Casterton. When he arrived in 1840 it was ‘splendid country’ with excellent grasses and free of weeds – ‘all the landscape looked like a park with shade for sheep and cattle’. For three or four years little changed, but some indigenous plants began to disappear, replaced by invasive weeds. As the deep-rooted native grasses died out the soil began to dry out and crack and there were hundreds of landslips. As the land was ‘trodden hard with stock, springs of salt water are bursting out in every hollow or watercourse, and as it trickles down the watercourse in summer, the strong tussocky grasses die before it, with all others’. The resulting bare land was further eroded by the action of sun and rain, and the run-off muddied the creeks and rivers. ‘Ruts, seven, eight, and ten feet deep, and as wide, are found for miles, where two years ago it was covered with tussocky grass like a land marsh.’^{xiv}

The pre-eminence of wool-growing as the principal economic activity was suddenly challenged when gold was discovered in 1851 – it brought even greater environmental impacts.

1851 – 1870 – Gold Era

Gold was discovered in the central region of the newly-separated colony of Victoria in 1851, stimulating a great rush of diggers and other immigrants, at first from the Australian colonies and then from overseas. In the next two decades gold was found and mined in many areas of the colony and took over from wool as the principal export industry. Gold mining remained a significant economic activity and environmental influence for the rest of the century.

This influx of immigrants and the direct effects of gold mining caused a rapid and far-reaching impact on Victorian ecosystems. These effects fall essentially into three categories: population and urbanisation; the environmental impacts of gold mining; and the stimulus to agriculture and (to a lesser extent) to the pastoral industry.

Developments associated with the gold rush and the later gold mining industry brought people to Victoria and scattered them across the landscape in significant numbers. The population jumped from nearly 100,000 in 1851 to 540,000 in 1861 and then to nearly 750,000 in 1871. Meanwhile, Melbourne rose from about 23,000 to 125,000 in the 1850s and to 207,000 in the 1860s. Geelong grew considerably and two new cities were established at Ballarat and Bendigo. Equally importantly, a multitude of new gold towns was scattered across the colony, including Clunes, Stawell, Beechworth, Castlemaine, Woods Point and Walhalla. In 1871 there were fifty-one towns with a population of more than 1000.^{xv}

Such numbers of people and urban centres had significant environmental implications, especially given that Victoria had one of the wealthiest communities on the planet for that time, with high standards of living. While many lived in relative poverty, Victorians ate more and consumed more material goods than most humans, which meant that their ecological footprints, both personal and those of their urban centres, were large and placed pressures on available resources. Increased numbers of Europeans who were determined to tame the land and to extract a living from it also took an enormous toll on indigenous fauna. Through clearing of habitat, the introduction of predators, deliberate killing for food and as ‘sport’ or just casual slaughter, populations of mammals, reptiles and birds were plundered.^{xvi}

Increasing volumes of food were produced at distance from the large urban centres, and manufacturing industries were established to meet the demands of townspeople, miners and agriculturalists – all with the usual environmental implications. Roads, telegraph lines and railways were carved across the countryside. Building materials were manufactured (timber and stone), land was cleared, rivers and creeks dammed or diverted for domestic, mining and farm water, and untreated human waste was poured in great quantities into the environment. Innumerable new species of flora and fauna were introduced into homes, gardens and farms, including domestic cats, dogs, foxes and rabbits, all of which took their toll on indigenous mammals and flora.^{xvii} Ecologically, large areas of Victoria were being transformed.

A prime example of Melbourne’s impact was the construction of the Yan Yean reservoir on the upper reaches of the Plenty River. As its name suggests, to that time the Plenty was a significant stream with a deep gully that snaked its way to the Yarra. However, once its upper reaches were diverted into a new reservoir, from where water was first released into Melbourne in

December 1857, it was plentiful no more. Yan Yean was Australia's first large dam and without it Melbourne's development may have ground to a halt.^{xviii} However, its construction confirmed three environmentally destructive patterns. First, as the Yarra was no longer needed for potable water, it was made freely available to serve as Melbourne's main drain for effluent. Second, it demonstrated the community acceptance of the ecological destruction of both the wetland at the headwaters of the Plenty and of the Plenty itself, in the name of human progress. Third, it manifested the spread of the city's ecological footprint.

Gold mining also had direct environmental impacts in three ways: localised damage from digging and the spread of subsoils as mullock or tailings; the clearing and consumption of timber; and the degradation of water systems.^{xix}

The industry developed in a series of phases. Until the middle of the 1850s the predominant form involved the digging of alluvial gold which occurred as flakes, specks and small nuggets in surface soil, in gravel and silt in creek beds and in the beds of ancient, buried streams where it was reached by shafts. Mostly, the gold was separated from the silt by frequent washing in water. Mining regions were scarred as vegetation was removed and volumes of soil and rock were dumped on the surface. Streams were diverted and the water was used for washing before carrying its body of silt downstream. Siltation, weed invasion, destruction of timber and vegetation and loss of fauna species resulted from all this, and from the use of fire to clear the land.

The second phase, from the late 1850s, focussed on the discovery and crushing of gold-bearing quartz that was most commonly found buried below the surface, often at great depths. To mine it required deep shafts and sophisticated engineering and technology including steam-driven winding wheels and quartz batteries or stamping machines. These consumed even greater volumes of water which in turn fostered hydraulic projects to dam and divert creeks and rivers. The first major diversion was the Coliban scheme in the 1860s which involved a series of reservoirs and aqueducts across the region between Kyneton and Bendigo.^{xx} It was very expensive and ultimately unsuccessful. Some mines also dispersed chemicals, such as arsenic, which were increasingly used in extraction processes.

This phase also annually consumed hundreds of thousands of tonnes of timber for pit props, fuel for steam engines, firewood and construction of fences, buildings, etc. Vast areas of central Victoria were stripped of much of its box-ironbark and other forest types, but concern about the loss of timber also contributed to the first efforts at forest conservation from the 1860s. Under various pieces of legislation and regulation, timber reserves and state forests were set aside totalling 960,853 acres by 1874.^{xxi}

Mining decreased in significance after the 1860s, but was still an important industry in some regions for many years. From late in the nineteenth century it entered a third phase with the introduction of hydraulic and water-based systems in which huge steam-driven water hoses blasted away creek banks to gain access to alluvial deposits, and large dredges worked their way down creeks, digging up and processing a swathe of land as they went. Both forms did irreparable damage to water systems, while dredges also spread large areas of mullock that created a wasteland that would grow little more than weeds.

The third major effect of the gold era was the stimulus it gave to agricultural industries, mainly because of the greatly increased demand for food. There was a heightened volume of land clearance and conversion of pastoral and other land to agricultural production. Initially this was largely close to Melbourne and the main mining centres, but as roads improved and railways pushed out from Melbourne they enabled the viable agriculture at much greater distances.

The pastoral industry was pushed in diverse directions. The greater population opened a large new market for meat, but the mounting pressure on arable land for food production meant that sheep and cattle grazing was also pushed further into areas that had not been occupied prior to the 1850s.

Following permanent settlement, especially with the population explosion that accompanied the gold rushes in the 1850s, a commercial fishing industry was established. Initially it was concentrated in Port Phillip Bay to supply the Melbourne market. Fleets were established at such places as Frankston and Mordialloc but they died away in later decades, although whether that was more a result of declining fish numbers or the extensive pollution of the Bay is unclear.

It was agrarian development that would be the dominant factor in the remaining decades of the nineteenth century.

1870-1901 – Selection Acts, Agriculture and Marvellous Melbourne

From 1870 until the end of the nineteenth century was a significant phase in Victoria's ecological and general history as the colony readjusted after the rawness of the gold era and developed a more complex and sophisticated modern society and economy. While both the population and the economy grew significantly, there were periods of spurts and slowdowns. The economy was particularly erratic, most notably a boom in Melbourne in the 1880s that was followed by a profound depression in the early 1890s.

Victoria's population nearly doubled from 540,000 to over 1.2 million between 1871 and 1901, a significant part of which occurred in the 1880s. Both Victoria's rural and urban populations grew in size and significance, although not evenly.

The period was marked by a major increase in the agricultural industry. As gold mining had begun to decline in the 1860s, employing fewer people and playing a less predominant role, there was a profound need for readjustment of the Victorian economy. Immigrants were still arriving in numbers, but employment opportunities were shrinking as gold declined. Colonists were concerned that Victoria would not hold its population or remain attractive to newcomers unless some new employment were found. One of the potential solutions was to take the land back from pastoral licence holders and to make it available for small farmers.

To do this would provide food and employment for the colonists, but it would also promote one of the culturally significant aspirations in settler societies in Australia, New Zealand and the United States – the creation of a yeoman farmer society. The goal was to subdivide the land into small farms, each tended by its own independent farmer with his wife and children, who would live a life of hard yet uplifting work producing food for those who lived in the city. This dream was associated with the contemporary belief that rural life was morally and socially superior to urban life - closer to God's wish that the land should be cultivated and made productive. Farming was good, producing food was good, and farming should become the backbone of the colony.

This combination of pragmatism and aspiration underlay the passing of a series of Selections Acts in the 1860s, 1870s and 1880s. The first of these in the 1860s were not successful and resulted in much of the land in the Western District being acquired as freehold by pastoralists. Later legislation from 1869 onwards was more successful, resulting in large areas of the Northern Plains and Goulburn Valley being broken up into farms in the 1870s, followed by parts of Gippsland and the Wimmera. All this resulted in the clearance of millions of hectares of indigenous vegetation, with consequent ecological implications.

Acquiring land was only the first of a series of challenges that faced farmers, and a significant proportion failed. Little land in Victoria was suitable for the sort of intensive agriculture on small holdings that was envisaged. Much of the soil is fragile and has limited fertility, while the irregular climate (El Niño - droughts and La Niña flooding rains), especially droughts, made survival, let alone success, rather tenuous. On top of that, the nature of the land and climate meant that 'small' farms in Australia needed to be much larger than was common in Britain and Europe where a few acres intensively farmed could support a family at a subsistence level. In Victoria, grants of 320 acres or even 640 acres became the norm, and even larger in more arid areas. Even then, there was a high attrition rate and there was a trend towards consolidation of blocks in the hands of smaller numbers of successful farmers operating on a broader scale.

The weather played a significant role, too. There had been periods of severe drought in the second half of the 1860s, but the first half of the 1870s was quite wet and the second half slightly less so, which promoted small-scale agricultural success and encouraged more people onto the land. By contrast, the first half of the 1880s was quite dry and, following a wet year in 1887, there was a profound drought in 1888. Until the middle of the 1890s the seasons were then generally satisfactory, but from about 1895 until 1902 was the exceptionally dry period known as the Long or Federation Drought. These ups and downs were part of farming life, but contributed to attrition.^{xxii}

Selectors in Gippsland and the Wimmera faced even more extreme challenges. In Gippsland the dense rainforests had to be cleared by human and animal muscles and axes before farming could start. In one of the greatest ecological tragedies in Victoria, millions of trees were ring-

barked, felled and burned. In purely commercial terms, today the timber would be worth billions of dollars.

In the Wimmera and more arid regions, the problems included both clearing the dense scrub and the challenges of farming in poor soils and in a dry climate. The application of phosphate fertilisers (when they could be afforded) provided some fertility, but had environmental impacts on indigenous flora and water systems. The development of dryland farming involved particular challenges, including the potential rapid erosion by rain and wind of exposed friable soils. A farming technique that was introduced in these years and continued into the twentieth century was particularly harmful – dry fallowing. This involved repeated fallowing of the land to keep it bare between crops, in the mistaken belief that it would help retain moisture and increase fertility. What it did, in fact, was break down the soil's structure and facilitate erosion. It took many years and much land damage before this technique was abandoned.^{xxiii}

Compounding all these difficulties was a particularly damaging man-made disaster – the millions of rabbits that had occupied much of Victoria since they were introduced in the late 1850s. Their destruction of crops and pasture is incalculable in its immensity, as is their impact on indigenous flora and fauna. However, they did produce new complementary industries – rabbit exterminators and trapping for human consumption.^{xxiv}

A 'solution' to the dry climate towards which theorists and farmers increasingly turned was irrigation. It was argued that there was not a shortage of water, but a maldistribution – rain fell in the wrong places in the wrong volumes and at the wrong times. This limitation could be overcome, it was believed, by damming the rivers and creeks and then releasing water when it was required.

A few small-scale schemes were set up by individuals and water trusts in the 1860s – 1880s, but it was apparent that the capital costs and technical difficulties required a much more holistic approach by the government. One of the most grandiose private proposals in the 1870s was the Grand Victorian North-Western Canal, to start at Murchison on the Goulburn River and traverse Victoria, intersecting and picking up the waters of several rivers, storing in a series of reservoirs, and finally connecting to both the Murray River and to the sea at Portland. The

scheme was never able to gain sufficient support to commence, which is most fortunate as the environmental impacts would have been immense.

In 1884 government Minister Alfred Deakin was appointed to head a Royal Commission on the development of irrigation in Victoria. The resulting legislation in 1886 provided for a 'national system' in which the government took control of all waters and of the overall planning to build large reservoirs and canals, while providing loan funds to local trusts to carry out local distribution. The first 'national' project was the Goulburn reservoir near Nagambie. However, there was little development of irrigation before the end of the century because of costs and technical problems compounded by the Federation Drought.

Nevertheless one scheme was initiated that would become a leader in irrigation in the new century. Canadian Americans George and William Chaffey came to Victoria in 1886 hoping to advise on irrigation and set up irrigation schemes. George Chaffey was eventually able to negotiate to acquire a large area on the Murray River at Mildura for an irrigation colony. Work commenced in the late 1880s, the town was laid out and there was widespread advertising to attract farmers to take up blocks. While there were some good results, the settlement struggled with drought and the problem of transporting produce to market. It was not until the railway opened early in the new century that Mildura progressed.^{xxv}

This was only the start of irrigation development, and of the associated environmental repercussions, both of which would greatly increase in scale in the next century and will be discussed in the next phase.

Ironically, two major landscape transformations were, in effect, the reverse of irrigation – the drainage of wetlands. At that time the ecological significance of wetlands was not understood and 'swamps', as they were negatively termed, were seen as wastelands. They were another 'problem' with the environment that could be 'improved' by technology. The Carrum Carrum Swamp was a large, low-lying region behind the coastal dunes on the eastern side of Port Phillip Bay between Mordialloc and Frankston, and stretching for up to five kilometres inland. It was seen as a barrier to Melbourne's progress, and as a waste of good farmland, so drainage began in the late 1870s, focussed on the digging of the Patterson Cut – now Patterson River – the main outlet drain. Despite enormous technical difficulties and setbacks, the region was drained

over the next two decades, and after being farmed for some decades is now mainly covered by suburbs. On the northern shores of Western Port was the even larger Koo Wee Rup Swamp which was similarly drained from the 1880s to provide farmland.^{xxvi}

Another major trend in late nineteenth century Victoria was the advance of urbanisation. The proportion of Victorians living in urban centres rose to about 60% at the end of the century, which was very high by world standards. An increasing percentage of these were in Melbourne where about 43% lived, with another 17% in other urban centres.

This high urban population and the unusually high percentage in Melbourne was the result of a number of factors. Perhaps the major one was environmental – the fact that few if any parts of Victoria (or Australia) were capable of supporting the sort of intensive agrarian populations that were common in pre-industrial Europe and Asia, or even large areas of North America. The limitations imposed by soils and climate meant that the two major agrarian sectors, pastoralism and agriculture, needed large areas for relatively small volumes of production, and these were managed by a small labour force. The pastoral industry employed few people to care for large areas and many animals, while Victorian family farms were relatively large, so rural regions had low population densities. As the gold industry declined, the economic purpose of most country cities and towns (including many newly emerging ones) was as service centres for the small rural populations. For that reason, and because of the overwhelming economic power of Melbourne, few towns achieved significant size.

Melbourne, on the other hand, grew rapidly, especially during the boom years of the 1880s. Its population reached nearly half a million at the end of the 1880s, but when the depression of the early 1890s set in Melbourne's growth faltered and at the end of the century was 494,000. During the boom it became an impressive and prosperous city, for a period the seventh largest in the British Empire boasting extravagant and grand buildings, one of which was briefly the world's highest building. The city and its ever-spreading suburbs were serviced by a sophisticated public transport system of railways, cable tramways and horse-drawn vehicles. An illustration of its prosperity was that Melbourne had an exceptionally high proportion of home ownership.^{xxvii}

The city's role and power were encapsulated by the pattern of Victorian railway development, as all major lines radiated out from Melbourne. These helped to channel most port trade, commerce and industry through the capital, which also developed a sophisticated range of secondary industries. The city's ecological footprint grew as it sucked increasing volumes of food, water, building materials and timber from its hinterland into 'Marvellous Melbourne'.

An alternative name was 'Smellbourne', for all was not well. Prosperous citizens concentrated in the suburbs that expanded into the undulating country on the eastern and south-eastern sides of the city, while low-lying areas along the Yarra such as Collingwood became polluted slums and the site of many noxious industries. To the west, the banks of the Maribyrnong River around Footscray increasingly became the centre of animal processing and other noxious industries. The filth flowing from the factories often poured into open drains that passed through the suburbs and into the Yarra and Maribyrnong Rivers. Aquatic life was killed the ecology of the Bay was damaged.^{xxviii}

The disposal of human waste added to the pollution flowing from the city. The smells from open drains and backyard privies made it an inescapable part of urban life for most residents. Sanitation was a major problem, compounded by an inefficient system of collection of human waste by 'nightmen' – some of it used as fertiliser on Moorabbin market gardens. Finally a Royal Commission on the Sanitary Condition of Melbourne in 1888 resulted in the establishment of an authority to undertake the construction of a deep sewer system in the 1890s, focussed on a pumping station at Spotswood that sent the waste to a 'sewerage farm' at Werribee.^{xxix}

One effect of the loss of forests and other damage to the environment was a stirring of the first attempts to establish conservation controls and protected areas. It was a movement that grew further in the twentieth century and will be discussed in more detail in the next phase. However, it is worth noting that the first environmental and recreational reserve in Victoria was in 1866 when 600 hectares was reserved at Tower Hill near Warrnambool to preserve some of what was left of that geological and ecological jewel. Other aesthetic and recreational bush reservations were established at Fern Tree Gully in 1882 and later at Mount Buffalo and Wilson's Promontory. In 1892 Tower Hill became the first Victorian National Park, although by then it had lost most of its natural vegetation.^{xxx}

1901 – 1945 – Closer Settlement, Irrigation, Forestry

The first four and a half decades of the twentieth century brought essentially a continuation or extension of the economic and environmental patterns set in the last decades of the previous century. It was not an easy period in many respects, being punctuated by two world wars and the major economic depression in the 1930s. Changes were more a matter of degree than kind as agricultural and urban industries continued to grow, the pastoral industry was static and gold mining was replaced by timber as the main extractive industry. Victoria's population nearly doubled from 1.2 million in 1901 to 2.3 million in 1951.

There were, however, two major areas of transformation that would have long-term significance for the planet's climate - brown coal mining and hydro schemes for electricity generation, and the rapid adoption of motor vehicles.

The introduction of electricity in Melbourne dated back to the 1880s and it had been progressively adopted since then, generated in small power stations using black coal imported from NSW. (The Wonthaggi State Coal Mine operated from 1910, but its black coal was used for Victorian Railways' steam engines until electrification began in the 1919.) It was known that there were large deposits of brown coal in the La Trobe Valley, but its poor quality and high moisture content meant that it was technically difficult and not economic to use until the development of new processes early in the century. In 1920 the State Electricity Commission of Victoria was established to mine brown coal from an open cut at Yallourn. The dried coal was largely used to generate electricity which in coming years was distributed by an expanding network of high voltage transmission lines. Some coal was dried and compressed into briquettes which became a major source of industrial and domestic energy and heating. It was not fully understood at the time that brown coal processing had a long-term climatic effect by releasing carbon dioxide and other pollutants into the atmosphere. Nevertheless, this relatively cheap source of energy enabled Victoria to maintain its position as a major industrial and manufacturing centre.^{xxx}

The generation of electricity by water power also had many supporters because it was seen as a 'cleaner' source and boasted extra efficiencies, since water that was dammed for irrigation could be used to generate power when it was released. As a result, parallel with Yallourn during the 1920s, the SECV commenced development of hydro-electric power at five stations on the

Rubicon, Royston and Goulburn Rivers. The largest project was the construction of the first stage of Eildon Reservoir on the upper reaches of the Goulburn, which began generating in 1929. Despite its clean image, hydro power has deeply damaging environmental impacts on water systems and associated biota because of the flooding of dam sites and the profound disruption of downstream flows.

The internal combustion engine also commenced its major impact on the atmosphere from the beginning of the century. Cars, buses and trucks were a fast, flexible and convenient form of transport that were quickly developed and adopted. By 1930 there were 125,000 privately registered cars, 25,000 motor cycles, 626 buses and 231,000 licensed drivers and riders. Despite some attempts by the government to limit their impact on the railways in which there had been such an enormous investment, the growth of road transport was inexorable. So, too, was the impact of their exhaust on the atmosphere.

Among primary industries, sheep growing for wool and meat remained fairly static in numbers and production. By contrast, agriculture grew significantly. The area under cultivation in Victoria rose from 1.5 million hectares at the start of the century to 2.6 million hectares in 1921 and 3.8 million hectares in 1931. Wheat remained by far the main product, assisted by advances in farming equipment such as lighter motorised tractors and combine harvesters, and increased use of superphosphate. Until the 1920s dry fallowing was still practised in some areas. As wheat prices fell in the 1920s and into the depression years, there was greater pressure on farmers to grow more. As a result, many over-worked their land. The 1930s brought huge problems of erosion and degradation, dust bowls, sand drift and dust storms as damaged soils combined with rabbit damage and over-clearing to leave the land bare and vulnerable. Victoria lost large volumes of its 'soil capital'. After years of denial and resistance, in 1940 the government passed a Soil Conservation Act which established a Soil Conservation Board.^{xxxii}

Developments in agriculture included the intensification of closer settlement and the allied wider introduction of irrigation. The 1904 Closer Settlement Act was the first of a series of legislation prior to WWI which provided for the compulsory acquisition of broad acre properties for subdivision as small farms. The main sites were in the Goulburn Valley, Western District, Wimmera and along parts of the Murray River. As not enough Victorians were interested in

becoming farmers, there were campaigns to attract British immigrants. By 1914 more than 4000 farms had been taken up. After WWI and during the 1920s soldier settlement schemes and closer settlement schemes took over another half million hectares scattered across diverse parts of Victoria, from Gippsland to the Mallee. Again, substantial further areas of trees and ‘scrublands’ were cleared. It seems that little had been learned and despite some attempts to make the schemes more effective, there was a very high failure rate. Lack of experience and capital, inadequate government support, rabbits and pests compounded the problems of soil and climate.^{xxxiii}

There were renewed efforts to overcome climatic limitations with irrigation, at times in conjunction with closer settlement. The 1905 Water Act established the State Rivers and Water Supply Commission which was given control over inland waterways, the ability to impose compulsory rating of all rural properties to finance waterworks, and the power to distribute water ‘rights’ to farmers. In theory it seemed an excellent system but it was deeply flawed. Over time the SRWSC allocated the ‘rights’ to considerably more water than was available, while the term ‘rights’ carried with it an enhanced expectation of the ownership and volume of water due to those to whom it was theoretically allocated.^{xxxiv} Overcoming these concepts would be a major challenge to authorities in the late twentieth and early twenty-first centuries.

Irrigation gathered pace, spurred by droughts and fed by a belief that arid land could be converted to production by simply conserving and adding water. Some of the post-WWI soldier settler and other closer settlement schemes were irrigation settlements devoted to a mixture of orchards, vineyards and irrigated pasture for dairying. Increasingly the state’s rivers were dammed and the waters redistributed. The Glenmaggie Weir on the Macalister River in Gippsland, for example, was dammed for irrigation in the 1920s. Between 1914 and 1940 the area under irrigation in Victoria increased from about 40,500 hectares to 240,000 hectares.

Dairying also benefited from the introduction of irrigated pastures in regions such as the Goulburn Valley. Butter manufacture for Melbourne residents and export to Britain had emerged as an important industry in the 1890s when new technologies had promoted the establishment of numerous regional butter factories whose produce could be transported and exported by refrigerated railway cars and ocean vessels.^{xxxv}

While initial returns from irrigation of orchards, crops and pasture were often good, by WWII there was increasing evidence that irrigation was causing waterlogging and salinisation. Nothing was done to alleviate the situation and salinity became major problems in later decades.^{xxxvi}

From the earliest years, cutting timber to clear land and for materials and fuel had resulted in the loss of trees across huge swathes of Victoria. Into the new century the process increased as more land was cleared for farms and the demand for construction timber saw professional timber cutters working their way into the hills and mountains to the north and east of Melbourne. A loose system of timber licences and conservation reserves had developed in the nineteenth century, but dissatisfaction with the system had resulted in the appointment in 1897 of a Royal Commission to examine these controls and the development of a better conservation system. The Commission reported in 1901 but it was not until 1907 that a Forests Act was passed. It established a Department of State Forests under a Minister for Forests who together were intended to supervise timber harvesting while establishing a higher level of conservation control over timber on Crown Land through a reserve system. The Forestry School at Creswick was opened in 1911 to train foresters in this work, and the Forests Commission of Victoria was established in 1918 to facilitate access to the forests by the timber industry.^{xxxvii} The industry left a now-disappearing legacy of light railway lines and bridges and remote mountain towns. Some of those towns and other settlements that have now disappeared were destroyed in the tragic Black Friday bushfires of 13 January 1939 when 71 people died and large areas were burned.^{xxxviii}

Melbourne continued to be the dominant economic and demographic force in Victoria with the continued growth of its population and industrial and commercial base. The population passed the million mark at end of the 1920s, about 57% of the State population. The suburbs spread mainly along the transport corridors to the east and south-east of the city, while the north and west were generally less favoured. To meet the city's water needs, new reservoirs were established at Maroondah (1927) O'Shanassy (1928) and Silvan (1932).

in the later decades of the nineteenth century and into the twentieth century commercial fishing spread well beyond Port Phillip. Along the coast and in the Gippsland Lakes, commercial fishing was established at port towns such as Port Fairy, Portland, Warrnambool, Lakes Entrance and San Remo. At first these involved essentially coastal fishing, but in due course

ocean-going vessels moved well into Bass Strait and beyond. A major challenge was to deliver the catch to the Melbourne market in edible condition. Initially catches were salted, but transportation became much easier following the development of ice making and refrigeration, and the spread of the railway network with refrigerated vans.

Coastal species taken from Victorian waters included barracouta, snapper, flathead, crayfish (now southern rock lobster), King George whiting, abalone and squid, while deep sea species include rockling, hoki, blue eye trevalla and bluefin tuna.

All these trends towards a higher level of exploitation of Victoria's land, flora, fauna and water systems caused mounting concern among a minority of the population and stimulated early moves towards conservation. However, rather than the main anxiety being the loss of species or ecological systems, the motivation underlying most early conservation was an anthropocentric preoccupation with the need to preserve natural elements for human future use as resources or for recreation.

As mentioned above, some of earliest protection in Victoria in the nineteenth century involved the establishment of timber reserves on Crown lands for the conservation of forests for future timber use, and in some cases for protection of water catchments. Melbourne was one of the few places in the nineteenth century to protect areas around water catchments, banning timber cutting, grazing animals and human activities in the interests of a more reliable supply of purer water. This practice continued into the twentieth century and, although recent governments have allowed access to timber companies, it endowed Victoria with an immensely valuable stands of old growth forest relatively close to Melbourne. Sadly, large areas were burned out in the bushfires of February 2009.

Other conservation motivations that grew stronger as the decades passed were the emotional, aesthetic, recreational and scientific interests in the Australian bush. The 'bush' came to be seen as less alien and threatening than it had been in earlier decades, becoming a place for picnickers, bushwalkers and naturalists to enjoy for recreation, exercise and study – a place for education, leisure and pleasure. There was also increasing pride in the bush and the outback as being distinctively Australian and playing a role in the shaping of the Australian character and source of identity.

The protection of birds became popular. The Royal Australian Ornithologists Union was established 1901, followed by the Gould League of Bird Lovers in 1909 which was organised through the Victorian Education Department to encourage school children to value Australian birds for purposes other than egg collecting and shooting.

Bushwalking or hiking was a favoured activity from about the 1880s and underwent a boom in inter-war years. Bushwalking clubs and naturalist clubs lobbied authorities government to preserve 'wilderness' areas, and were instrumental in the further establishment of national parks. A Council for the Preservation of National Monuments was formed as a subcommittee of the Victorian Field Naturalists Club in 1936 and drew up a list of places for preservation which included some wilderness areas and natural sites.^{xxxix}

Such activities produced some progress in having areas partly protected. In 1905 Wilson's Promontory became Victoria's second national park, and in 1909 more remote areas were reserved at Wingan Inlet, Wyperfeld and Mallacoota, although they had only vague status and limited protection until 1956.

The years after WWII would bring a renewed attack on the Victorian environment, but at the same time give birth to an eco-centred environmental movement and a number of new organisations including the Victorian National Parks Association.

1945 - 1990 – Prosperity, People, Technology and Environmentalism

Despite all the earlier environmental repercussions of European activity, it is the post-WWII period which brought the greatest spurt of 'development' and environmental degradation, but also a much more significant assertion of environmental care and protection.

In essence, there was a complex web of causal interconnections. Rapid developments in technology transformed human life, stimulating prosperity and population levels that in turn triggered a wave of consumption of the resources of the State (and more widely of the planet), and with that came an increase in a wide variety of environmental pollutants and forms of degradation. In response, there was a major growth in environmental thought and protective actions, although insufficient to stem the tide.

A large-scale post-war immigration programme and a 'baby boom' caused the Victorian population to jump from 2.3 million in 1951 to about 4.25 million in 1991, placing enormous pressure on the ecosystems of the State. Melbourne again dominated, its population outpacing the State and increasing to 3.157 million in 1990. New reservoirs were built in the hills and mountains east of Melbourne to try to meet water demand, namely the Upper Yarra (1957), Greenvale (1971), Cardinia (1973), Sugarloaf (1981) and the Thomson (final stage 1983). However, in the 1980s the authorities also sought to reduce consumption by promoting wiser use (the 'Don't be a Wally with Water' campaign) and controls (compulsory dual-flush toilets).

Not only was there a rise in the number of people, it was a period of generally sustained prosperity. The lives of citizens was transformed as new and/or cheaper technologies could be acquired – motor cars, refrigerators, washing machines, dishwashers, television sets, and more clothing and recreational equipment were only part of the mountains of new personal property. To house the population involved a relentless expansion outward from the city, covering the landscape with new suburbs. The houses that were being built were increasing in size, too, a reflection of the prosperity and of the increasing volumes of possessions. In the 1950s homes built by A.V. Jennings ranged from about 100m² to 124 m². In the 1980s the median of the Jennings range was about 131 m² but with some models up to nearly 350 m². A high proportion of homes now included four bedrooms (compared with two in the 1950s) and such facilities as en suite bathrooms, a family room and other recreational zones. All this represented greater consumption, more resources drawn from the environment and increased pollutants and emissions.

To meet the demand for food involved increasing intensification of agriculture. This began with more soldier settlement schemes after the war, but was continued by technologies that changed many aspects of farming. Bulldozers and chain saws epitomise the period, making land clearing and timber felling much easier and cheaper, all of which was officially sanctioned by a taxation system that offered deductions for 'improvements' such as clearing. The application of trace elements, chemical fertilisers and pesticides (such as DDT and 2-4-5-T) greatly boosted productivity, often with severe ecological implications.

Another major factor in the intensification of agriculture was the increase in irrigation, made possible by the systematic damming or diversion of most of the State's rivers which effectively

destroyed much of their ecology. Eildon reservoir was increased tenfold in the early 1950s. Extensive irrigation also increased environmental damage by raising water tables which brought salt to the surface across large areas of the Goulburn Valley, the Northern Plains and along the Murray. Thousands of hectares were forced out of production and millions of dollars were spent to try to clear the salt and reduce salinity, with limited effect.^{xl}

Forestry also underwent great expansion as timber-felling pushed further into Gippsland and East Gippsland. Already by the 1930s there had been mounting concern about the loss of forests which in 1944 led to the establishment in of a professionally-based organisation, the 'Save the Forests Campaign' which in 1951 morphed into the Natural Resources Conservation League of Victoria (NRCLV).^{xli} After the War, demand for timber increased further, initially mostly for the housing boom, but governments also began to licence the export of wood chips to Japan for papermaking – large areas of Victorian forests were cheaply sold off to the chipper. The clear-felling old growth forests, especially for woodchipping, became and has remained one of the hottest environmental issues in Victoria. Environmental protests began to slow the rate of destruction from about the 1980s but the future of East Gippsland's forests remains a major source of ecological concern.

Much of Victoria's public transport was allowed to moulder away after the War as the drive to motor transport was encouraged by the building of more and bigger roads and freeways, and government assistance to the motor industry.

The demands for energy to power in this new economy were immense. Brown coal electricity generation grew enormously and new mines and power stations were opened. Supplemented by some further hydro schemes, this enabled full electrification of the State. Oil was imported in large quantities, although for a number of years Victoria was able to meet some of the nation's needs from wells in Bass Strait. The discovery of large reserves of natural gas in Bass Strait made a major contribution to industrial and domestic energy needs.

Most of these developments were at the expense of the environment. The atmosphere was degraded by the consumption of fossil fuels and other processes that released greenhouse gases. Damage to the ozone layer resulted in a hole that at times extended across Victoria. By

contrast, urban industrial waste and pollution, and Melbourne's air quality, were generally carefully controlled.

From the 1950s there was increasing world-wide concern with the state of the environment which generated a small library of environmental literature, and which raised awareness among Victorians. Writers such as Vance Packard,^{xlii} David Suzuki^{xliii} and Paul and Ann Ehrlich^{xliv} warned of various aspects of increasing human numbers and consumerism. Arguably the most influential work was Rachel Carson's *Silent Spring* with its exposé of the impact of chemicals on the ecosystems around us.^{xlv} Australian writers included Jock Marshall,^{xlvi} Vincent Serventy,^{xlvii} Len Webb^{xlviii} and Charles Birch.^{xlix}

This literature influenced a reassessment of the European occupation of Australia and its interaction with the natural environment. There was a rise in the number of active environmental organisations concerned primarily with the preservation of ecosystems for their own sake, not just for human benefit – an ecocentric or deep green philosophy/understanding. The need for more areas to be preserved in national parks, and for a higher level of protection for those that existed, was an increasing focus. In 1952 the Victorian National Parks Association was created by a federation of organisations concerned about these issues. In 1956 a National Parks Act more clearly defined and protected areas that were given that status. The Australian Conservation Foundation, based in Melbourne, was formed in 1965.

Probably the single most important trigger in the rise of environmental consciousness and action was the Little Desert controversy in the 1960s. The Little Desert was an area of sandy and partly saline Mallee country in far western Victoria which had been grazed and burned, but had remained Crown Land because it had been considered too poor for agriculture. Post-WWII land clearing technology, trace elements and superphosphate had made it seem marginally possible to bring the area into production, although opponents asserted that farming would never be economic. In the late 1950s and 1960s there were unsuccessful proposals to subdivide the land for farms, but these generated opposition from a variety of individuals and groups who were wished to conserve all or part as flora and fauna reserves.

In 1967 there was a more serious government proposal to set part of the area aside as a national park and to farm the majority, and in 1969 the necessary legislation was passed. The

proposal generated strong opposition from a variety of groups in the community, both locally and in Melbourne. A 'Save the Little Desert Campaign' was organised, supported by the *Melbourne Age*. There was opposition from some of the local agricultural and town communities who were troubled by possible environmental repercussions, such as increased salinity. In Melbourne, a combination of scientists, conservationists and concerned citizens formed the 'Save Our Bushland Action Committee'. Eventually, for a mixture of political and environmental reasons, the government abandoned the scheme and most of the Little Desert was declared a national park.ⁱ

The campaign, together with contemporary controversies about developments in the Lower Glenelg in far south-western Victoria and the Melbourne Botanical Gardens, brought environmental issues into the public consciousness as never before. A number of citizens and existing organisations formed the Conservation Council of Victoria (now Environment Victoria) which has lobbied and worked with governments for land conservation and protection. In turn, the government formed the Land Conservation Council (later changed to the Environment Conservation Council and now Victorian Environment Assessment Council) to 'carry out investigations and make recommendations to the government with respect to the use of public land in order to provide for balanced land use in Victoria'. It fostered research to develop a knowledge base for the ecological evaluation of Victorian landscapes.

Over the next two decades several new national parks were reserved, including Hattah-Kulkyne (1960/1980), Baw Baw (1979), Grampians (1984) and Murray-Sunset (1991). A major focus for both government and non-government bodies was the large alpine region that occupied much of the eastern third of the State. Parts had been grazed since the 1830s, mainly by cattle, and it had become practice among licence holders to move herds into mountain pastures over summer. It was an economic benefit and a social cultural/tradition that the mountain cattlemen were determined not to give up. There was also pressure on the Alps from timber companies who wanted access to the vast stands of timber. Countering this was increasing concern about the damage by cattle to fragile ecosystems, the loss of biodiversity (species such as mountain pigmy possum were under threat) and of erosion and siltation of streams and dams.ⁱⁱ In 1989, 6460 square kilometers of high country was declared the Alpine National Park, but cattle grazing was allowed to continue.

Another response to mounting community environmental concern was a gradual extension of government policies, authorities and actions, including the Victorian Environment Protection Authority (1970) and the establishment of a department responsible for conservation. The Victorian government's achievements were patchy as the department was subject to ideological change in name and status, and the resources to sustain the new policies and initiatives were generally inadequate and similarly subject to fluctuations of political support, economic conditions and the effectiveness of industry lobbies.

Hanging over the later stages of this phase was a mounting awareness of the possibility of major climatic changes that could reshape the future. Advances in atmospheric and climate sciences had produced a clearer comprehension of both the El Niño Southern Oscillation and of changes in the atmosphere that were increasing the likelihood of global warming and climate change. South-eastern Australia was predicted to become hotter and drier and the effects of El Niño more frequent and extreme. The deep drought in 1982, followed by alarming dust storms and the devastating Ash Wednesday bushfires in early 1983 might be just a foretaste of the future.

1990 – Present – Climate Change, Drought, Water and Fire

The phase from 1990, especially after 1995, was marked by climate change – its effects and the debates over what should be done. Dominating the period environmentally in Victoria was the longest, hottest and driest period since European settlement. Melbourne experienced eight of its nine hottest ever-recorded years in the period after 1999. In the twelve years between 1997 and 2009, not a single year reached Melbourne's long-term rainfall average.^{lii} While patterns differed slightly across the State, Melbourne's experience was not unique, or even rare.

One repercussion of the aridity was an increase in bushfire frequency and severity, with three particularly extensive series of fires. The first was in eastern and alpine Victoria in the early months of 2003, the next also mainly in eastern Victoria in late 2006 and early 2007, and finally the tragic fires culminating in Black Saturday, 7 February 2009, to the north and east of Melbourne.

The long drought created a crisis in the State's water supplies, both domestic and agricultural. Inflows into Melbourne's catchments (and other cities and towns) dropped steeply in 1997 and

while there were fluctuations they remained low until 2010-11, with lowest year on record in 2006. As gardens died and people became alarmed about the future of the city, increasingly stringent water restrictions were introduced. In 2008 Melbourne Water implemented the Target 155 programme, encouraging people to limit their water use to 155 litres per person per day. Nevertheless, storage volumes fell to a nadir in June 2009 of 25.5% before higher rainfall lifted levels again.

The decline in stored volumes also drew attention to the fact that in recent years the government had opened parts of the previously closed catchments to clear felling by the timber industry, which was impacting negatively on the water harvest. The Black Saturday bushfires in February 2009 also damaged about 30% of the catchments, causing great loss of old growth forests.

Melbourne's water crisis produced two major responses from the government, both of which proved highly controversial. A pipeline was built across the ranges to pump water from the Goulburn River into the Melbourne system. However, as the Goulburn Valley was itself in deep drought and needed all the water it could get, and because the pipes crossed numerous private properties, there was a strong negative community response in the Valley and elsewhere. Whether the pipes will be used as planned, remains to be seen. The second project was an extraordinarily expensive desalination plant to be built at Wonthaggi which, while it would be able to produce large quantities of water, would do so at great expense using very large amounts of brown coal-generated electricity and producing large quantities of pollutants.

Rural Victoria suffered even more than urban Melbourne as the drought elongated. Many towns were on severe water restrictions as reservoirs dried up. Natural systems suffered profoundly as creeks and rivers evaporated and vegetation desiccated. Agrarian industries suffered denuded and dead pasture, a shortage of water for stock and reduced irrigation allocations. In the Murray-Darling Basin, Australia's food bowl, drought and then floods in 2010-11 devastated crop production and forced many farmers off the land or placed them in jeopardy. It has shown that food security is not guaranteed, even in Australia.

There were many responses to the water crisis. Some wasteful irrigation practices were abandoned and there were experiments with more efficient forms of irrigation such as lining

and covering channels and computer-controlled drip systems. The government freed up the traditional allocation of water 'rights' by enabling those who 'owned' the water to trade their entitlement. This provided struggling farmers with an income and enabled others to give up their farms. Government-funded schemes were also established to buy back water allocations, some of which were then used to restore environmental flows in the water systems. As a large part of Victoria is in the Murray-Darling Basin, Victoria was involved in ongoing attempts to find a 'national' approach to coordinating 'ownership' and 'control' of water across the Basin. However, these efforts ran into the stalemate of interstate jealousies, resistance to change and anti-environmental sentiment that had caused the failure of all other plans across the preceding century.

These crises focussed community attention like never before on the environment and on climate change. However, Victorian (and Commonwealth) government responses were not in proportion and went little further than some low-level carbon reduction schemes, including subsidies to assist households to install solar panels for water heating and power generation. A few wind turbine farms were erected in the Victorian countryside, until a 2011 announcement that they were to be severely restricted in where they could be built, but otherwise there was not a high level of response and the brown-coal power stations in the La Trobe valley continued to pour CO₂ into the atmosphere. Population pressure, rather than a new-found environmental awareness, stimulated attempts to rebuild the State's public transport system.

Governments continued to show limited and mixed concern for conservation of old growth forests and timber cutting extended further into East Gippsland where it met ongoing resistance from activists. More favourably, the development of Victoria's national parks system continued with the addition of new parks including Murray-Sunset (1991), Snowy River (1992), Yarra Ranges (1995), Great Otway (2004) and in 2010 almost 100,000 hectares of new River Red Gum national parks in northern Victoria – the first jointly indigenous managed national park in the State. In 2011 Victoria has 45 national parks, thirteen marine national parks and eleven marine sanctuaries (following a long-running marine protection campaign) and many other parks protected under the National Parks Act.

There has also been a backward step. After years of controversy, in 2005 Victoria followed NSW in banning cattle from grazing in its Alpine National Park. It was an unpopular decision in east

Gippsland and in 2010 a newly-elected conservative government fulfilled an election promise by reintroducing cattle under the guise of a 'scientific' experiment to measure the impact of the cattle. After some months the Commonwealth government ordered their removal, but the future of the issue is not yet clear.

Commercial fishing continued in Port Phillip through the twentieth century, accompanied by the increasing popularity of recreational angling. The populations of some species declined and from such practices as scallop-dredging and sardine fishing, and the effects of invasive species. Scallop-dredging in Port Phillip was closed in the 1990s.

Along the coast, by the early twenty-first century a number of species including southern rock lobster and snapper were under pressure from over-fishing and other environmental effects such as by-product damage from trawling.^{liii} Populations of many species that are consumed by humans are widely believed to be well below pre-European levels and the sustainable future of some species and the industries dependent upon them is in doubt. However, the issues of fish 'stocks' and fishing is a highly contentious and disputed one as there is virtually no data on pre-European populations on which to base projections and sustainable limits, and both commercial and recreational fishers at times resent both each attempts to impose controls.

Nevertheless, after significant environmental campaigns, and in an attempt to provide wide ecosystem protection, in 2002 the Victorian government declared thirteen marine national parks and eleven marine sanctuaries. Commercial net fishing was banned in Western Port in 2007.

The future

The relationship of European Victorians with the landscape and the environment has changed greatly over the last nearly 200 years. We inhabit a very different natural world from the one first encountered by British sealers and explorers in the early nineteenth century. Much has been lost, and it will never be seen again as it was since so many species (especially of small marsupials) have been made extinct or reduced to a mere remnant. However, there is now much greater appreciation of our ecosystems, and a greater level of awareness of the need to conserve that is gradually resulting in protection and remedial action.

There are many environmental matters that will confront Victoria in coming years - local, national and international in origin. Arguably the most serious are the interconnected issues of planetary climate change and the threats to water systems in the Murray-Darling Basin, which have profound implications for Victorian agrarian industries, food production and natural systems.

The greatest challenge to overcoming these matters are not technological but relate essentially to the conceptual framework within which our society operates. We are still dominated by a preoccupation with short-term self-interest, development, consumption, growth economics and economic 'progress' above all else. These values direct attention away from solutions, or deliberately block the paths to them and, unless we can overcome such philosophical hurdles and place ecological wellbeing to the fore, the future appears gloomy.

Effective change or improvement will only be achieved by strong political action by politicians with the knowledge and courage to make hard decisions and to convince the community of the need. However, most of our politicians are, perhaps of necessity, preoccupied with short-term election cycles, and therefore tend to trade upon existing public attitudes rather than trying to lead the public towards new values and wider horizons.

For more effective leadership we need to educate both our politicians and the electorate - education in environmental knowledge and understanding is the most important long-term strategy. Our society needs to understand that humans are part of the environment, not apart from the environment. If the environment is not healthy, human economies and societies cannot prosper.

Only when we are educated will we find and vote for politicians who have the capacity to lead us towards solutions.

That is where community organisations and activists such as Victorian National Parks have such an important role to play – in educating the public and politicians while ensuring the ongoing protection and appreciation for what we have.

- ⁱ For a general overview see Commissioner of Environmental Sustainability, *Victoria, SoE Report, 2008*, accessed through <http://www.ces.vic.gov.au/ces/>; State of the Environment 2011 Committee. *Australia state of the environment 2011*. Independent report to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities. Canberra: DSEWPac, 2011, accessed through <http://www.environment.gov.au/soe/2011/report/index.html>
- ⁱⁱ Presland, Gary, *First People: the East Kulin of Melbourne, Port Phillip and Central Victoria*, Museum Victoria Publishing, 2010; Hateley, Ron, *The Victorian Bush: its 'original and natural' condition*, South Melbourne, 2010; Gammage, Bill, *The Biggest Estate on Earth: how Aborigines made Australia*. Allen & Unwin, 2011; Flannery, Tim F, *The Future Eaters: an ecological history of the Australasian lands and people*, New Holland Publishers, 1997.
- ⁱⁱⁱ http://vro.dpi.vic.gov.au/dpi/vro/map_documents.nsf/pages/bioregional_strategic_overviews
- ^{iv} Traill, Barry & Christine Porter, *Nature Conservation in Victoria 2001*, VNPA, 2001. Other accounts of Victorian vegetation and bioregions include: Frood, Doug & Malcolm Calder, *Nature Conservation in Victoria, Study Report*, Victorian National Parks Association, 1987; Hateley, Ron, *The Victorian Bush: its 'original and natural' condition*, South Melbourne, 2010.
- ^v <http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html>
- ^{vi} Shillinglaw, J.J., *Historical Records of Port Phillip; the first annals of the Colony of Victoria*, Melbourne, 1979; Hateley, Ron, *The Victorian Bush: its 'original and natural' condition*, South Melbourne, 2010.
- ^{vii} Hovell, W.H. & H. Hume, *Journey of Discovery to Port Phillip, New South Wales in 1824 and 1825*, Sydney, 1837.
- ^{viii} Eg Mitchell, T.L., *Three Expeditions into the Interior of New South Wales*, London, 1839; Curr, Edward, E.M., *Recollections of Squatting in Victoria*, Melbourne, 1883; Bride, T.F. (ed), *Letters from Victorian Pioneers*, Melbourne, 1898.
- ^{ix} Gammage, Bill, *The Biggest Estate on Earth: how Aborigines made Australia*. Allen & Unwin, 2011.
- ^x Garden, Don, *Australia, New Zealand and the Pacific: an environmental history*, Santa Barbara, 2005.
- ^{xi} For an outline history of Victoria and the source of most of the quoted statistics see Garden, Don, *Victoria: a history*, Melbourne, 1984.
- ^{xii} Rolls, Eric, *From Forest to Sea; Australia's changing environment*, St Lucia, 1993, pp. 161 ff.
- ^{xiii} There is a very large body of research on this matter but see eg: CSIRO, <http://www.csiro.au/resources/AlpineGrazingAndFire.html>; VNPA <http://vnpa.org.au/admin/library/attachments/PDFs/Issues%20papers/ISSUES%20PAPER%20-%20Alps%20grazing%20risks%20threatened%20species.pdf>; Australian Academy of Science, www.science.org.au/natcoms/nc.../nc-geography-submission-june04
- ^{xiv} John G. Robertson, 26 September 1853, in Bride, T. F. (ed), *Letters From Victorian Pioneers*, Melbourne 1898, pp167-69.
- ^{xv} On the gold era see Serle, Geoffrey, *The Golden Age: a history of the Colony of Victoria, 1851-1861*, Melbourne, 1963; Garden, Don, *Victoria: a history*, Melbourne 1984, chap 2.
- ^{xvi} Wheelwright, H. W. (An Old Bushman), *Bush Wanderings of a Naturalist: Notes of the Filed Sports and Fauna of Australia Felix*, London, 1861; Howitt, William, *Land, Labour and Gold*, London, 1855; Hateley, Ron, *The Victorian Bush: its 'original and natural' condition*, South Melbourne, 2010.
- ^{xvii} Rolls, Eric, *They All Ran Wild: The Animals and Plants that Plague Australia*, A&R, 1984.
- ^{xviii} Dingle, Tony & Helen Doyle, *Yan Yean, A history of Melbourne's early water supply*, Public Record Office and Melbourne Water, 2003
- ^{xix} Barry McGowan, 'Mullock heaps and Tailing Mounds: Environmental Effects of Alluvial Mining', in Ian McCalman et al, *Gold: Forgotten Histories and Lost Objects of Australia*, CUP, 2001; Garden, Don, 'Catalyst or Cataclysm? Gold Mining and the Environment', *Victorian Historical Journal*, vol 72, no's 1 & 2, September 2001
- ^{xx} J.M. Powell, *Watering the Garden State: Water, land and community in Victoria 1834-1988*, Allen & Unwin, 1989, pp. 74ff.
- ^{xxi} Ray Wright, *The Bureaucrats' Domain: Space and the Public Interest in Victoria, 1836-84*, OUP, 1989, pp. 153ff.
- ^{xxii} Garden, Don, *Droughts, Floods & Cyclones; El Niños that shaped our colonial past*, Melbourne, 2009.
- ^{xxiii} Barr, N. & Cary, J., *Greening a Brown Land: the Australian Search for Sustainable Land Use*, South Melbourne, 1992; Dingle, Tony, *Settling*, Sydney, 1984.
- ^{xxiv} Coman, Brian, *Tooth & Nail: The Story of the Rabbit in Australia*, Text Publishing, 1999; Low, Tim, *Feral Future: The Untold Story of Australia's Exotic Invaders*, Viking, 1999; Rolls, Eric, *They All Ran Wild: The Animals and Plants that Plague Australia*, A&R, 1984.
- ^{xxv} On irrigation and related matters see: Powell, J.M., *Watering the Garden State: Water, Land and Community in Victoria 1834-1988*, Sydney, 1989; Hallows, Peter J. & Donald G. Thompson, *The History of Irrigation in Australia*, Mildura, Vic., ANCID, First Mildura Irrigation Trust, 1995; Tyrrell, Ian R., *True Gardens of the Gods: Californian-Australian environmental reform, 1860-1930*, University of California Press, 1999.
- ^{xxvi} Hibbins, G.M., *A History of the City of Springvale: Constellation of Communities*, City of Springvale & Lothian, 1984; McGuire, Frank, *They Built a River: A Short History of the Carrum Swamp, its People, and its Reclamation*, City of Chelsea Historical Society, Revised edition, 1991; Roberts, David, *From Swampland to Farmland: a history of the Koo-Wee-Rup flood protection district*, Rural Water Commission, 1985.

- ^{xxvii} Serle, Geoffrey, *The Rush to be Rich: a history of the Colony of Victoria 1883-1889*, MUP, 1971.
- ^{xxviii} Barrett, Bernard, *The Inner Suburbs: The Evolution of an Industrial Area*, MUP, 1971; Lack, John, *A History of Footscray*, Hargreen 1992; Dunstan, David, 'Dirt and Disease' in Davison, G, Dunstan, D. & McConville, C., *Outcasts of Melbourne: Essays in Social History*, Allen & Unwin 1985; Lack, John, "'Worst Smelbourne": Melbourne's Noxious Trades' in Davison, G, Dunstan, D. & McConville, C., *Outcasts of Melbourne: Essays in Social History*, Allen & Unwin 1985.
- ^{xxix} Dingle, Tony & Rasmussen, Carolyn, *Vital Connections: Melbourne and its Board of Works 1891-1991*, McPhee Gribble, 1991.
- ^{xxx} Calder, Jane, Victoria's national and State Parks, VNPA, 1990; Brady, Anita, *A Centenary History of Tower Hill*, Department of Conservation & Natural Resources, 1992; Garnett, J. Ros, *A History of Wilsons Promontory* <http://vnpa.org.au/page/publications/a-history-of-wilsons-promontory>; Parks Victoria website <http://parkweb.vic.gov.au/>
- ^{xxxi} Edwards, Cecil, *Brown Power: a jubilee history of the State Electricity Commission of Victoria*, SECV, 1969; Serle, Geoffrey, *John Monash: a biography*, MUP, 1982.
- ^{xxxii} Keating, Jenny, *The Drought Walked Through: A History of Water Shortage in Victoria*, Dep't of Water Resources, 1992.
- ^{xxxiii} Lake, Marilyn, *The Limits of Hope: soldier settlement in Victoria, 1915-1938*, OUP, 1987.
- ^{xxxiv} Powell, J.M., *Watering the Garden State: Water, Land and Community in Victoria 1834-1988*, Sydney, 1989
- ^{xxxv} Goldbold, Norman, *Victoria, Cream of the Country: a history of Victorian Dairying*, Hawthorn, 1989; Brinsmead, Greg, 'A Geographical Study of the Dairy Manufacturing Industry in Gippsland, 1840-1910' MSc thesis, University of Melbourne, 1978.
- ^{xxxvi} Russ, Peter, *The Salt Traders: A History of Salinity in Victoria*, Salinity Bureau, 1995.
- ^{xxxvii} Public Record Office of Victoria, Function VF 30, Forests, <http://access.prov.vic.gov.au/public/>
- ^{xxxviii} Griffiths, Tom, *Forests of Ash: an environmental history*, CUP, 2001.
- ^{xxxix} On the early conservation movement and associated activities see: Hutton, Drew & Libby Connors, *A History of the Australian Environment Movement*, CUP, 1999; Wheeler, Graeme, *The Scroggin Eaters: a history of bushwalking in Victoria to 1989*; Mulligan, Martin & Stuart Hill, *Ecological Pioneers: a social history of ecological thought and action*, CUP, 2001; Hall, Colin M., *Wasteland to World Heritage: Preserving Australia's Wilderness*, MUP, 1992.
- ^{xl} Russ, Peter, *The Salt Traders: A History of Salinity in Victoria*, Salinity Bureau, 1995; Howes, Hilary, 'From Commission to Community: a history of salinity management in the Goulburn Valley, 1886-2007', MA thesis, University of Melbourne, 2008.
- ^{xli} Robin, Libby, *Building a Forest Conscience: an historical portrait of the Natural Resources Conservation League of Victoria*, NRCLV, 1991.
- ^{xlii} eg Packard, Vance, *The Waste Makers*, London, 1961.
- ^{xliii} eg Suzuki, David T & Holly Dressel, *Naked Ape to Superspecies: a personal perspective on humanity and the global eco-crisis*, St Leonards, 1999.
- ^{xliiv} Ehrlich, Paul, *The Population Bomb*, New York, 1971.
- ^{xli v} Carson, Rachel, *Silent Spring*, Boston, 1962.
- ^{xli vi} Marshall, A.J., *The Great Extermination: a Guide to Anglo-Australian Cupidity Wickedness and Waste*, London, 1966.
- ^{xli vii} Serventy, Vincent, *A Continent in Danger*, Andre Deutsch, 1966
- ^{xli viii} Webb, L.J., D. Whitelock & J. Le Gay Breerton (eds), *The Last of Lands*, Jacaranda Press, 1969.
- ^{xli ix} Birch, Charles, *Confronting the Future: Australia and the world: the next hundred years*, Ringwood, 1975.
- ⁱ Robin, Libby, *Defending the Little Desert: the rise of ecological consciousness in Australia*, MUP, 1998.
- ⁱⁱ Johnson, Dick, *The Alps at the Crossroads: the quest for an Alpine National Park in Victoria*, VNPA, 1974.
- ⁱⁱⁱ Bureau of Meteorology, site 86071 - http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=36&p_display_type=dataFile&p_s tn_num=086071
- ⁱⁱⁱⁱ Commissioner of Environmental Sustainability, *Victoria, SoE Report*, 2008, accessed through <http://www.ces.vic.gov.au/ces/>