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**The health of our catchments**  
> a Victorian report card

## ABBREVIATIONS

ABS	Australian Bureau of Statistics
Ag Vic	Agriculture Victoria division of DNRE
ANZECC	Australia and New Zealand Environment Conservation Council
AUSRIVAS	Australian Rivers Assessment System
BE	Bulk (water) Entitlements
CaLP Act	Catchment and Land Protection Act 1994
CaW	Catchment and Water division of DNRE
CLPR	Centre for Land Protection Research
CMA	Catchment Management Authority
DNRE and NRE	Department of Natural Resources and Environment
DOI	Department of Infrastructure
EPA	Environment Protection Authority
EVC	Ecological Vegetation Classes
GIS	Geographic Information Systems
GVP	Gross value of production
ICM	Integrated Catchment Management
In prep	In preparation
ISC	Index of Stream Condition
kL	Kilolitre = 1000 litres (or 1 cubic metre)
MDBC	Murray Darling Basin Commission
ML	Megalitre = 1,000,000 litres (or 1,000 cubic metres). The approximate amount of water contained in one 50-metre Olympic sized swimming pool.
N/A	Not applicable
NAP	Commonwealth/State Joint National Action Plan for Salinity, Water Quality and Biodiversity
NGO	Non-government organisations
NHT and NHT II	The Commonwealth Natural Heritage Trust and the Natural Heritage Trust Stage Two
NLWRA	National Land and Water Resources Audit
PFF	Parks, Flora and Fauna division of DNRE
Port Phillip CaLP Board	Port Phillip Catchment and Land Protection Board
RCS	Regional Catchment Strategy
SEPP WoV	State Environment Protection Policy, Waters of Victoria
SLA	Statistical Local Area
SOE	State of the Environment Report
VCMC	Victorian Catchment Management Council
VGS	Victorian Government Solicitor
VRHS	Victorian River Health Strategy

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## FOREWORD

iii

The Victorian Catchment Management Council and its predecessor, the Catchment and Land Protection Council, have a statutory responsibility to report to the Government every five years on the condition and management of the State's land and water resources. This is its second report. The first report, *Know your Catchments (1997)*, provided a benchmark for some of the indicators and stimulated a major project to establish a comprehensive suite of indicators to inform the Government on the condition and management of land and water resources and the related social and economic base of our catchments.

The Council has been greatly assisted in this task by staff of the Centre for Land Protection Research, Department of Natural Resources and Environment, the Environment Protection Authority and other agencies. The Council has also drawn on the impressive body of work undertaken by the National Land and Water Resources Audit and other Federal and State data collection and analyses.

Healthy catchments provide both urban and rural Victorians with a wide range of services necessary to sustain life. Among other things these services include water quality and quantity, salinity mitigation, carbon sequestration and food. Maintenance of biodiversity and ecosystem function underpin all of these services.

This is a report on the health of the ten catchment regions in Victoria and the ability of those catchments to continue to provide life-sustaining services to a growing and increasingly urbanised population. Our analysis is based on best available scientific, social and economic data and has been informed by the national and international debate on sustainable development. The Council can report that, while much of our land, water and biodiversity resources are stressed, significant effort at the State and regional level has been expended in developing and implementing a range of strategies and plans to alleviate this stress.

The Council also reports that, while some stresses can be alleviated by a process of continuous improvement and best practice, some issues will require a different approach to land and water management if, as outlined in the 'Growing Victoria Together' policy, we are to promote sustainable development of the State while protecting the environment for future generations.

The Council encourages those involved in natural resource management and policy development to use the information in this report and information publicly available on the web to better inform decision-making and improve management responses.

Christine Forster



Chairperson  
Victorian Catchment Management Council  
October 2002

## CONTENTS

>	Abbreviations	ii
>	Foreword	iii
>	Contents	iv
>	Executive summary	vi
>	Victorian catchment management	1
<b>1.</b>	<b>Introduction</b>	<b>3</b>
1.1	Background	3
1.2	Biodiversity, ecosystems and natural resource condition	3
1.3	Resource management	4
1.4	Report structure	6
<b>2.</b>	<b>Knowledge Management</b>	<b>7</b>
2.1	Adaptive management and the importance of knowledge	7
2.2	Knowledge generation	7
2.3	Knowledge synthesis	8
2.4	Knowledge exchange	9
<b>3.</b>	<b>Reporting on Catchment Indicators</b>	<b>10</b>
3.1	Background to the indicators	10
3.2	Assessing indicator condition and trends	11
3.3	Assessing management responses to indicator condition	11
3.4	Theme 1 – Changing socio-economic landscapes	12
3.5	Theme 2 – Biodiversity	26
3.6	Theme 3 – Rivers, wetlands and estuaries	32
3.7	Theme 4 – Managing water resources	50
3.8	Theme 5 – Managing land	62
3.9	Theme 6 – Managing pest plants and animals	74
3.10	Theme 7 – Greenhouse gas emissions and climate change	80
3.11	Theme 8 – Community attitudes and involvement in natural resource management	86

## CONTENTS



<b>4. Overall Results and Future Issues for Natural Resource Condition and Management</b>	<b>92</b>
4.1 Overview of indicator condition and trend results	92
4.2 Overview of statewide management responses	93
4.3 Overview of regional management responses	94
4.4 Are we making a difference?	95
4.5 Looking ahead to an uncertain 2050	95
<b>5. A 2020 Vision for Condition and Management</b>	<b>103</b>
5.1 A VCMC vision	103
5.2 The case for supporting the vision with ecosystem services	104
5.3 Are there activities upon which we can build?	106
<b>6. Reaching the 2020 Vision – Next Steps</b>	<b>108</b>
6.1 Some key considerations for sustainable resource management	108
6.2 Next steps	109
6.3 Conclusion	110
<b>Bibliography</b>	<b>111</b>
<b>Acknowledgements</b>	<b>113</b>

## EXECUTIVE SUMMARY

Every five years the Victorian Catchment Management Council is required by the *Catchment and Land Protection Act 1994* to report to Parliament through the Minister for Environment and Conservation on the condition and management of Victoria's catchments. This report is based on a series of established indicators and compiled from a range of available information.

The report finds that Victoria is the most densely settled state in Australia; a result of geography, climate and soldier settlement programs after two world wars. As a consequence, our natural resources are under pressure, and in many cases will not be passed on to the next generation in good condition. The Government has in place many strategies, plans and programs to encourage sustainable use of resources. If given adequate resources, most of these will make a significant impact on the health of our catchments.

Under current resourcing and management paradigms our efforts to protect and sustainably manage natural capital are not keeping pace with the breadth of degradation symptoms depreciating the natural capital base. One of the key hindrances to community and government efforts in this area is knowledge. In compiling this report we have found it difficult to answer questions on the condition of the State's resource base.

New knowledge is helping and we have made great strides in the last five years. This knowledge coupled with experience and efforts over the past two decades tell us much about what we need to do. It is clear that current 'best management practices' will not be enough to ensure sustainable use of the land and water in many parts of the State. Major change will need to be made in the management of many areas to offset the impact of issues such as dryland salinity and soil acidity. If we are to protect and enhance the natural capital of the State, revolutionary change is required in the way we manage much of Victoria's landscape. The 'continue as we are' scenario will not ensure a long-term economic and environmental future for agriculture in Victoria.

Current trends for resource condition across Victoria do not reflect the definition of sustainability offered in this report. To reach a level of sustainability a comprehensive new approach is required. The range of strategic documents developed by the State to manage specific degradation issues is impressive. However, we are lacking a coherent system for setting priorities and allocating resources between individual management programs at State level.

The next step must focus on designing catchments and the landscape for future sustainability. The planning time frame for such an activity will need to be long-term, probably 30-50 years, to allow the community to adapt and adopt new ideas and management paradigms.

The ability to make hard long-term decisions would be greatly enhanced through the development of an integrated catchment management strategy across the State.

In the long run, it is cheaper to manage our natural resources properly than to pay the exorbitant repair bill we are accumulating; prevention is always cheaper.

## VICTORIAN CATCHMENT MANAGEMENT

The Victorian Government is committed to the integrated management of catchments as one of the best ways to deliver a sustainable Victoria. In Victoria, the concept of integrated catchment management (ICM) underpins sustainable management of land and water resources and contributes to biodiversity management.

Victoria has a strong integrated catchment management system established under the *Catchment and Land Protection Act 1994* ('the CaLP Act'). Under the CaLP Act, Victoria is divided into 10 catchment regions (see Figure 1). A Catchment Management Authority (CMA) is established to provide strategic direction in each catchment region.

Under the CaLP Act and the *Water Act 1989*, CMAs have responsibility for coordinating and advising on strategic resource management priorities at a regional level. In an operational sense, CMAs have direct responsibility for waterway management, floodplain management and rural drainage.

At a statewide level the framework also includes the Victorian Catchment Management Council (VCMC). The VCMC is the State Government's peak advisory body on catchment management. The Council is uniquely placed to take a long-term independent view of catchment management across the State.



### Goals and Outcomes of Catchment Management

To effectively implement integrated catchment management (ICM) as a tool for ecologically sustainable development, it is essential to clearly identify the goals and desired outcomes for the management of land, water and biodiversity resources. In Victoria the primary goal of catchment management is:

**To ensure the ecologically sustainable development of our natural resource-based industries, the protection of land and water resources and the conservation of natural and cultural heritage.<sup>1</sup>**

The Victorian framework for catchment management has been developed to achieve:

- > community involvement in and commitment to natural resource management
- > ecologically sustainable development of natural resource-based industries
- > maintenance and improvement in the quality of water and condition of rivers
- > prevention and reversal of land degradation
- > conservation and protection of the diversity and extent of natural ecosystems
- > minimisation of damage to public and private assets from flooding and erosion
- > minimisation of the economic and environmental impacts of pest plants and animals.

Figure 1. Victoria's Catchment Management Authority Regions.  
Source: CaW, NRE.

To achieve these outcomes, Victoria has six principles that govern the way catchment management is implemented throughout the State. They are:

### **1. Ecologically Sustainable Development**

Victoria's whole-of-catchment approach to natural resource management seeks to deliver social, economic and environmental outcomes for the community and reduce our ecological footprint.

### **2. Community Empowerment**

Catchment management is a partnership between community and Government. Planning and implementation of natural resource management programs should maximise opportunities for community engagement.

### **3. Integrated Management**

Management of natural resources should recognise the linkages between land and water and that the management of one component can impact on the other.

### **4. Targeted Investment**

Government and community need to ensure that resources are targeted to address priorities and deliver maximum on-ground benefits.

### **5. Accountability**

Those making decisions on natural resource management should be clearly accountable to Government and the community, both in a financial sense and for biophysical outcomes. Performance assessment, monitoring and review are key elements of the Framework and provide the process to understand if biophysical condition is improving and management activities are effective.

### **6. Administrative Efficiency**

To maximise on-ground results catchment management structures should facilitate more efficient procedures and practices.<sup>1</sup>

Internationally, the CMA approach taken by Victoria to the management of the environment is recognised as one of the key elements in the new paradigm of integrated natural resource management.

In *Growing Victoria Together*<sup>2</sup>, the Victorian Government makes a commitment to build on the strong foundation of the CMA system. This Government commitment is welcome. It reinforces the importance of the partnership approach between government, community and industry that is fundamental to ensure sustainable management of Victoria's natural resources now and into the future.



## ONE

## INTRODUCTION

## 1.1 Background

The Victorian Catchment Management Council (VCMC) was established in 1997, taking over from the previous Catchment and Land Protection Council.

Under the *Catchment and Land Protection Act 1994*, one of the key statutory roles of Council is to provide a five-yearly report to State Parliament on the condition and management of land and water resources in Victoria. The Report of 2002 constitutes the second effort in assessing the condition of Victoria's land and water resources.

## Know Your Catchments

The first report, *Know Your Catchments* was produced in 1997 by the previous Catchment and Land Protection Council with the support of Catchment and Water Division, NRE and the EPA Victoria.

The 1997 Report highlighted that while much monitoring was being conducted, information harvesting, storage and interpretation were uncoordinated. This made it difficult to collect and present data in a clear, consistent statewide format. Along with identified information gaps the process highlighted a lack of consistent on-going priorities and commitment to monitoring against agreed indicators with targets for condition.<sup>3</sup>

## The Catchment Condition Indicators Project

The gaps and difficulties uncovered in developing *Know Your Catchments* initiated a Natural Heritage Trust (NHT) funded project involving the VCMC, CMAs, NRE and the EPA. The Resource Assessment and Monitoring (RAM) Group worked over four years to develop agreed statewide indicators to enable consistent future reporting on catchment condition.

The Catchment Condition Indicator project was completed in 2001 by the RAM Group. The Catchment Condition Indicators form the framework upon which this report is based.

Stakeholder and public access to the information generated by the catchment indicators is available. In December 2001 the Minister for Conservation and Environment launched the Catchment Condition Indicators Online website. The web-based format has allowed interrogation of the information at a range of scales including:

- > State
- > Catchment Management Authority region
- > Local Government Area
- > Bioregion
- > River basin.

Information on the indicators, including condition and trends, is available through the Victorian Catchment Indicators Online (VCIO) web site - ([www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)). Access to data and map-based products will also be made available through infrastructure created under the Regional Data Net project. This will enable wider access to NRE's corporate data library and eventually provide online map development capabilities.<sup>3</sup>

## 1.2 Biodiversity, ecosystems and natural resource condition

Biodiversity, ecosystems and natural resource condition are inextricably linked. The term biodiversity refers to the variety of life forms, microorganisms, plants, animals, the genes they contain and the web of life they collectively form.<sup>4</sup> The interactions occurring between the physical environment, nutrient cycles, water cycles, plants and animals are all functions of natural ecosystems.

The term "ecosystem services" has been coined to describe the processes and conditions by which natural ecosystems sustain and fulfil human life.<sup>5</sup> Services such as clean air, water cycling and purification, nutrient cycling, soil formation, biomass production, waste disposal, crop pollination, provision of food and minerals, and the maintenance of genetic diversity result from functioning ecosystems.

**Ecosystems are the Earth's primary producers, solar-powered factories that yield the most basic natural resources and services at an efficiency and cost unmatched by any current technology.<sup>6</sup>**

World Resources Institute, 2000

One clear reason for seeking solutions to maintain natural ecosystems and environmental assets is to protect the range of services and benefits provided to humans from nature and its components.<sup>5</sup>

Understanding the benefits from complex interrelationships within ecosystems can be a difficult message to explain. Ultimately, healthy and resilient ecosystems are responsible for producing a range of natural resources (sometimes termed natural capital) that benefit the entire community. While services such as air and clean water are easily recognised they have often been taken for granted and undervalued.

These non-market and often unmeasured ecosystem services underpin basic needs and health and are as important to human wellbeing as measures of consumption and economic growth.<sup>7</sup>

**In an attempt to benchmark the contribution of ecosystems at a world scale, Costanza *et al* estimated the value of ecosystem services to be in the range of \$16-54 trillion (US) per year, with an average of \$33 trillion offered. At the same period the global gross national product was \$18 trillion (US) per year.<sup>8</sup>**

Harvesting the natural resources provided by ecosystems supports our economies, provides employment and every year contributes to people's health, with millions visiting outdoor regions to relax. CSIRO has estimated the value of ecosystem services in Australia to be worth \$1327 billion each year.<sup>9</sup>

Previously, ecosystem services were assumed to be endlessly renewable.<sup>5</sup> There is now clear evidence that the current use of some environmental assets is resulting in accelerated degradation of the asset base. This will significantly reduce benefits available to future generations.<sup>7</sup>

Although plentiful, natural resources are finite and need to be managed accordingly. For example, when the use of water is properly assessed there is no excess capacity. The water that many people think is simply flowing away unused is supporting ecosystems that provide an enormous range of services.<sup>7</sup>

Finding the balance between environment and development will be an ongoing long-term process of education, consultation, negotiation and trade-offs.<sup>5</sup>

It is increasingly recognised that the health and well being of communities is linked to healthy ecosystems and sustainable management of natural resources. Managing sustainably means managing natural resources to service current needs and desires while ensuring that future generations have access to the same ecological, economic, social and cultural opportunities from these finite resources.<sup>10</sup>

Ecosystem function is of primary importance in sustaining species and the interactions between species and natural processes. Continued degradation of ecosystems and decline in biodiversity undermines Australia's natural capital base, reducing future opportunities for rural and urban communities.

## 1.3 Resource management

### Historic management of resources

In biodiversity terms, Australia is a mega-diverse continent providing habitat for a range ecosystems and species. For over 40,000 years humans have been harvesting knowledge, spirituality, energy and basic resources from these ecosystems. Ecosystems are never static. The Aboriginal use of fire facilitated many changes in ecosystems and landscape appearance.

Using the services provided by ecosystems, Aborigines formed complex economic, social and spiritual relationships with the Australian landscape. This relationship, nowadays sometimes termed 'caring for country', sustained Aboriginal Nations for thousands of years.

The principles of understanding, value and respect for the services and structure of natural ecosystems inherent in 'caring for country' are, in different ways, gaining acceptance within the broader Australian community and industry sectors.

### Recent management of natural resources

In recent history, the use of natural resources in Australia has often been based on an unsustainable management paradigm – although this has not always been recognised. For nearly 200 years European farm management methods have been employed, significantly transforming landscapes. This is especially evident in intensely settled and farmed States such as Victoria.

These farming methods were actively encouraged by Governments for one and half centuries and were fundamental to the economic and social development of the State and nation. We now recognise that, although practised in good faith, European management methods have resulted in longer-term losses and degradation of Victoria's natural capital base.<sup>11</sup>

Victorian farming must continue, but the methods employed need to reflect the inherent ability of the landscape to produce goods without accentuating longer-term environmental degradation. In other words land use and management must align with land capability.

**In 2002 the agriculture sector is responsible for 11 per cent of Victoria's gross state product, and 33 per cent of all State exports. The production, processing and marketing of food employs 205,000 people, or 9.7 per cent of total Victorian employment. In rural and regional Victoria, the sector accounts for 21 per cent of all jobs.<sup>12</sup>**

**Bruce Kefford, Executive Director Agriculture Division, NRE 2002**

The unplanned growth of modern cities and the consumer aspirations of successive generations of Australians are steadily running down our natural capital and affecting ecosystem health. It is important to understand that almost everything we do and every choice we make has an environmental impact.

Minimising negative impacts should be a short-term goal in the transition to developing and employing the knowledge and technology required to remove negative impacts.

**The Council of Australian Governments, when announcing the National Action Plan for Salinity, Water Quality and Biodiversity, estimated the total cost of land and water degradation at \$3.5 billion annually.<sup>13</sup>**

### Rehabilitation and protection initiatives

Governments, individuals, communities and industries responsible for managing natural resources now recognise the need to protect the health of Australian ecosystems. State and Commonwealth Governments since the 1940s have been legislating and investing to protect and rehabilitate environmental systems and assets.<sup>11</sup> Some notable recent examples include:

- > Landcare, which began in Victoria with the first group action in 1986, has subsequently spread across the nation. Nationally, there are over 2000 groups of individual land managers collectively tackling local degradation issues and striving for increased farm production through sustainable use of resources.
- > Over the past two-years, the State Government has invested \$10 million in Landcare. For 2002/03, \$4.8 million has been committed to local projects through Catchment Management Authorities.<sup>14</sup>
- > The Commonwealth Natural Heritage Trust program from 1997 to 2001 invested \$200 million across Victoria to protect ecosystems and address the causes of degradation symptoms threatening natural resources.<sup>15</sup>
- > Since 1990 the Victorian State Government has invested \$257 million on salinity management activities.<sup>16</sup>
- > Local Governments across Australia spent more than \$2.1 billion on environment related activities in 1998-99. \$1.8 billion of this was spent on water and solid waste management with the balance on activities related to biodiversity management.<sup>17</sup>
- > In 2001, the Commonwealth and the Victorian State Government agreed to jointly spend \$1.4 billion over the next seven years through a National Action Plan (NAP) to combat dryland salinity, water quality and biodiversity decline in six priority catchments across Victoria.
- > The Commonwealth Government have also announced a continuation of the Natural Heritage Trust (NHT 2) program. The regional component indicative budget will be worth around \$50 million to 2005.<sup>15</sup>

### Monitoring and evaluation

The above initiatives and partnerships are vital to protecting and enhancing ecosystems and the natural resource capital they produce. A clear part of these initiatives will be condition and performance evaluation. In any industry, monitoring, evaluation, reporting and review maintain a significant part of any investment cycle.

Monitoring condition consists of three things:

- > keeping a continual record of certain parameters/indicators
- > advising whether they are being maintained within prescribed limits
- > warning if undesirable changes occur.

Monitoring requires regular data assessment and feedback systems to respond to the monitoring results.<sup>18</sup>

Victoria has a long history of addressing threats to sustainability and ecosystem health. Despite being nationally considered an information-rich State, there is much about the workings of Victoria's ecosystems, intervention opportunities and impacts that remains to be explored.

Changes made today may not achieve desired outcomes for 50 to 100 years. Due to a limited information base it has taken 150 years to recognise and understand degradation issues such as biodiversity decline and dryland salinity. No doubt clues were available for some time but without a systematic process for monitoring and reporting, it was difficult to determine trends and present clear arguments for early intervention.

In a recent survey of the global environment, the Economist magazine offered the following observations: "The World Resources Institute, World Bank and the United Nations in their joint publication – 'People and Ecosystems' recently sought to gauge the condition of ecosystems. Surveying best available data the report reached two conclusions:

1. That ecosystems are fraying from the impact of human activity, and
2. Ecosystems in future will be less able than in the past to deliver the goods and services humans depend upon – pointing to unsustainability.

In reaching the above conclusions, the report clearly stated it was difficult to know what would be truly sustainable as much of the knowledge required to make such an assessment is incomplete or missing altogether."<sup>19</sup>

**Our knowledge of ecosystems has increased dramatically, but it has simply not kept pace with our ability to alter them.<sup>6</sup>**

**World Resources Institute, 2000**

At a national level a Commonwealth Performance Audit report conducted in 2001 on the Natural Heritage Trust program noted: "that an absence of baseline data on environmental condition was a major constraint on measuring and reporting on changes and trends in natural resource management and the environment."<sup>20</sup>

One of the first efforts to benchmark the environmental condition of Victoria occurred in 1991 with publication of the *State of the Environment (SOE) Report*. It noted there was a paucity of monitoring information and data on land degradation, despite over five decades of awareness and government on-ground activity.<sup>11</sup>

The *Know Your Catchments* report of 1997 also outlined gaps in the co-ordination, collection, storage and presentation of data. Both the SOE and the *Know Your Catchments* reports were limited by a lack of consistent, agreed condition indicators that provided benchmarks upon which to measure environmental trends and assess performance.

In 1993 and again in 2001, the Auditor General of Victoria conducted a review of the appropriateness of action taken within the State Salinity Management Program. Amongst many positive findings in the 2001 report the Auditor General noted: "...the State does not have a comprehensive evaluation program, nor a comprehensive set of objectives or performance indicators covering the productive capacity, environmental quality and social well being of salt affected areas, as recommended in our 1993 report."<sup>16</sup>

The above examples outline a real need for improvement in monitoring, evaluation and performance reporting at a global, national and State level.

**Businessmen always say, 'what matters gets measured.' It is astonishing that governments have been making sweeping decisions on environmental policy for decades without baseline data.<sup>19</sup>**

**The Economist Magazine, 2002**

One of the great challenges for resource managers is to engage government and the community into committing investment now, for environmental outcomes that will benefit generations not yet born.<sup>19</sup> This requires courageous decision-making by community and political leaders. This is especially the case for investment allocation to areas such as monitoring, evaluation and research which, in a political sense, can lack the panache of on-ground activity.

**In these turbulent times, politicians cannot allow the desire for popular support today to sway them from making responsible choices for tomorrow.<sup>21</sup>**

**Mikhail Gorbachev 2002**

Monitoring and performance reporting is fundamental to educating and engaging the community. Continued research underpinned by consistent monitoring, evaluation and reporting helps review, support and validate investment decisions, slowly providing the information necessary for selecting appropriate intervention activities. Victoria has much to gain by ensuring monitoring of environmental condition and evaluation of performance occurs in a consistent framework on a long-term basis.

The Catchment Condition Report of 2002 reports on condition and management of land and water resources using 32 catchment condition indicators. It assesses condition and trends, outlining current and historically persistent gaps in knowledge, management and process associated with monitoring, evaluation and reporting. The Report also explores the relationship and progress of management activity in responding to indicator condition and trends.

## 1.4 Report structure

The information provided by this report involves the following structure:

- > Chapter 2 outlines discussion on knowledge management and the current gaps, needs and opportunities.
- > Chapter 3 presents the 32 Catchment Condition Indicators used in this report. This involves a brief discussion on indicators and their use before following on to the eight themes and 32 indicators. The eight theme headings are:
  - Changing socio-economic landscapes
  - Biodiversity
  - Rivers, wetlands and estuaries
  - Managing Water
  - Managing Land
  - Pest plants and animals
  - Greenhouse and climate change
  - Community attitudes and involvement in natural resource management.

Each of the themes introduces the range of related indicators. The 32 indicators are assessed in terms of condition status, trend and management responses.

- > Chapter 4 provides an overall assessment of condition and management and addresses the question of whether we are making a difference. This section also explores some likely outcomes for catchment condition if we continue current management responses and activities through to the year 2050.
- > Chapter 5 presents discussion on a preferred management and condition vision for the State in 2020, introducing some potential management options available to reach the vision.
- > Chapter 6 overviews what is required to reach the VCMC vision for the condition and management of the State's natural resources.

## KNOWLEDGE MANAGEMENT

### 2.1 Adaptive management and the importance of knowledge

Victoria's Catchment Management Framework relies on an adaptive management approach with Regional Catchment Strategies reviewed and renewed every five years. Adaptive management is an integrated, multidisciplinary method for natural resource management.<sup>22</sup> It is adaptive, because it acknowledges that the natural resources being managed will always change and our management approaches must reflect these changes. In this way, adaptive management is a way to achieve objectives, but also a means of learning more about the resource system being managed.<sup>23</sup>

A second essential characteristic of adaptive management is the presence of a direct feedback loop between science and management which allows for management and policy decisions to be modified in light of new scientific information (see Figure 2). Adaptive management is thus a continuing process of action based on planning, monitoring, evaluation and adjustment.

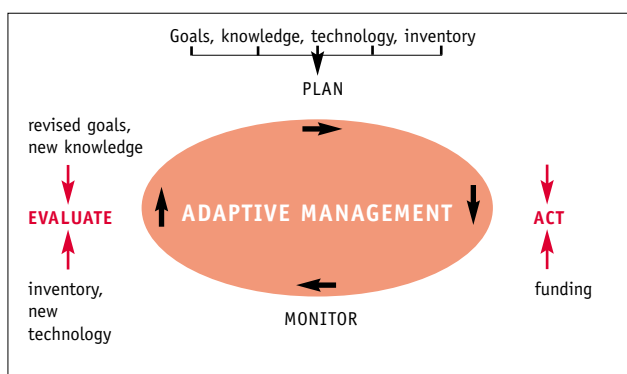


Figure 2. Adaptive Management

Source: Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.<sup>24</sup>

Knowledge management is an intrinsic part of the adaptive management cycle. New knowledge is an important driver of economic growth, a fundamental and fully renewable resource necessary to progress the health and wealth of communities and individuals. The transfer of such knowledge within the community is a vital ingredient in enhancing Victoria's competitiveness while ensuring sustainability.<sup>25</sup>

Knowledge constitutes the difference between an informed and an uninformed approach to decision-making. Gaps in knowledge brought about by lack of information, poor communication and sporadic processing of existing information are fundamental constraints to effective natural resource management.

There are three key areas of knowledge. These are:

- > knowledge generation (developing new knowledge)
- > knowledge synthesis (compiling / interpreting it)
- > knowledge exchange (using it) across the State.

Knowledge generation, synthesis and exchange are fundamental aspects of managing for the future sustainability of natural resources, particularly healthy ecosystems.

In compiling this report, the VCMC note there exist some very positive knowledge initiatives, but equally there are some glaring gaps across these three areas of knowledge.

### 2.2 Knowledge generation

Research advances understanding of environmental systems, drives new technologies and underpins informed policy and management decisions.<sup>26</sup>

Environmental research, education, monitoring and assessment are essential to environmental problem-solving. Joint Commonwealth and State research initiatives should be viewed as an investment in our capacity to evaluate signals now and help determine the 50-year management decisions required.

A wide range of knowledge generation organisations exist, including co-operative research centres, SRCs, Land and Water Australia, Agriculture Victoria research institutes in Bendigo and Rutherglen, agricultural industry research and university research.

Despite the good science going on, gaps in our predictive understanding of environmental systems still exist. Knowledge development within this context is subsequently poorly understood. We need more sophisticated models to understand complex landscapes and the interplay among the various existing and emerging components. Increased resources are needed for interdisciplinary research and monitoring efforts.<sup>25</sup>

In particular, any ideas regarding a market-based approach for ecosystem services will require a sound understanding of processes to derive a 'currency' for trading and assign a value to that currency.

Other specific research areas in need of enhancement include agricultural production systems, decision support tools, and strategic environmental technologies. We are also lacking specific information and understanding about the biological processes that underpin soil health.

A long-term commitment to knowledge generation research, monitoring and evaluation is required.<sup>25</sup>

The catchment indicators are largely newly developed and specific knowledge generation needs abound. There remain significant topics not addressed including:

- > Estuarine condition
- > Wetlands condition
- > Floodplain management and condition
- > Native vegetation condition
- > Dryland salinity.

Similarly, some of the current indicators are not able to provide the type of information required to assess if the condition of resources is improving or declining. Further development is required for indicators on biodiversity, soils, greenhouse, and water management.

Many of the current indicators suffer from a lack of correlation between data collection and time. Spatially, data can be provided readily but it remains difficult to report on indicators based on time (e.g. trends in the last year). This limits the usefulness of the indicators to CMAs reporting annually on catchment condition.

Limited by knowledge and resourcing, the indicators present a segmented, issues based approach to knowledge generation, synthesis and exchange.

No State-agreed process exists for monitoring and reporting on catchment condition at a holistic catchment or ecosystem scale. Addressing this problem will be challenging. Implementing ecosystem management approaches is limited, not simply by a lack of data on ecosystems and how they function, but also by a lack of knowledge on how to sensibly apply existing knowledge.<sup>26</sup>

## 2.3 Knowledge synthesis

A number of monitoring and evaluation programs exist around the State at various community and organisational interface levels.

A positive example is the Victorian Water Resources Data Warehouse and the State Water Quality Monitoring and Assessment Committee which combine information and skills across a range of organisations and community groups including Melbourne Water, the EPA, water authorities, NRE and Waterwatch community monitoring.

This synthesis of water quality data collection, interpretation, communication and extension is the most comprehensive processes of all the natural resource management data sets in the state.

Despite this glowing example, the VCMC still had trouble pulling best available information together on water quality. This problem was inherent in synthesising information for all the indicators. There is no statewide process for collecting, interpreting and updating natural resource management data.

Generally the information is held across NRE and associated divisions by individuals. The Catchment Indicators project assigned a patron to each indicator. The VCMC received absolute cooperation from all the patrons. Unfortunately, the indicator patrons had to provide or review information as an additional task rather than a core function. The synthesis of information is still not identified as a priority across the State.

A clear consistent process for providing and synthesising knowledge is required. Most importantly responsibility for coordinating a State approach needs to be considered a priority and appropriately resourced. A basic framework now exists through the Catchment Indicators and this activity should be expanded. The issue of cyclical and ongoing funding for data collection also needs to be addressed.

As part of knowledge synthesis it is important to continually develop, review and assess our information data sets. There are four main stages in the evolution of an information set, namely:

- (1) definition of the standard
- (2) design of the monitoring strategy
- (3) deployment of the monitoring program
- (4) acquisition of the information set.

Addition of a fifth stage (review) turns the above process into a life cycle. The review stage needs to accommodate both changed requirements (driven by variance in the system under study or new information needs) and opportunities for efficiency gain (ie. new technology).

Evaluation of an information set against the above lifecycle can be useful in identifying its maturity. Additionally, the completeness, quality and accessibility of the information needs to be reviewed.

With respect to the indicators used in this report few are supported by mature infrastructure. In some instances, condition can be assessed against a predetermined benchmark. Trends and performance on the other hand were often difficult to assess. In many instances information has not been gathered long enough or in an appropriate form to produce trends.

No indicators possess clear outcomes or targets as goals of improved condition. This makes it difficult to assess performance and results of management activities.

Clear performance measures and targets are required for each indicator. These targets need to be time constrained and



supported by on-going monitoring of activities to ascertain the relationship of an activity and its impact on improving condition.

To date, the indicators have not been employed by the catchment management authorities as a basis for regional reporting on condition. Further work is required to develop a process for reporting based on indicators that link to the various management strategies and programs operating at regional, State and national level.

This is partly being addressed through the NAP Program. The NAP is further encouraging regions to set targets and performance measures to drive activity and support clear evaluation and reporting.

## 2.4 Knowledge exchange

At a broad level the Regional Data Net (an initiative of NRE Catchment & Water division) is an attempt to provide a program style approach to the provision of information infrastructure and support for monitoring and knowledge exchange. At the next level down, the catchment indicator, a program approach is generally lacking.

In almost all the areas of information acquisition and management, the current environment is characterised by short-term project based investment. Project objectives are usually not aligned with:

- > collection of information to meet standards required for broader use; and
- > effective information management and quality assurance.

The lack of a program approach to the collection of the indicators undermines the development of a rational and coordinated approach to integrated monitoring. The result is higher costs, less information and impairment in our ability to interpret information and understand the changing environment.

As noted, significant effort has been required to pull together the information for each of the catchment condition indicators. The intention of the catchment indicators web site is to make such knowledge available.

Currently, the indicators web site is incomplete, with few indicators displaying full data. Although there is a clear process and commitment from Catchment and Water division to update the information in the short-term, a long-term commitment across NRE is required to ensure an on-going schedule of data collection, interpretation and updating on the web site.

Regional communities have a partnership role alongside government in managing natural resources. Due to the changing and complex nature of environmental systems communities need to be equipped with an equivalent knowledge resource to manage natural resource management issues.

A key pre-requisite for empowering communities to develop management scenarios for a sustainable future is access to quality data.<sup>27</sup>

In addition to the need for community knowledge exchange, there are a number of existing reporting needs at a State and regional level. These include:

- > SOE reporting
- > RCS monitoring-evaluation programs
- > Coastal Strategy development monitoring – evaluation and reporting
- > NRE reporting – CaW, AgVic, PFF and Forests
- > Local government reporting
- > CMA Annual reporting
- > VCMC annual and five yearly reporting to State Parliament
- > State Water Quality and Assessment Committee annual report card
- > Specific program reporting for pest management, the NAP and the NHT II.

As noted earlier, there is no responsible body or process for facilitating reporting arrangements, avoiding duplication, cross sharing information, providing consistency and quality control, and communicating natural resource management information to the community.

Clear opportunities and potential efficiencies exist in:

- > coordinating the operation and process of data management
- > coordinating data collection and information sharing
- > coordinating use of data, especially in evaluation and reporting
- > coordinating access to data and quality control
- > coordinating communication of the data to the general public to inform engagement processes and decision-making.

The institutional arrangements and resourcing requirements to facilitate this coordination requires further discussion.

## REPORTING ON CATCHMENT INDICATORS

### 3.1 Background to the indicators

Environmental indicators are being developed both at the national and State level. At a national level, solid progress has been made since the first SOE report, *Australia: State of the Environment 1996* (State of Environment Advisory Council 1996). This has included the development of a suite of environmental indicators through Environment Australia, the completion of the National Land and Water Resources Audit (NLWRA), and the release of *Australia: State of the Environment 2001*.

Victoria has contributed significantly to national programs such as State of Environment Reporting (SOER), the National Land and Water Resources Audit (NLWRA), and the performance reporting requirements of the NHT, NAP and MDBC.

It is important to recognise that although the national and Victorian reporting programs appear similar, there is little duplication in effort. Much of the Commonwealth effort has been directed at aggregating and interpreting data provided by the State, with less involvement in data creation.

The idea of a project to develop Catchment Indicators for the State was initiated in 1995/96 but did not begin until 1998.

In this report the VCMC use 27 indicators (of the original 30 developed) and have created five additional indicators. These relate to community awareness, Landcare participation, estuaries, greenhouse emissions and climate change.

Since 1998 around 260 people have been involved in consultation on the development of the 30 original Catchment Condition Indicators. For each indicator a methodology was developed detailing:

- > definition and rationale for the indicator
- > relevant data sources and collection procedures for the indicator
- > methods of data storage for the indicator
- > methods of data analysis and interpretation for the indicator
- > reporting products and protocols
- > clearly defined responsibilities and funding arrangements.<sup>3</sup>

The indicators were developed to:

- > identify the condition of land and water resources, allowing comparison between a measurement and a condition benchmark
- > assess the current trends in condition and management and the impacts on the resource base
- > provide a basis upon which to evaluate the performance of natural resource management programs
- > provide feedback to planning cycles and support policy development.<sup>3</sup>

The majority of the indicators have been developed to reflect on the impact of NRE and CMA resource management programs. To do this indicators need to be sensitive to change over short-term periods (3-5 years) and link to programs with a clear cause and effect relationship between program activity and subsequent impact.<sup>3</sup>

Due to the complex nature and long time frames associated with most environmental issues, some of the indicators will not provide relevant short-term information. Instead the value will be in interpreting information over a 20-30 year time frame.

As noted in Chapter 2, currently few of the indicators have performance measures and targets, nor are they clearly linked or imbedded in the range of NRE or CMA programs. Finally, the indicators have not been developed for aggregation to provide a clear overall assessment of catchment condition.

Developing the indicators has required compromise between what is possible and desirable. There are many components of the indicators that could be improved but the current list at least provides a base from which improvements can be made.<sup>3</sup>

Victoria is placed as well or better than any other State in the country to systematically tackle long-term monitoring and evaluation of natural resource condition.



This document represents our current best effort to report on condition. Making a jump from individual indicator condition assessment to a collective condition assessment at a whole of catchment or ecosystem level is a task undermined by information deficiencies and has not been attempted in this report.

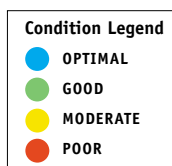
More appropriate indicators that better holistically display catchment or ecosystem condition are required. In this report the VCMC, where possible, make an assessment of the condition and management responses for each individual indicator at a State and regional level.

Attempting to assess condition and management responses in 2002 provides a benchmark for future reports on condition. As further research, monitoring and evaluation takes place and performance measures are developed, reporting accurately on condition will improve dramatically.

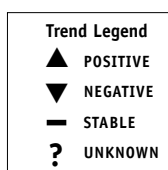
### 3.2 Assessing indicator condition and trends

At a State and CMA region level, condition and trend assessment is based on collected information and interpretation of data supporting each indicator. Condition assessment and appropriate text on extent, impact and condition trend of the indicator is provided where available.

For each indicator the VCMC assessment of condition is presented through the following colour legend:



Similarly, presentation of trends at a State and regional level is offered through the following symbol legend.



The above legends appear on the bottom left hand page of each indicator double page spread.

### 3.3 Assessing management responses to indicator condition

This chapter also attempts to review the management response for the 32 individual indicators at State and regional level.

At a State level brief discussion is provided on the management response to each indicator. For CMA regions a snapshot review of appropriate existing or soon to be released management plans is provided.

The legend of S, Pm, C, and me is used to introduce answers to the following questions on management responses at both the State and regional level:

- S** = This symbol describes if a State strategy (OR regional action plan), of relevance to the indicator, exists or is in preparation.
- Pm** = This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.
- C** = This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.
- me** = This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

In assessing management responses within CMA regions, the VCMC is not implying CMA responsibility for implementing management responses to all of the indicators. The CMAs have specific defined implementation responsibilities for waterway management, floodplains and rural drainage.

Associated natural resource management issues are coordinated through the CMAs strategic planning role and the regional catchment strategies. The Regional Catchment Strategies will include many natural resource management issues for which CMAs have no direct responsibility in an implementation or resource distribution sense.

The assessment of regional management responses should not be interpreted as an assessment of CMA performance. It is a snapshot of current activity at a regional level between a range of stakeholders.

#### Quality of data

Development of the suite of indicators only concluded recently in 2001. Over the last five years the information collected and interpreted has varied. Some indicators have significant historical information upon which to base condition and trend analysis. Other indicators have a very limited information base.

The VCMC condition and trend assessment will, in some instances, be hampered by a lack of data or inconclusive, short-term information. Therefore, for each condition indicator a simple analysis of the quality of data supporting the assessment will be provided. This information confidence rating will be a simple traffic-light representation where:



A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;



An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;



A Red symbol represents poor or limited data collection and interpretation.

To assist readers, the legend associated with State and regional management responses (S, Pm, C, and me) and the information confidence rating is represented at the start of each of the eight indicator themes.

### 3.4 theme 1 CHANGING SOCIO-ECONOMIC LANDSCAPES

12



#### The importance of agriculture in rural landscape

What happens on and to Victoria's farms is of crucial importance for all Victorians concerned about natural resource management policy. Approximately 85 per cent of Victoria's privately owned land is nominally used for agricultural production. Agriculture uses 77 per cent of the State's water resources. Over half the native vegetation on private land is considered to be representative of threatened ecological communities. The Victorian agricultural sector plays a pivotal role in the economic health of regional communities and individual land managers. Changes in the structure of Victoria's agricultural sector will change the way we manage Victoria's natural resource base. Understanding the changes occurring in the agricultural sector will help predict potential negative impacts and identify opportunities for improving management of the resource base.

#### Indicators:

- > Gross Value of Production (At the time of printing the data available under the indicator 'Gross Value of Production' required additional analysis and interpretation. This could not be completed in the timeframe of this document.)
- > Net Farm Worth
- > Percentage of private land used for agriculture

#### Continued cost-price squeeze on agriculture

Agriculture as a business is characterised by a long-term decline in the terms of trade. Increases in agricultural production generally occur faster than the capacity of the market's willingness to pay for those increases in production. As a result, the long-term real price of most agricultural commodities falls. In the past fifty years the ratio of 'prices paid' to 'prices received' by Australian farmers has fallen by seventy per cent, though this fall has been obscured by major fluctuations. The response of agricultural industries has been to improve productivity, often by adopting new methods of farming that require an increase in the scale of the business. Over recent years the annual productivity growth for the farm sector has been 2.1 per cent per annum. In aggregate, this rate of productivity growth has been sufficient to keep ahead of the decline in terms of trade over the past 20 years.

Like the terms of trade, productivity growth does not occur at a steady rate, nor is it evenly shared across the agricultural sector. Nationally, the specialist cropping sector has achieved annual productivity increases of 3.6 per cent. At the other end of the spectrum, the nation's sheep industries have achieved annual increases of 0.6 per cent.<sup>28</sup> Productivity increases are also much more likely to be captured by the financially largest ten to twenty per cent of farms.<sup>29</sup> Finally, neither farm size nor farm industry are evenly spread across the landscape. Regions with the greatest numbers of small farms and grazing farms will be far less likely to keep pace with the compression of the terms of trade.

Indicator:

- > Percentage of farm land managed by financially large farm businesses.

#### The changing balance of farm and urban population

The counterpoint of increased productivity in agricultural industries is a decline in the number of farms and farmers. The number of Australian farms has halved in the past 40 years. While the farmer population has been declining, the non-farm population of Australia has been steadily increasing. The result has been an accelerating decline in the relative contribution of farming to the total Victorian and Australian population. In 1920 there were 20 Victorians for every farm in the State. By 1970, the ratio had risen to 50:1. Today the ratio is over 175:1. By 2021, this ratio may reach 400:1

Indicator:

- > Percentage of workforce employed in farming.

#### Changing social values

An outcome of the increasing urbanisation of Victoria is an increased demand for environmental and amenity services from land and water in competition with demand for production from land and water. This trend can be seen in increased support for environmental initiatives such as the increasing restrictions upon previously existing rights to clear land or the more recent return of water to the Snowy River. These pressures operate not just through government intervention, but also through the land market, and it is the land market that has the greatest impact upon the competitiveness of agricultural industries.

Increased demand for land as a place of residence will often increase the market value of land. This increased value reduces the capacity of agricultural enterprises to purchase land and improve productivity. In the long run this will lead to an inevitable and continuing decline in competitiveness.

Indicators:

- > Ratio of value of agricultural land to value of agricultural produce.
- > Community concern for environmental values – indicator under development and not included in this report.

#### A diverging social landscape

The capacity of Victorian farms to maintain long-term competitiveness in international markets will vary according to geographic location. This will create a number of diverging landscape trajectories. In the broadacre cropping districts where there is little amenity competition for land, farm businesses will continue to increase in size and decrease in number. In areas where agriculture finds it difficult to compete with other land users, agricultural businesses will follow one of two paths: intensification or gradual decline.

The intensification of agriculture will be evident as an increasing proportion of the value of agricultural production coming from a decreasing area of land. The gradual decline of agriculture in some areas will be evidenced by an increasing age of farmers and/or a decline in the proportion of full-time farmers. A range of other indicators is planned and under development, but has not been completed in time for this report.

Indicators:

- > Median age of farmers
- > Area producing 80 per cent of farm total profit – indicator under development.
- > Value of agricultural production at full equity – indicator under development.
- > Gross margin per megalitre of irrigation water applied – indicator under development.
- > Proportion of full-time farmers – indicator under development.





#### VCMC Report Card Assessment of Socio-economic condition and trends.

Due to the type of indicator information available in the socio-economic theme it was not seen as appropriate to attempt condition and trend assessment using the format developed for this document. General trends are described in the text where possible and appropriate.




The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:

-  = This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.
-  = This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.
-  = This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.
-  = This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend

-  A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;
-  An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;
-  A Red symbol represents poor or limited data collection and interpretation.



### State Trend

#### Results and Interpretation

Net Farm Worth (NFW) calculates a rate of return on financial capital and human resources invested in a farm enterprise as well as the maintenance of the productive capacity of the natural resource base. Net Farm Worth (\$) can be presented at the statewide level using Australian Bureau of Statistics (ABS) data but the statistic is not measured at a regional level. A similar Australian Bureau of Agricultural Resource Economics (ABARE) publication has the same limitation. It is possible to apportion the statewide Net Farm Worth Indicator to Victoria's Catchment Management Authority (CMA) regions, but the accuracy and reliability of data at this level is poor.

#### Average Net Farm Worth for Victoria

In Victoria, there was a modest reduction in the average NFW from 1996/97 to 1997/98 and a significant increase in 1998/99 (see Fig. 3a). Although total NFW for Victoria increased slightly, the decrease in average NFW from 1996/97 to 1997/98 may reflect structural adjustment in Victoria as a result of changes in the total number of establishments with agriculture, changes in farm enterprises and the impact of below average rainfall in several Victorian regions.

In comparison to the Australian average NFW, the Victorian average is significantly lower. This may highlight a significant difference in the average size of farm holdings within Victoria when compared to other state averages. The difference may also reflect changes in farm enterprises and the impact of below average rainfall in several Victorian regions. However, a significant increase in average NFW for Victoria was recorded from the 1997/98 year to the 1998/99 year. Not only was the increase significant in comparison to Victoria's performance from 1997/98, but also significant compared to the relative increase in the Australian average from 1997/98.

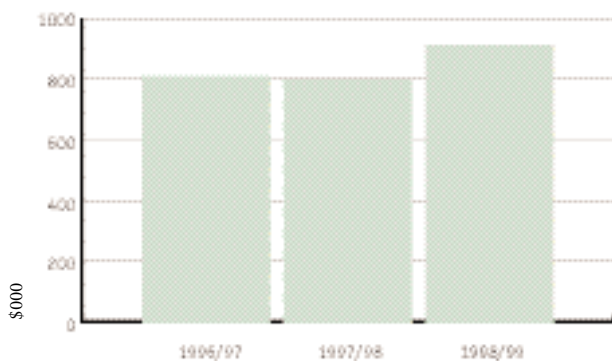


Figure 3a. Average Net Farm Worth for Victoria.

Source: Australian Bureau of Statistics.



Figure 3b. Average Net Farm Worth for Australia.

Source: Australian Bureau of Statistics.



**Indicator Definition** The Net Farm Worth (NFW) measure is defined as the total value of farm assets less total gross farm indebtedness. **Rationale** NFW measures the value of land, structures, capital equipment, financial assets and the value of livestock, while accounting for the level of farm debt. Analysing the value of financial capital and human resources of farm enterprises can provide a useful insight into the income, expected farm income and how they might relate to the maintenance of the productive capacity of the natural resource base.

## MANAGEMENT RESPONSE

15

### State Management Response

- S** To date there has been no strategic imperative for a State Agriculture Plan. Industry sectors have tended to produce comprehensive strategic plans and Research and Development (R&D) programs. A range of drivers is pressuring change in the agricultural sector, this is stimulating discussion regarding an overarching vision and strategy for the future of agriculture in Victoria.
- Pm** Comprehensive performance measures and targets exist at the industry level.
- C** There is an extensive range of agriculture related programs that implicate this and other socio-economic indicators.
- me** The Centre for Land Protection Research conducts much of the socio-economic research related to NRM, including data interpretation on a project-by-project basis. Across the divisions of NRE a range of groups are reviewing socio-economic data.

### Regional Case Study

The new FarmBis program which commenced in July 2002, will provide about \$6 million of grants each year for the next three years in Victoria to subsidise training for farmers, land managers and wild-catch fishers to improve their self-reliance and ability to manage change.

The program is jointly funded by the Commonwealth and State Governments. Natural resource management training is a priority of the new FarmBis.

Jon Christopher is a dairy farmer near Korumburra in south Gippsland. His farming system and production were impacted on significantly after attending the FarmBis-subsidised 'Healthy Farming Systems' course. Jon commented, "it's not just the learning - being with other farmers, exchanging ideas, problems and learning informally with each other, are also major benefits of ongoing education."

The course provides good basic knowledge and gives farmers the confidence and knowhow to manage change.

Source: Greg Smith Victorian Landcare & Catchment Management, Issue 22, Victoria.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	no	no	yes
North East CMA	yes	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no



## CONDITION

## State Status

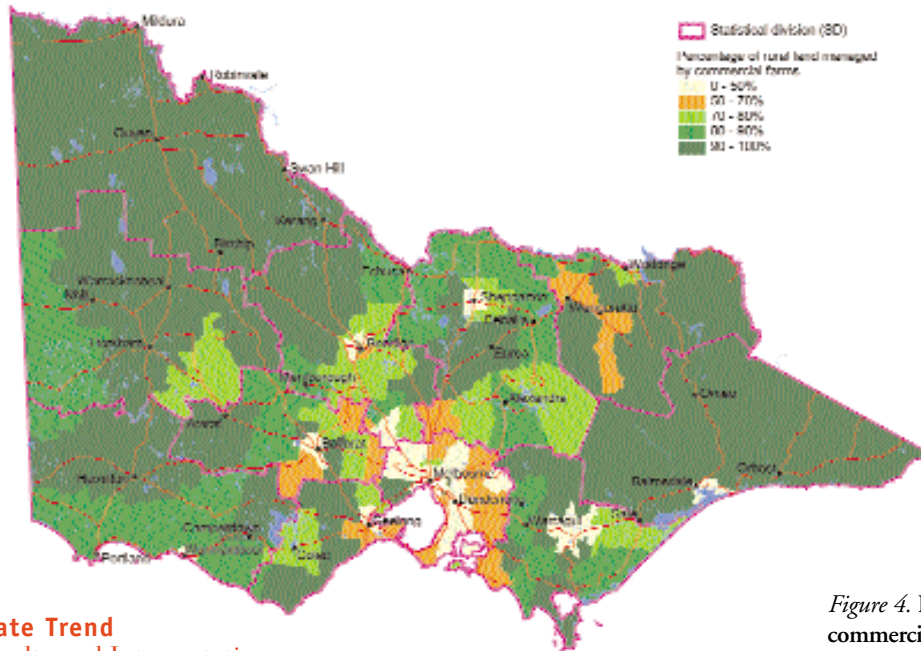


Figure 4. Percentage of rural land managed by commercial farms.

Source: Australian Bureau of Statistics.

## State Trend

## Results and Interpretation

This indicator shows the total area of farm establishments reported to the Australian Bureau of Statistics through the farm census as a percentage of the total privately owned or leased rural land (excluding built-up areas) within each Statistical Local Area (SLA).

A high percentage indicates a high proportion of rural land is used by farm businesses that produce sufficient gross income to qualify for inclusion within the Australian Agricultural Census.

A low percentage indicates a significant proportion of rural land is not managed as part of a farm business.

Commercial agriculture dominates rural land use in the Mallee, Wimmera and East Gippsland.

Commercial agriculture is less dominant in peri-urban areas around Melbourne and regional centres of Geelong, Bendigo, Ballarat, Shepparton, the La Trobe Valley and Wangaratta. In

these locations we can conclude that much of the "agricultural" land identified by the Bureau of Rural Sciences land use map is serving an amenity function.

Coastal and hill country locations are transitional, with commercial agriculture generally being the major land use, but less dominant than in the Mallee or Wimmera. In these locations, land values are often higher than would be suggested by the agricultural capacity of the land. This will limit the capacity of farms in these regions to maintain commercial viability over the longer term.

These differences have implications for land management programs. Some sustainable land management practices such as the sowing of perennial pasture for salinity control will be of little relevance to rural land owners who are not motivated by commercial objectives.

**Indicator Definition** The indicator presents the percentage of private land utilised by commercial farming enterprises in Victoria.

**Rationale** What happens on and to Victoria's farms is of crucial importance for all Victorians concerned about natural resource management policy. Approximately 85 per cent of Victoria's privately owned land is nominally used for agricultural production. Agriculture uses 77 per cent of the State's water resources. Over half the native vegetation on private land is considered to be representative of threatened ecological communities. The state of the Victorian agriculture sector sets the bounds of achievable change in catchment and resource management for much of Victoria. Changes in the structure of Victoria's agricultural sector will change our capacity to protect much of Victoria's natural resource base.

## MANAGEMENT RESPONSE

17

### State Management Response

- S** To date there has been no strategic imperative for an agricultural strategic plan for the state. Industry sectors have tended to produce comprehensive strategic plans and research and development programs. A range of drivers is pressuring change in the agricultural sector. This is stimulating discussion regarding an overarching vision and strategy for the future of agriculture in Victoria.
- Pm** Comprehensive performance measures and targets exist at an industry level.
- C** There is an extensive range of agricultural related programs that implicate this and other socio-economic indicators.
- me** CLPR conducts much of the natural resource management related socio-economic research and data interpretation on a project-by-project basis. Across the divisions of NRE a range of groups is reviewing socio-economic data.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	no	no	no
North East CMA	yes	yes	yes	yes
Mallee CMA	no	no	no	no
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	yes	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no



## State Status

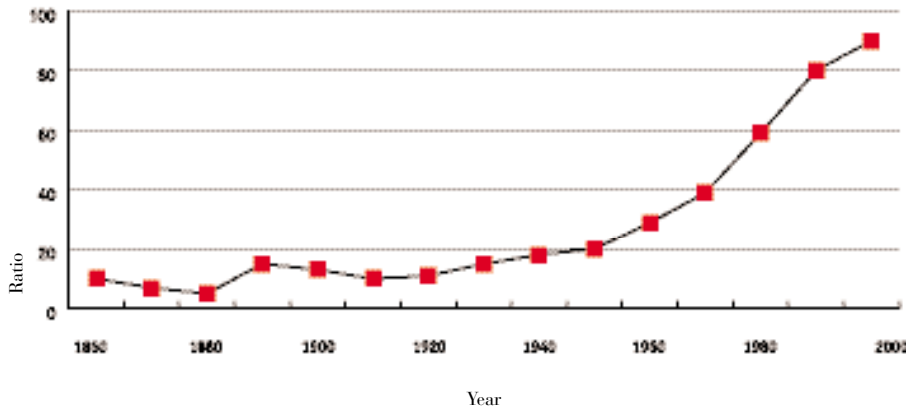


Figure 5. Ratio of Melbourne Population to Victorian Farm Establishments

Source: Australian Bureau of Statistics.

## State Trend

## Results and Interpretation

Since the 1950s Victorian society has rapidly transformed from an agrarian to a non-agrarian society. The number of Victorian farms has halved since the Second World War. In the same period Victoria's non-farm population has doubled, fuelled by the post-war baby boom and migration. The result has been an exponential increase in the ratio of Melbourne residents to farm establishments. The period of greatest transformation occurred between the 1970s and 1980s. Figure 5 shows that in 1885 there were around 5 urban people for every farm establishment. By 2000 this ratio had increased to reach 90 to one. The rate of increase in this ratio may slow in the future as a consequence of a slowing in the rate of population increase. The number of farm establishments can be expected to continue to decline.

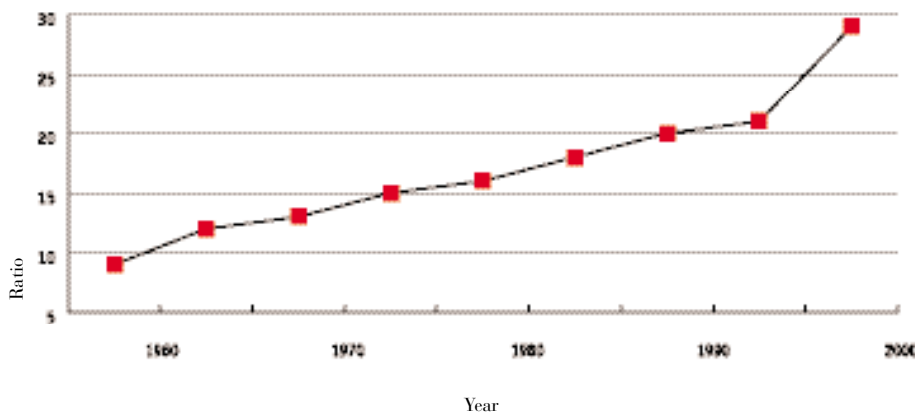


Figure 6. Ratio of total workforce to agricultural workforce in Victoria 1954-1996

Source: Australian Bureau of Statistics.

Similar trends are apparent in the ratio of the total workforce to agricultural workforce in Victoria. Between 1954 and 1996 this ratio increased from 10 to 30 (see Figure 6). The period of greatest increase was between 1986 and 1996, suggesting this transformation of our society is far from complete.



**Indicator Definition** This indicator portrays the proportion of the workforce employed directly in farming enterprises. It does not portray employment in the food industry or the agricultural service sector. **Rationale** A decline in the number of farms and farmers is an inevitable outcome of increased productivity achieved by Victoria's agricultural businesses. This decline, coupled with an increase in the urban population, has contributed to the long term transformation of Victoria from an agrarian society to a much more complex society. In some areas of Victoria, this will provide opportunities for government policy to promote improved land stewardship and ecosystem services.

## MANAGEMENT RESPONSE

19

### State Management Response

- S** To date there has been no strategic imperative for an agricultural strategic plan for the state. Industry sectors have tended to produce comprehensive strategic plans and R&D programs. A range of drivers is pressuring change in the agricultural sector. This is stimulating discussion regarding an overarching vision and strategy for the future of agriculture in Victoria.
- Pm** Comprehensive performance measures and targets exist at an industry level.
- C** There is an extensive range of agricultural related programs that implicate this and other socio-economic indicators.
- me** CLPR conducts much of the natural resource management related socio-economic research and data interpretation on a project by project basis. Across the divisions of NRE a range of groups is reviewing socio-economic data.

The declining proportion of the workforce employed in agriculture is not just a phenomenon related to the growth of Melbourne. This decline is apparent in all parts of Victoria and can be seen in the two snapshots of Victoria's workforce in 1954 and 1996.

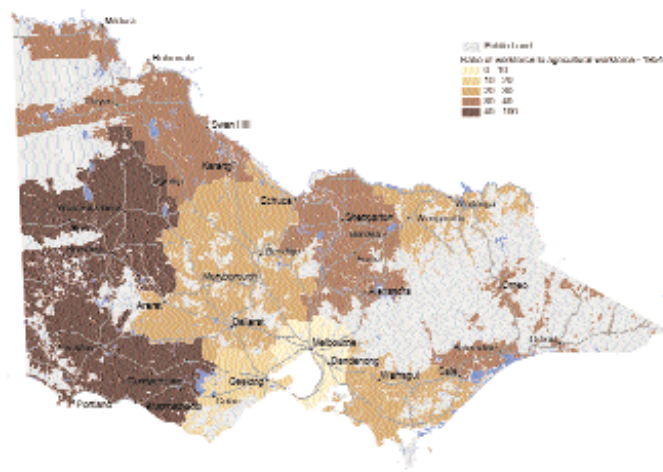


Figure 7. Ratio of agricultural workforce to total workforce in Victoria - 1954

Source: Australian Bureau of Statistics.

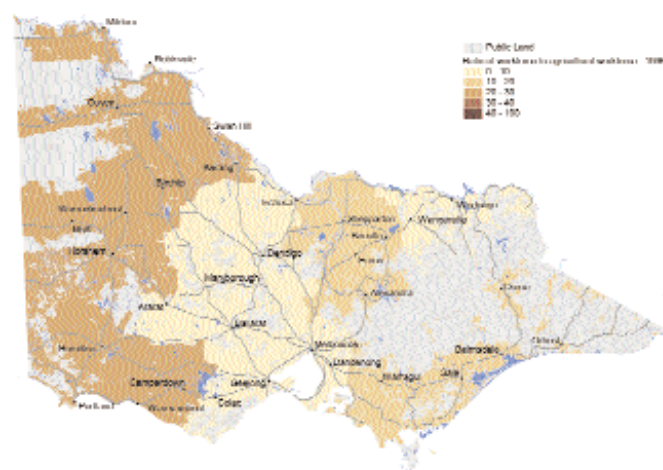


Figure 8. Ratio of agricultural workforce to total workforce in Victoria - 1996

Source: Australian Bureau of Statistics.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	yes	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no

## Ratio of value of agricultural land to value of agricultural production



**Indicator Definition** The indicator is a ratio of the value of agricultural land and the value of production from agricultural land.

**Rationale** An outcome of the increasing urbanisation of Victoria is an increased demand for environmental and amenity services from land and water in competition with demand for agricultural production from land and water. This trend can be seen in increased support for environmental initiatives such as the return of water to the Snowy River. These pressures operate not just through government intervention, but also through the land market, and it is the land market that has the greatest impact upon the competitiveness of agricultural industries. Increased demand for land as a place of residence will often increase the market value of land. This increased value reduces the capacity of agricultural enterprises to purchase land and improve their productivity. This will, in the long run, lead to an inevitable and continuing decline in competitiveness.

## MANAGEMENT RESPONSE

21

### State Management Response

- S** To date there has been no strategic imperative for an agricultural strategic plan for the state. Industry sectors have tended to produce comprehensive strategic plans and R&D programs. A range of drivers are pressuring change in the agricultural sector. This is stimulating discussion regarding an overarching vision and strategy for the future of agriculture in Victoria.
- Pm** Comprehensive performance measures and targets exist at an industry level.
- C** There is an extensive range of agricultural related programs that implicate this and other socio-economic indicators.
- me** CLPR conducts much of the natural resource management related socio-economic research and data interpretation on a project by project basis. Across the divisions of NRE a range of groups are reviewing socio-economic data.

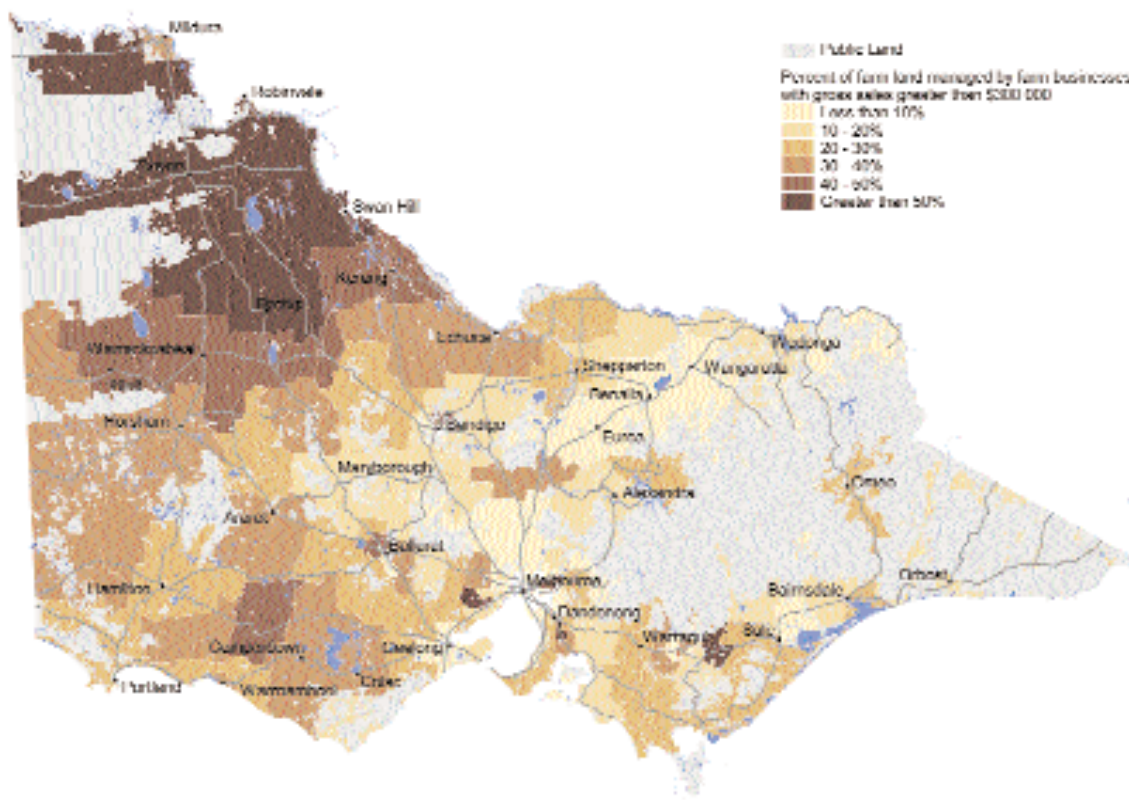


Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	no	no	no
North East CMA	yes	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no



## CONDITION

## State Status



### State Trend

## Results and Interpretation

Figure 10. Percent of farm land managed by farm businesses with gross sales greater than \$300,000.

Source: Australian Bureau of Statistics.

There are similarities between the information provided in Figure 10 and that provided on previous maps for indicators on agricultural workforce and value of agricultural land to value of production. This demonstrates a relationship between the viability of broadacre agricultural industries, land values and the relative importance of agriculture to the regional economy.



**Indicator Definition** Percentage of farm land managed by financially large farms in Victoria. **Rationale** Compression of farmers' terms of trade are an ongoing aspect of most agricultural industries. To remain competitive, farm businesses must generate productivity increases at a rate that generates sufficient productivity gains to stay ahead of the compression of farmers' terms of trade. Recent research suggests that only the larger broadacre farms (measured by gross income) are generating these gains. Therefore, small and medium farms will need to expand to manage the declining terms of trade. In areas with high land value, farm expansion may be restricted by increased capital investment and lower returns. Over the longer term, high land values are likely to lead to the adoption of intensive agricultural land uses or land retirement from agriculture. This indicator will identify where land use change is likely to occur and will provide government with spatial information to support strategy and policy development.

## MANAGEMENT RESPONSE

23



The majority of the farm landscapes of the cropping and irrigation regions of northern Victoria are managed as part of farm businesses with gross sales greater than \$300,000 per annum. Businesses in these regions can be expected to generate positive returns to capital and to be capable of keeping up with the decline in the agricultural terms of trade. Relatively low land values will allow some of these businesses to expand through purchase of neighbouring farms. This aggregation will fuel regional population decline.

The farm landscape of many SLAs along the northern slopes of the Great Dividing Range is dominated by smaller farms. These farms will be less likely to keep up with the decline in the agricultural terms of trade. They will also be less likely to increase scale because of the higher relative land values in these areas. The future for agriculture in these regions will be a combination of intensification of operations on some farms and decreasing competitiveness on others. This is associated with a gradual ageing of the farm population in these areas as fewer young persons enter agriculture due to perceived limited opportunities.

### State Management Response

- S** To date there has been no strategic imperative for an agricultural strategic plan for the state. Industry sectors have tended to produce comprehensive strategic plans and R&D programs. A range of drivers is pressuring change in the agricultural sector. This is stimulating discussion regarding an overarching vision and strategy for the future of agriculture in Victoria.
- Pm** Comprehensive performance measures and targets exist at an industry level.
- C** There is an extensive range of agricultural related programs that implicate this and other socio-economic indicators.
- me** CLPR conducts much of the natural resource management related socio economic research and data interpretation on a project by project basis. Across the divisions of NRE a range of groups is reviewing socio-economic data.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	yes	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no

theme SOCIO-ECONOMIC

Indicator



# Median age of farmers

Indicator Information Confidence Rating



24

## CONDITION

### State Status

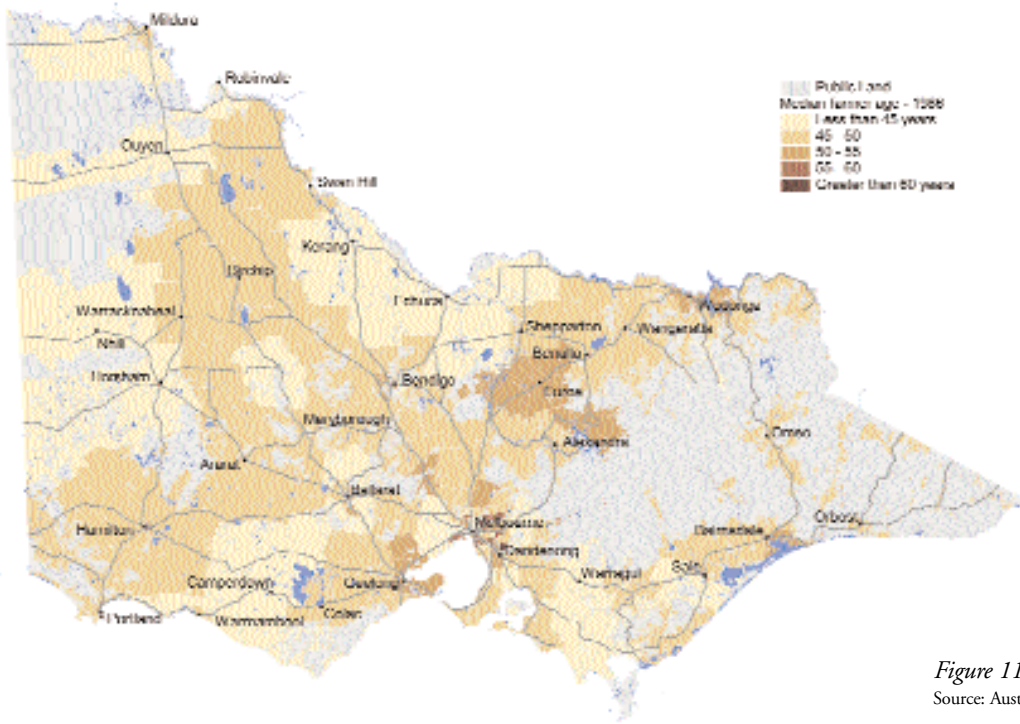


Figure 11. Median farmer age - 1986.  
Source: Australian Bureau of Statistics.

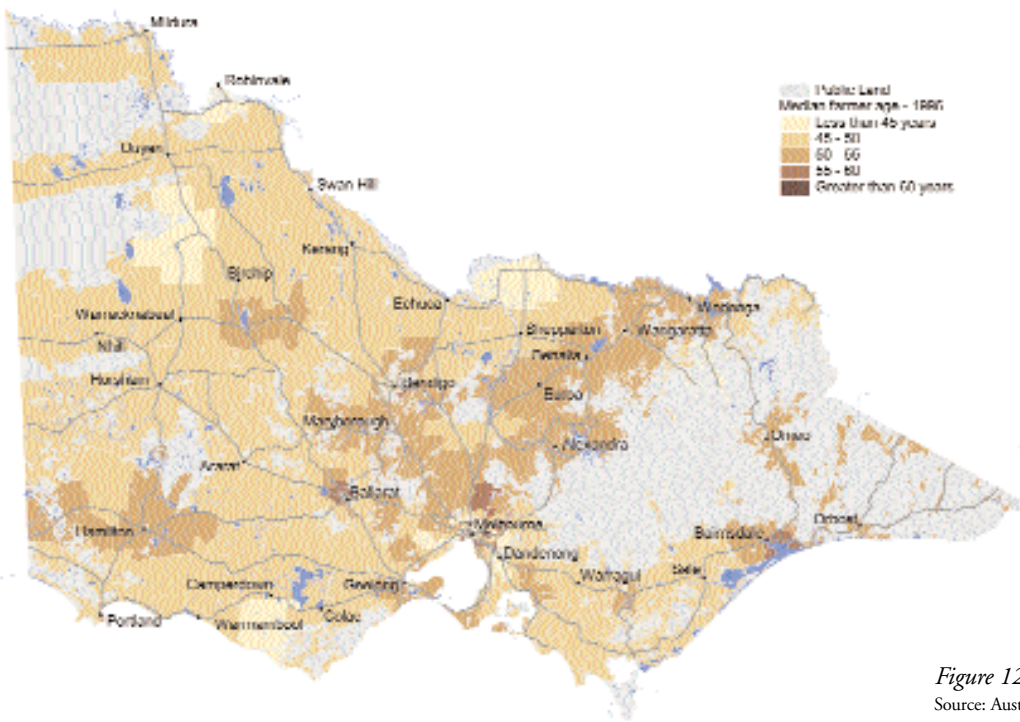


Figure 12. Median farmer age - 1996.  
Source: Australian Bureau of Statistics.

**Indicator Definition** The median age of farmers in Victoria. **Rationale** The decline in the rate of entry of younger people to farming and the associated deferral of retirement from farming is expected to lead to an ageing of the farm population. The ageing of the farm population has been evident in official statistics Australia since 1981.<sup>30</sup> In some regions, increasing median farmer age may be a transitory phase between present land use patterns, and a new land use structure that will develop when the current generation of land managers retire from farming.

## MANAGEMENT RESPONSE

25

### State Trend

#### Results and Interpretation

Between 1986 and 1996 the median age of farmers increased in most regions of the state. This is an outcome of reduced numbers of younger persons entering agriculture.

Median ages of farmers are highest in those regions with smaller farms, higher land values and lower proportions of the workforce employed in agriculture.

There are major questions arising over intergenerational transfer and land ownership in these regions during the next two decades. It is likely that subsequent generations of users of this land will have different cultural expectations with regard to the land and farming.

Changes in the values and aspirations of the land-owning population may open new options for catchment protection. Some districts may move increasingly towards a form of retirement farming with a stable aged population of land managers. This scenario is most characterised by the beef industry in the high rainfall zone and in sections of the wool industry.

### State Management Response

- S** To date there has been no strategic imperative for an agricultural strategic plan for the state. Industry sectors have tended to produce comprehensive strategic plans and R&D programs. A range of drivers is pressuring change in the agricultural sector. This is stimulating discussion regarding an overarching vision and strategy for the future of agriculture in Victoria.
- Pm** Comprehensive performance measures and targets exist at an industry level.
- C** There is an extensive range of agricultural related programs that implicate this and other socio-economic indicators.
- me** CLPR conducts much of the natural resource management related socio-economic research and data interpretation on a project by project basis. Across the divisions of NRE a range of groups is reviewing socio-economic data.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	no	no	no
North East CMA	yes	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no



## 3.5 theme 2 BIODIVERSITY

26



The maintenance of biodiversity is underpinned by healthy ecosystem processes and ecologically sustainable catchments.

*Know Your Catchments* (1997) did not address biodiversity condition, pressures and trends at any meaningful level.

The pressures on biodiversity result from the fragmentation and continued degradation of native vegetation and other habitats and direct impact on species. Major threatening processes which degrade habitat values and impact on the viability of threatened species populations include overgrazing, introduced predators, herbivores, environmental weeds, altered fire and water regimes, salinity, habitat loss and disturbance.

Based on limited information, current trend analysis indicates the continued decline of biodiversity values across much of the landscape.

The *Victorian Catchment Indicators Report, 2001* discusses indicators developed to report on conservation status and condition of native vegetation classes and native species. We have good information on the distribution of these assets across much of the State. However, data on condition and trends is extremely limited.

We currently have bioregional conservation status for native vegetation data for in excess of 70 per cent of the State, and mapping of the remainder will be completed by 2004. The implementation of the Native Vegetation Management Framework means that in the medium-term, trends in conservation status and the contribution of native vegetation to catchment biodiversity values will result mainly from changes in

condition. Whilst the 'habitat hectares' approach will enable us to measure such changes at a site-based level, this approach needs to be supplemented by additional data to allow the measurement of ongoing changes in vegetation condition resulting from threatening process and management changes at a landscape scale. Our current inability to assess native vegetation condition at a broad-scale is perhaps the biggest gap in our current knowledge base.

Native species conservation status is assessed at National and State level and trials of bioregional status have been underway for the past two years. Changes in the number of threatened species in each status class is a relatively coarse measure of environmental and catchment condition. Information on the size of a representative sample of threatened (and non-threatened) species populations is required as a useful baseline for reporting changes in catchment biodiversity condition and is a component of the national framework for monitoring and evaluation. A developmental project is required to establish protocols and techniques for this indicator.

We need a considerable increase in effort to establish baselines and commence periodic monitoring of trends in native species populations and habitat quality. Ideally we require across the landscape assessment of changes in native vegetation and other habitat condition which can be linked to land management practice.

Baseline population data should be collected for at least all threatened species considered as bioregional priorities. Within this group, monitoring of trends in populations should be





 A Red symbol represents poor or limited data collection and interpretation.

## theme BIODIVERSITY

Indicator

Conservation status of native vegetation types at the state and bioregional level

Indicator Information Confidence Rating



28

## CONDITION

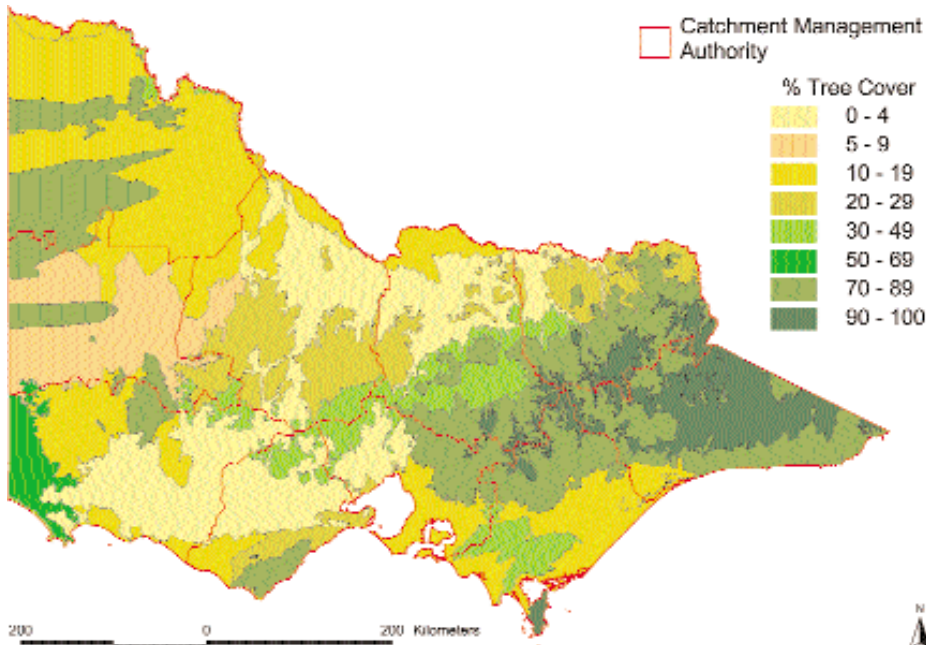


Figure 14. Proportion of remnant tree cover within bioregions.

Source: NRE GIS Corporate Database

## State Trend

## Results and Interpretation

Loss of extent and condition of native vegetation since European settlement is recognised as the greatest historical impact on native biodiversity. The consequences of this reduction and fragmentation for species viability and ecological resilience, continue to be expressed and are a major reason for the continuing decline in biodiversity.

It is estimated that 70 per cent of Victoria's native vegetation has been cleared since European settlement, and that this clearing has impacted in particular on vegetation types (Ecological Vegetation Classes) in the more fertile and/or accessible landscapes that are suited to pastoral, agricultural or urban use.

Of the remaining 30 per cent, it is estimated that 7.4 million hectares are located on public land and approximately 1.1 million hectares are found on private land.

According to our most recent statewide assessment Victoria is still losing an estimated 2,500 hectares of native vegetation per year.

Data on the current and presumed original extent of EVCs is available for the majority of Victoria and this allows determination of conservation status based primarily on historical impacts. However, data on short-term changes in extent and condition is very limited and so quantitative trend assessments are not yet possible.

## State Condition and Trend



## Regional Condition and Trend

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

## Condition Legend

- OPTIMAL
- GOOD
- MODERATE
- POOR

## Trend Legend

- POSITIVE
- NEGATIVE
- STABLE
- UNKNOWN

**Indicator Definition** This indicator describes the current conservation status of Ecological Vegetation Classes (EVCs) at the bioregional level. EVCs are categorised as either Presumed Extinct, Endangered, Vulnerable, Depleted, Rare or Least Concern (conservation status criteria). This indicator also reports on the extent of EVC depletion that has occurred post European settlement. In addition this indicator summarises the proportion of EVC being managed within different land tenures as a measure of the likely degree of protection. **Rationale** *The Flora and Fauna Guarantee Act, 1988, Victorian Biodiversity Strategy (1997), Regional Forest Agreements, Victoria's Native Vegetation Management – A Framework for Action 2002, Regional Catchment Strategies, Regional Native Vegetation Plans and Action Statements* all recognise the need for biodiversity conservation and monitoring across a range of native vegetation types. These strategies and plans recognise that a 'whole of landscape' or 'tenure blind' perspective is the most appropriate planning approach for native vegetation conservation, but also recognise that different strategic emphases and tools will be required for different tenures. It is important to ensure that information regarding the conservation status of native vegetation types is available to community groups and governments, both to guide priorities for protection and investment, and to measure progress resulting from these interventions.

29

## MANAGEMENT RESPONSE

### State Management Response

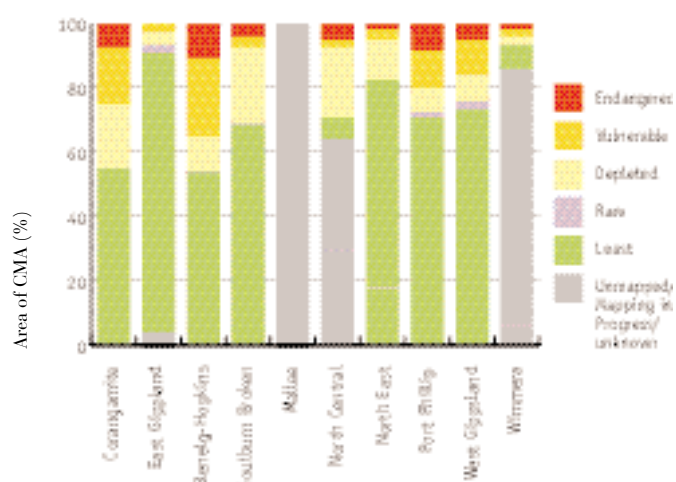


Figure 15. Bioregional Conservation Status of Ecological Vegetation Classes by Catchment Management Authority.

Source: Parks Flora and Fauna Division, DNRE 2002.

Bioregional Conservation Status of Ecological Vegetation Classes	
Presumed Extinct	Probably no longer present in the bioregion
Endangered	< 10% of pre-European extent remains
Vulnerable	10 – 30% pre-European remains
Depleted	>30% and up to 50% pre-European extent remains
Least Concern	>50% pre-European extent remains
Rare	Total range <10,000ha or pre-European extent in bioregion <1,000ha or patch size <100ha

Table 1. Definition of biological conservation status of EVCs.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes*	In prep	yes	In prep
North East CMA	yes*	In prep	yes	In prep
Mallee CMA	yes*	In prep	yes	In prep
North Central CMA	yes*	In prep	yes	In prep
Port Phillip CaLP	yes*	In prep	yes	In prep
Goulburn Broken CMA	yes*	In prep	yes	In prep
Glenelg-Hopkins CMA	yes*	In prep	yes	In prep
East Gippsland CMA	yes*	In prep	yes	In prep
West Gippsland CMA	yes*	In prep	yes	In prep
Wimmera CMA	yes*	In prep	yes	In prep

\* Regional Native Vegetation Plans are being finalised following release of Victoria's Native Vegetation Management – A Framework for Action and Bioregional Action Plans are under development.

- S** Victoria's Biodiversity Strategy; Victoria's Native Vegetation Management – A Framework for Action; Regional Forest Agreements.
- Pm** Reversal of decline in extent and quality of native vegetation, leading to a net gain with the first target being no net loss by 2001. The present diversity of species and ecological communities and their viability is maintained or improved across each bioregion. There is no further preventable decline in the viability of any rare species or of any rare community. There is an increase in the viability of threatened species (endangered and vulnerable) and in the extent and quality of threatened ecological communities.
- 15 per cent of the pre-1750 distribution of each forest ecosystem should be protected; at least 60 per cent of the remaining extent of vulnerable forest ecosystems should be reserved.
- C** Yes – resources for native vegetation protection and for native revegetation are provided through State and Commonwealth programs like Bushcare, National Action Plan for Salinity and Water Quality, and a range of other incentive schemes.
- me** The conservation status of vegetation types at the bioregional level primarily reflects the net result of historical impacts. These ratings are not expected to change in the short-term they are therefore suitable for indicating resource condition but not trend. Assessment of trends requires information on extent and condition changes at a finer scale, in both time and space. Information management systems to better record direct activities relating to native vegetation are under development. However there is currently no regular inventory of native vegetation extent / condition (at an appropriate scale) to measure the net outcome.

## theme BIODIVERSITY

Indicator

## Conservation status of species at the State and bioregional level

Indicator Information Confidence Rating



30

## CONDITION

## State Status

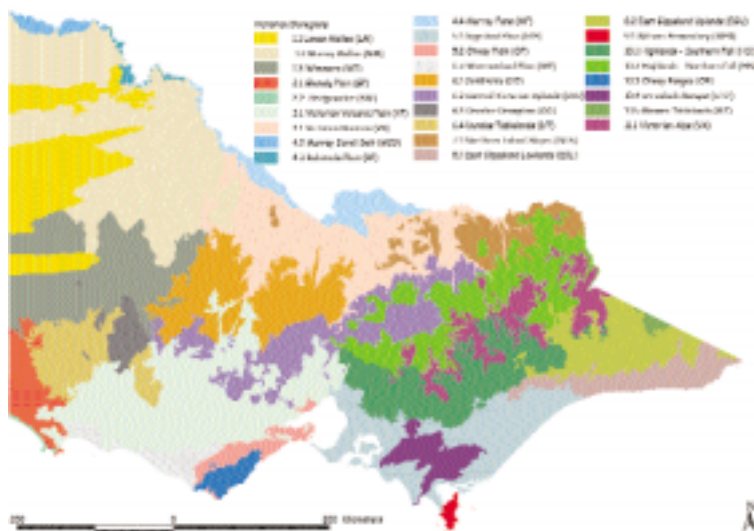


Figure 16. Victorian Bioregions.

Source: NRE GIS Corporate Database.

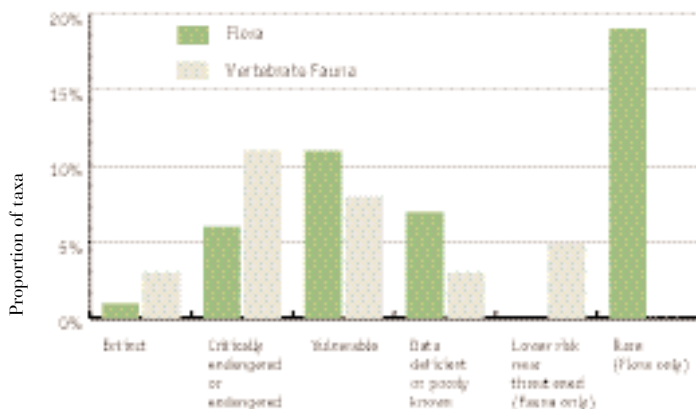


Figure 17. Conservation Status of Victorian Flora and Fauna.

Source: Flora Information System DNRE (May 2002), Threatened Vertebrate Fauna in Victoria - 2000, NRE.

## State Condition and Trend



## Regional Condition and Trend

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

Condition Legend	Trend Legend
OPTIMAL	POSITIVE
GOOD	NEGATIVE
MODERATE	STABLE
POOR	UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)

## State Trend

## Results and Interpretation

## Fauna

Figure 17 shows the statewide conservation status of vertebrate animal species within Victoria.

793 native vertebrate species (excluding marine fish) have been recorded for Victoria.

- > 23 (3%) taxa are Extinct in Victoria
- > 36 (5%) Critically Endangered
- > 52 (7%) Endangered
- > 64 (8%) Vulnerable
- > 62 (8%) are either near Threatened, or believed to be Threatened, but current data is insufficient to assign a level of threat.

69 invertebrate taxa have also been identified as Rare, Threatened or Extinct.

## Flora

Figure 17 shows the statewide conservation status of plant species within Victoria.

There are approximately 4,200 taxa (species subspecies or varieties) of native flora currently recognised in Victoria.

Of these:

- > 48 (1%) are believed to be Extinct in Victoria
- > 250 (6%) Endangered
- > 471 (11%) Vulnerable
- > 789 (19%) Rare
- > 306 (7%) are poorly known but believed to fall into one of the Rare or Threatened categories

The condition legend below relates to the proportion of species that are threatened within each CMA Region. Trend information is not available at the regional level.



**Indicator Definition** This indicator reports on the Victorian conservation status of animal and plant species at the State level and estimated changes in their abundance at the bioregional level. The indicator refers to species considered rare or threatened in Victoria only: their status elsewhere in Australia or beyond is not considered in assigning Victorian conservation status. **Rationale** Victorian biodiversity conservation policies recognise the need to protect and enhance biodiversity at a range of levels - ecosystems, species and genes. Species are often the most familiar level to the public, particularly the high-profile "charismatic" species like arboreal mammals, owls and parrots. However it is important to ensure that information regarding the conservation status of a wider range of species (representing evolutionary classes, life history types, and landscape processes) is also available to community groups and governments for practical decision making which provides comprehensive coverage of biodiversity conservation.

## MANAGEMENT RESPONSE

31

### State Management Response

- S** Victoria's Biodiversity Strategy, Victoria's Native Vegetation Management – A Framework for Action; Regional Forest Agreements, and the National Action Plan for Salinity & Water Quality.
- Pm** The present diversity of species and ecological communities and their viability is maintained or improved across each bioregion. There is no further preventable decline in the viability of any rare species or of any rare community. There is an increase in the viability of threatened species and in the extent and quality of threatened ecological communities.
- C** Yes – resources for the protection, enhancement and restoration of native species and communities are provided through State and Commonwealth programs including the Flora and Fauna Guarantee Act, 1988 implementation, Living Systems Project, and community programs such as Land for Wildlife, Bushcare, Nation Action Plan for Salinity and Water Quality, and a range of other incentive schemes.
- me** There is currently activity for a limited number of taxa, however it is anticipated that development of a more comprehensive monitoring program will be accelerated through the National Action Plan for Salinity and Water Quality.

### Regional Case Study

#### Goldfields Bioregion

**Description of Bioregion.** The Goldfields bioregion is dominated by dissected uplands and low hills between Stawell and Nagambie, north of the Great Dividing Range.

It supports fragmented native forests and grassy woodlands, mostly on the relatively poor soils. The bioregion is dominated by Box-Ironbark forests but also had large areas of dry foothill forest complexes.

The bioregion has 167 extinct, threatened or rare plant taxa and 78 extinct, threatened, near threatened or rare animal species. Ongoing threatening processes within this bioregion include loss of habitat, fragmentation of habitat, inappropriate grazing regimes, inappropriate fire regimes, introduced pest plant and animal species.

#### Results and Interpretation

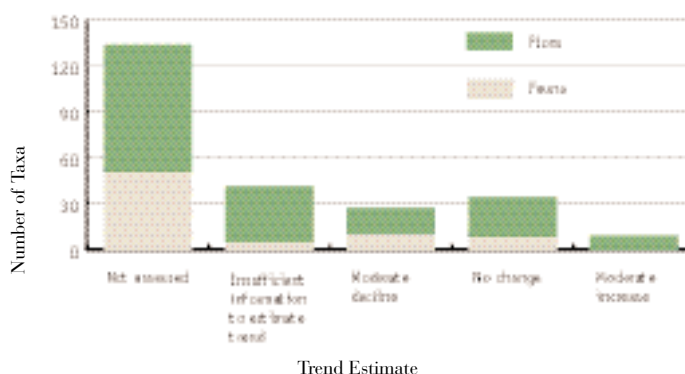
Figure 18 shows the estimated change in abundance over the past five years (since 1997/98) for Victorian rare, threatened or extinct species within the bioregion.

#### Fauna

Of the 27 animal species assessed, it was estimated that one showed a moderate increase, nine were unchanged and 11 had declined. There was insufficient information to indicate a trend for the other six. Fifty-one other taxa have not yet been assessed.

#### Flora

Of the 84 flora taxa assessed, it was estimated that 8 showed a moderate increase, 25 were unchanged and 16 had declined. There was insufficient information to indicate a trend for the other 35. Eighty-three other taxa have not yet been assessed.



**Figure 18. Change in abundance since 1997 for each rare or threatened species in the Goldfields bioregion.**

Source: Flora Information System NRE (May 2002), Threatened Vertebrate Fauna in Victoria - 2000, NRE.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	yes	no
North East CMA	no	no	yes	no
Mallee CMA	no	no	yes	no
North Central CMA	no	no	yes	no
Port Phillip CaLP	no	no	yes	no
Goulburn Broken CMA	no	no	yes	no
Glenelg-Hopkins CMA	no	no	yes	no
East Gippsland CMA	no	no	yes	no
West Gippsland CMA	no	no	yes	no
Wimmera CMA	no	no	yes	no

### 3.6 theme 3 RIVERS, WETLANDS AND ESTUARIES

32



Rivers, floodplains, wetlands and estuaries make up only a small portion of the Victorian landscape, yet their overall significance for the economy, the ecology and the social fabric of Victoria is immense. They provide society with a wide range of ecosystem services. They support biodiversity and natural processes that purify water, cycle water, nutrients and sediments, buffer coastlines and mitigate flooding. They provide water for drinking, irrigation and agriculture and for industry such as aquaculture, and forestry. They also provide focal points for recreation and tourism and cultural enrichment, especially for indigenous Victorians.

Victoria's rivers, wetlands and estuaries are in decline. Less than 27 per cent of our major rivers are in good or excellent condition, 35 per cent of our wetlands have been totally lost, and 44 per cent of our estuaries have been significantly modified. The most serious pressures on rivers, wetlands and estuaries are salinisation, changes to natural water regimes, impacts related to poor land use practices and the potential impacts of climate change. Furthermore, these pressures interact. For example, reduced flow in rivers exacerbates the impacts of salinisation and nutrient input.

Salinisation of rivers, wetlands and estuaries is likely to increase significantly in coming decades in line with the predicted increase in the area affected by dryland salinity. Rivers and wetlands are particularly vulnerable as they occur at low points in the landscape and often intersect water tables. The impact of changed water regimes on aquatic ecosystems has been significant and the status of many aquatic-dependent species will continue to deteriorate unless there are significant improvements in water regime management. Many species that depend on regular flooding to breed have become threatened in recent years.

Poor land use practices still contribute to nutrient enrichment of aquatic ecosystems and cause damage to wetland and riparian vegetation and in-stream habitat. Coastal wetlands often provide natural buffering to storms and high tides. However they are at risk as sea levels rise and climate events become more extreme as predicted under the greenhouse effect. Estuaries are vulnerable both to the upstream effects of salinisation, reduced flows and nutrient enrichment as well as changes in marine processes driven by global warming.

These pressures and impacts also have economic and social costs. The degradation in environmental condition and subsequent poor water quality can restrict the range of economic and recreation activities dependant on healthy rivers. As well, the demand for water from these activities will continue to grow and needs to be balanced against the environmental condition if river, wetland and estuary health is to be maintained or improved. Climate change is also likely to affect rainfall and impact on the water resources available for consumptive uses.

River condition is monitored by the Index of Stream Condition (ISC) which was developed as an integrated measure of river condition and will be important to benchmarking, setting management objectives and targets, and assessing the long-term effectiveness of river management programs.

The ISC was developed using the best available science. As our understanding of river processes and management responses increases the ISC will require regular review and updating. This will allow the ISC to reflect advances in scientific understanding to provide the most useful measure of stream condition to regional communities for planning and assessment. One immediate area is requirement for the hydrology component to take into account advances in environmental flows.

Key gaps in our knowledge of rivers have been identified in the Victorian River Health Strategy (VRHS).<sup>31</sup> These include the need to improve our understanding of the importance and likely impact of environmental flows and the importance of groundwater in affecting both the quality and quantity of water in river systems. As well, there is the need to develop acceptable monitoring methodologies for other indicators, such as floodplain condition and status of floodplain linkages, and to extend the monitoring coverage of some indicators. For example, there is incomplete coverage of water quality and hydrology data with much of the information estimated rather than sampled. With reduced funds to support the Victorian Water Quality and Quantity Monitoring Networks, the number of sites monitored for water quality and water quantity has halved over the last two decades. This is of concern as we need consistent, long-term datasets to detect change.

A key issue in monitoring river health is an understanding of the condition of the biota, particularly macro-invertebrate and fish communities which are used as indicators of the health of the rest of the biota. Macro-invertebrate communities in Victorian rivers were monitored over the last six years through the Australian Rivers Assessment Program, with Commonwealth funding assistance. Victoria has extended the monitoring for another three years. However there is not complete coverage for macro-invertebrates and no funding commitment after three years. Monitoring of fish communities has been through a range of specific studies rather than any regular program due, in part, to the fact that there is currently no agreed, consistent, cost-effective methodology for monitoring.

Currently there are no indicators which directly measure the impacts of threats on inland, marine or coastal wetlands or estuaries. These are urgently needed. Ideally, information is required to support a comprehensive analysis of management priorities across all wetlands and estuaries. This would include collecting the information on values (natural, economic, social) and threats, or risks, and the impact of threats (condition) for individual wetlands. An agreed valuation framework for wetlands and estuaries that provides a guide to the assessment of the full range of natural, economic and social values would be very useful to support consistent statewide assessment. Similarly an agreed measure of wetland and estuarine condition is required. Wetlands could then be prioritised based on relative value and threat. In addition, such information would support catchment-scale analyses to identify the most serious threats to wetlands across landscapes. Other monitoring information to measure the effectiveness of management techniques, actions and to support adaptive management is also required.

An important component of improving our knowledge and key information will be to increase our capacity to support additional data collection. Issues, such as data storage, information management and accessibility, statistical reliability, and resourcing need to be considered when introducing new indicators.

The VRHS establishes a vision for river health across Victoria and sets out a series of targets over the next 20 years to achieve this vision. Targets for 2021 are:

- > all Heritage Rivers to be maintained at least to their current condition and their Heritage River values protected
- > one major representative river reach in ecologically healthy condition in each major river class
- > an increase of 3,000 km in the length of rivers in excellent or good condition.

However, the interdependence between river, wetland and estuarine condition and human use and practices means that their management is not an easy task. It requires striking a delicate balance between using our rivers, wetlands and estuaries and maintaining their environmental condition. To achieve this balance, the community needs to fully understand the potential impacts of management actions on river, wetland and estuarine condition. Communities will have to make decisions about what purposes rivers, wetlands and estuaries serve, what consequent environmental condition they are prepared to accept and what the implications of that level of environmental condition are for other uses.

The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:



= This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.



= This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.



= This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.



= This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend



A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;



An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;



A Red symbol represents poor or limited data collection and interpretation.



**theme RIVERS, WETLANDS  
AND ESTUARIES**

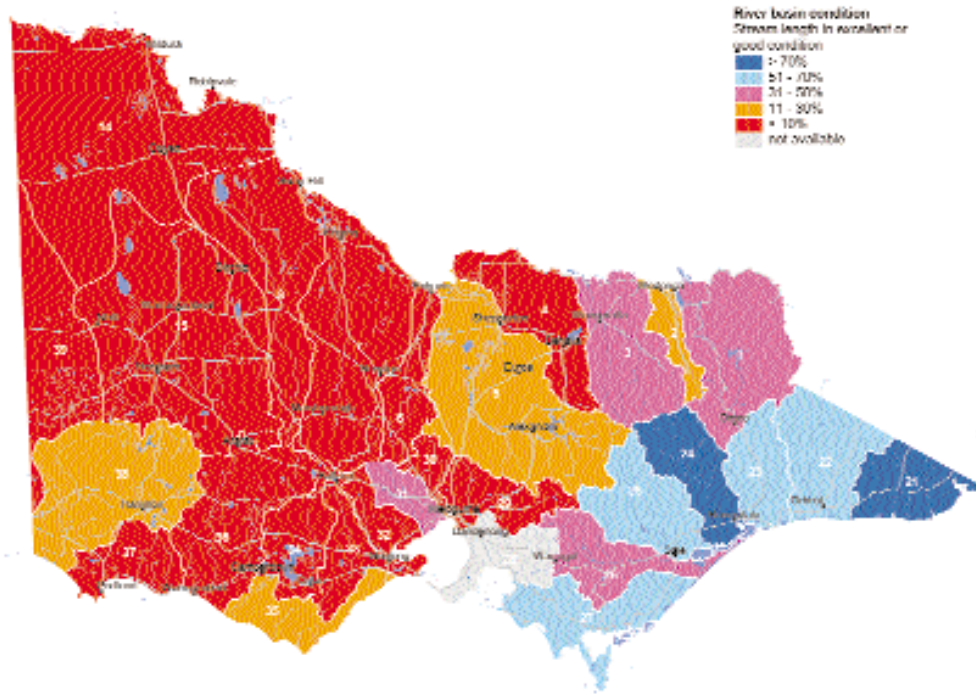
Indicator

**Index of stream condition**

Indicator Information Confidence Rating



34

**CONDITION**
**State Status**

**State Trend**
**Results and Interpretation**

In the first benchmarking exercise, undertaken in 1999, 950 reaches representing 18,000 km of Victoria's major streams and their tributaries were assessed. ISC benchmarking is to be undertaken every five years by the Catchment Management Authorities in partnership with NRE.

22 per cent of river length is in good or excellent condition. Of these, the majority are in the south east of the State, with the basins of the East Gippsland, Snowy, Tambo, Mitchell, Thomson and South Gippsland rivers having more than 51 per cent of their stream length in excellent condition.

34 per cent of major rivers and streams are in poor or very poor condition. The ISC has only been completed once and so this information provides only a benchmark. No trend information exists at this stage. This information will be available after the next ISC is completed in 2004.

*Figure 19. Stream length in excellent or good condition.*

Source: Victorian River Health Strategy<sup>31</sup> (Melbourne metropolitan area not included).

1-Upper Murray River, 2-Kiewa River, 3-Ovens River, 4-Broken River, 5-Goulburn River, 6-Campaspe River, 7-Loddon River, 8-Avoca River, 14-Mallee, 15-Wimmera-Avon Rivers, 21-East Gippsland, 22-Snowy River, 23-Tambo River, 24-Mitchell River, 25-Thomson River, 26-Latrobe River, 27-South Gippsland, 28-Bunyip River, 29-Yarra River, 30-Maribynong River, 31-Werribee River, 32-Moorabool River, 33-Barwon River, 34-Lake Corangamite, 35-Otway Coast, 36-Hopkins River, 37-Portland Coast, 38-Glenelg River, 39-Millicent Coast.

Basin numbers designated by the Australian Water Resources Council. Numbering of Victorian basins is not consecutive.

**State Condition and Trend**
**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	East Gippsland	North Central

Condition Legend	Trend Legend
OPTIMAL	POSITIVE
GOOD	NEGATIVE
MODERATE	STABLE
POOR	UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)



**Indicator Definition** The Index of Stream Condition (ISC) is an integrated measure of the overall state of a stream reach, based on the assessment of five component sub-indices – hydrology, water quality, physical form, riparian zone, and aquatic life. It is a measure of a stream's change from natural or ideal conditions. **Rationale** It is a Government objective to improve the condition of Victorian waterways to provide for the social, economic and environmental needs of current and future generations. To achieve this objective, we need to monitor trends in stream condition. This will flag problems and identify where more detailed waterway investigations are required. The Index of Stream Condition was developed as an integrated indicator to provide a measure of overall stream condition. There are a number of initiatives and ongoing programs aimed at managing one or more aspects of stream condition. The ISC will enable the assessment of the overall long-term effectiveness of an integrated river health management program.

## MANAGEMENT RESPONSE

35

### State Management Response

- S** Victorian River Health Strategy (VRHS).<sup>31</sup>
- Pm** The VRHS is an overarching framework. The performance measures and targets will be developed by CMAs in their Regional River Health Strategies.
- C** Commitment exists at state (NRE) and regional level through the CMA Regional River Health Strategies.
- me** CMAs in partnership with NRE will report on stream condition in their regions every five years using the Index of Stream Condition. NRE will review the Index of Stream Condition prior to each five-year assessment to ensure information collected is relevant and that there is long-term integrity of the data.

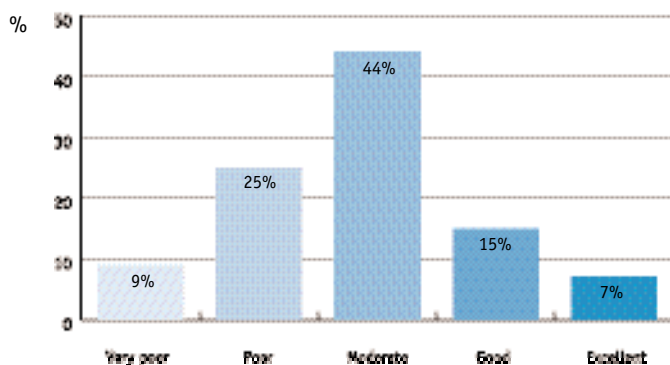


Figure 20. Percentage of stream length classified in each stream condition class for Victorian catchments.

Source: Victorian River Health Strategy<sup>31</sup>.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	2003	yes	yes
North East CMA	yes	In prep	In prep	In prep
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CalP	yes	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes	yes	yes	yes
West Gippsland CMA	yes	In prep	In prep	In prep
Wimmera CMA	In prep	In prep	In prep	In prep

**theme RIVERS, WETLANDS  
AND ESTUARIES**

Indicator

**Environmental flows**

Indicator Information Confidence Rating



36

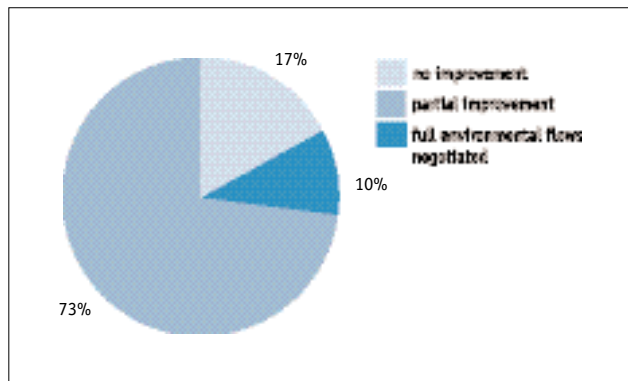
**CONDITION**
**State Status**


Figure 21. Statewide improvement in environmental flows achieved through the bulk water entitlements conversion process.

Source: CaW, NRE.

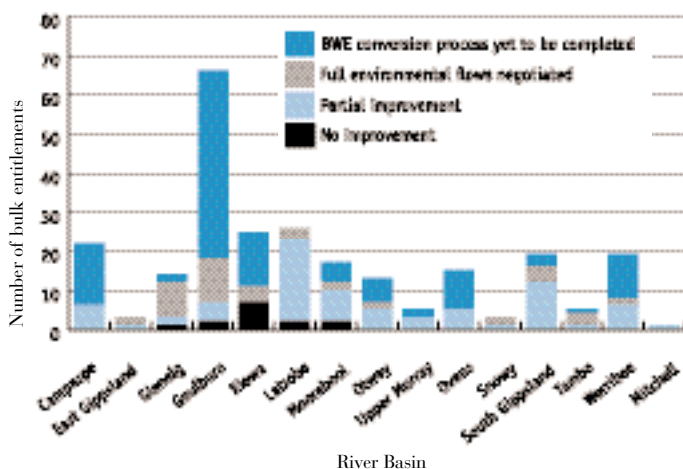


Figure 22. Improvements in environmental flows achieved through the bulk water entitlements conversion process by river basin.

Source: CaW, NRE.

**State Condition and Trend ?**
**Regional Condition and Trend**

Corangamite ?	Port Phillip ?	Wimmera ?	West Gippsland ?	North East ?
Goulburn Broken ?	Glenelg-Hopkins ?	Mallee ?	East Gippsland ?	North Central ?

Condition Legend	Trend Legend
● OPTIMAL	▲ POSITIVE
● GOOD	▼ NEGATIVE
● MODERATE	— STABLE
● POOR	? UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)

**State Trend**
**Results and Interpretation**

The Bulk Entitlement Conversion Program has been successful in obtaining an improvement in environmental flows across Victoria.

In those systems where increased environmental flows were sought, approximately 10 per cent resulted in a full environmental flow outcome, 73 per cent resulted in a partial environmental flow improvement and in 17 per cent of sites no improvement was negotiated.

Although 17 per cent of sites did not result in any environmental flow improvement, the Bulk Entitlement Conversion Program has capped consumptive water use and will limit the future decline in environmental flows.

Approximately 74 per cent of the total number of water supply systems now have Bulk Entitlements. This constitutes 83 per cent of the State's total surface water resources.

There are three SFMPs presently operating. The Gellibrand and Merri SFMPs have resulted in increased environmental flows, while the Upper Latrobe SFMP has confirmed that the existing level of diversions is consistent with maintaining the environmental health of the river.

This report offers a benchmark for bulk entitlements. The indicator will be assessed every five years from 2000, therefore no State trend and condition data is available at this stage.

**Indicator Definition** The Environmental Flow Indicator describes the number of Bulk Water Entitlements (BEs) or Streamflow Management Plans (SFMPs) that attain an Environmental Flow outcome after the Bulk Entitlement conversion and the Streamflow Management Plan processes. **Rationale** There have been relatively few scientific studies into environmental flows for Victoria's rivers. Consequently, in the short-term, it is not possible to identify all rivers that do not have an adequate environmental flow. Therefore a surrogate indicator has been developed to identify where water allocation processes such as Bulk Entitlements and Streamflow Management Plans have direct improvement in environmental flows. The ISC also has a surrogate indicator, which is 'change to natural flows'. The assumption is that the further away from the natural, the greater the stress on the aquatic environment. This indicator is being developed further and may be an important addition to the BE and SFMP surrogate indicator used in this report.

## MANAGEMENT RESPONSE

37

### State Management Response

- S** Victorian River Health Strategy.<sup>31</sup>
- Pm** By 2005, all rivers with either sustainable catchment limits or negotiated environmental flows.  
By 2011, significant improvements in environmental flow regimes of 20 high value river reaches currently flow stressed.  
33 streamflow management plans completed in priority areas by 2004.
- C** Commitment exists through the CMAs and NRE. CMAs are each developing Waterway Management Plans for implementation across each region. CMAs in partnership with NRE will report on stream condition in their regions every five years using ISC.
- me** CMAs, through their Regional River Health Strategies and RCS, will be identifying and developing plans for stressed rivers on a priority basis.

### Regional Case Study

#### Snowy River Environmental Flows

The construction of the Snowy Mountains Hydro-electric Scheme in the 1960s resulted in the diversion of 99 per cent of the Snowy River's natural flow at Jindabyne Dam. The result of this and other human activities has been a build-up of sediment in the river, weed infestation and reduced habitat for native flora and fauna.

In August 2002, the Premiers of Victoria and New South Wales released the first water back into the Snowy River as part of the plan to rejuvenate the historic waterway. The Snowy River will receive initially up to 38 gigalitres (GL) of water per year for three years from the Mowamba River. Over the next ten years, the Victorian and NSW Governments will spend \$300 million to increase the average natural flow at Jindabyne to 21 per cent (212 GL/year). Thereafter the Governments will work with the private sector to increase flows to 28 per cent of natural flow (294 GL/year).

Restoring environmental flows to the Snowy River will ultimately improve water quality, provide an improved habitat for native fish and riparian vegetation, encourage biodiversity, and increase opportunities for recreation and tourism.

Source: NRE: Land & Water Management: Restoring Health to the Snowy River. (2002).

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	In prep	In prep
North East CMA	yes	In prep	In prep	In prep
Mallee CMA	no	no	no	no
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes	yes	yes	yes
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

**theme RIVERS, WETLANDS  
AND ESTUARIES**

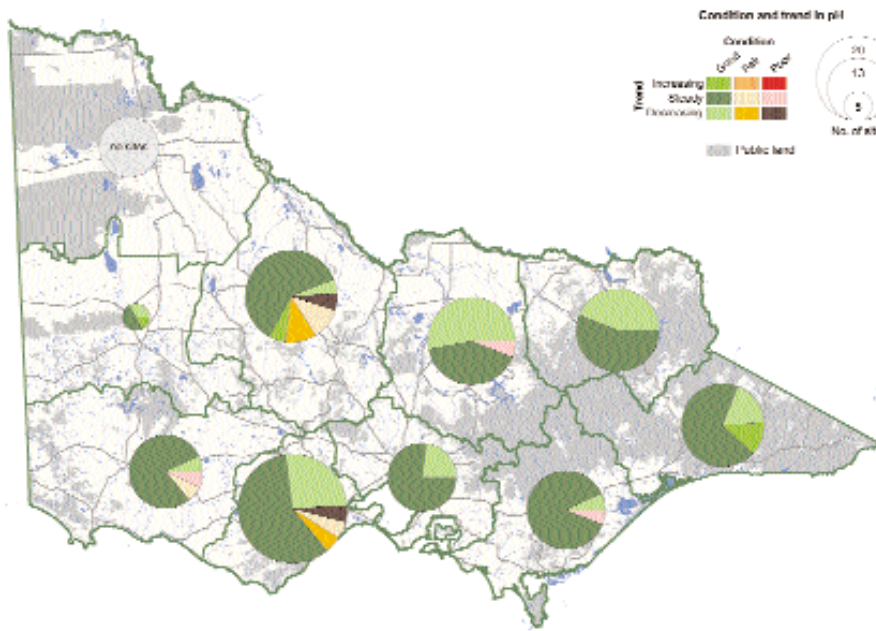
Indicator

**Water quality  
pH**

Indicator Information Confidence Rating



38

**CONDITION**
**State Status**


**Good** = <10% of samples exceeded guideline values  
**Fair** = 10-25% of samples exceeded guideline values  
**Poor** = >25% of samples exceeded guideline values

**Guideline:** Guidelines vary in some regions depending on expected natural conditions. Guidelines used were SEPP Waters of Victoria and schedules. Where SEPP was not available, default ANZECC Water Quality Guidelines are used.

*Figure 23. Condition and trend in pH within CMA regions.*

Source: Victorian Water Resources Data Warehouse

**State Trend**  
**Results and Interpretation**

pH is an emerging issue that regions are beginning to address through a broadening of Water Quality Strategies and Nutrient Management Plans. Significant pH changes can limit fish spawning, reduce macro-invertebrate numbers and mobilise toxicity of pollutants at low pH.

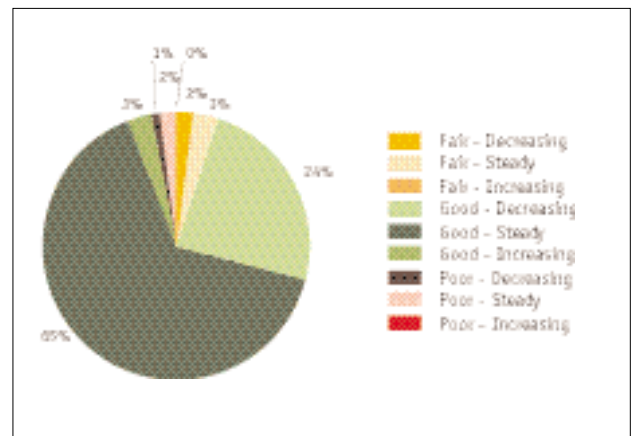
pH has the strongest statewide trend shown for all water quality parameters.

There is a decreasing trend throughout Victoria, with the exception of the East Gippsland CMA region and the northern areas of the North Central CMA region.

This decreasing trend was shown to be strongest in the Goulburn Broken and North East CMA regions.

The magnitude of most pH trends in the East and West Gippsland CMA regions was small relative to the rest of the state.

Due to the dry nature of north-western Victoria, there were only a small number of stations analysed in the Mallee and Wimmera CMA regions.



*Figure 24. Proportion of water monitoring sites in each condition and trend category for Victoria - pH.*

Source: Victorian Water Resources Data Warehouse.

**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	n/a	East Gippsland
				North Central

**Condition Legend**

OPTIMAL  
 GOOD  
 MODERATE  
 POOR

**Trend Legend**

Increasing  
 Decreasing  
 STABLE  
 UNKNOWN



**Indicator Definition** This indicator documents condition, change and trend in median monthly stream pH (acidity) at 108 sampling sites within Victoria. **Rationale** pH is an important water quality parameter that is currently used by national water quality guidelines, National State of the Environment reporting, Catchment Management Authorities and Water Authorities. Measuring concentrations of this parameter helps establish the condition and trend of water quality in streams at the regional and statewide level. It is important to establish long-term trends as this will flag where problems may arise and enable stream water quality targets to be set for specific river basins and streams. Long-term aspirational targets set through the State Environment Protection Policy, Waters of Victoria and medium-term resource condition targets will be set through regional Water Quality, Nutrient and Salinity Management Plans.

## MANAGEMENT RESPONSE

39

### State Management Response

- S** Victorian River Health Strategy.<sup>31</sup>
- Pm** By 2011, 95 per cent of all highland and all lowland monitoring sites will meet SEPP objectives. Achieving this objective may be difficult as the reason for reducing pH is unknown.
- C** Commitment exists at State (NRE) and regional level through the CMA Regional River Health Strategies implemented across each region. The CMA Strategies will be supported by Water Quality and Nutrient Management Action Plans.
- me** CMAs in partnership with NRE will report on stream condition in their regions every five years using the Index of Stream Condition. The Victorian Water Resources Data Warehouse keeps up to date information on water quality indicators.

For pH, Figure 24 indicates that 92 per cent of Victorian water quality monitoring sites are considered to be in good condition, while 5 per cent are in fair condition and 3 per cent in poor condition.

Overall, 27 per cent of water quality monitoring sites have registered decreasing or acidifying trend in pH.

Of further concern is the fact that 24 per cent of sites that remain in good condition now show decreasing trend for pH.

The CMA-based condition and trend assessment provided has been determined by the VCMC. This has been achieved by aggregating the results of compliance monitoring against SEPP and ANZECC water quality guidelines in each region.

### Regional Case Study

#### Corangamite CMA

The Corangamite CMA is made up of four major catchments including the Otway Coast, Lake Corangamite, Barwon and Moorabool Rivers.

A large proportion of monitoring stations show a zero trend for pH in the Corangamite CMA region, the remaining monitoring stations show a decreasing (more acid) trend in pH, no monitoring stations were found to have an increasing (more alkaline) trend in pH.

The Moorabool River catchment, the upper Barwon River, eastern coastline and Gellibrand River in the Otway Coast, all exhibited decreasing trends for pH.

The Leigh River and lower Barwon River, Woody Yallock Rivers and other rivers along the Otway Coast all exhibited zero trends.

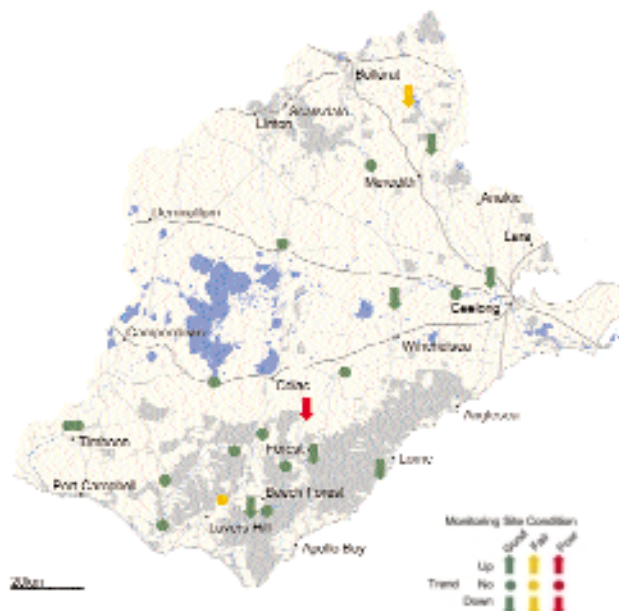


Figure 25. Condition and trend in pH for the Corangamite region.

Source: Victorian Water Resources Data Warehouse 2001.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	yes	yes
North East CMA	yes	no	no	no
Mallee CMA				
North Central CMA	no	no	no	no
Port Phillip CaLP	yes & In prep	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	yes & In prep	In prep	In prep	In prep
West Gippsland CMA	yes	In prep	In prep	In prep
Wimmera CMA	yes	yes	yes	yes

**theme RIVERS, WETLANDS  
AND ESTUARIES**

Indicator

**Water quality  
Stream Phosphorus**

Indicator Information Confidence Rating



40

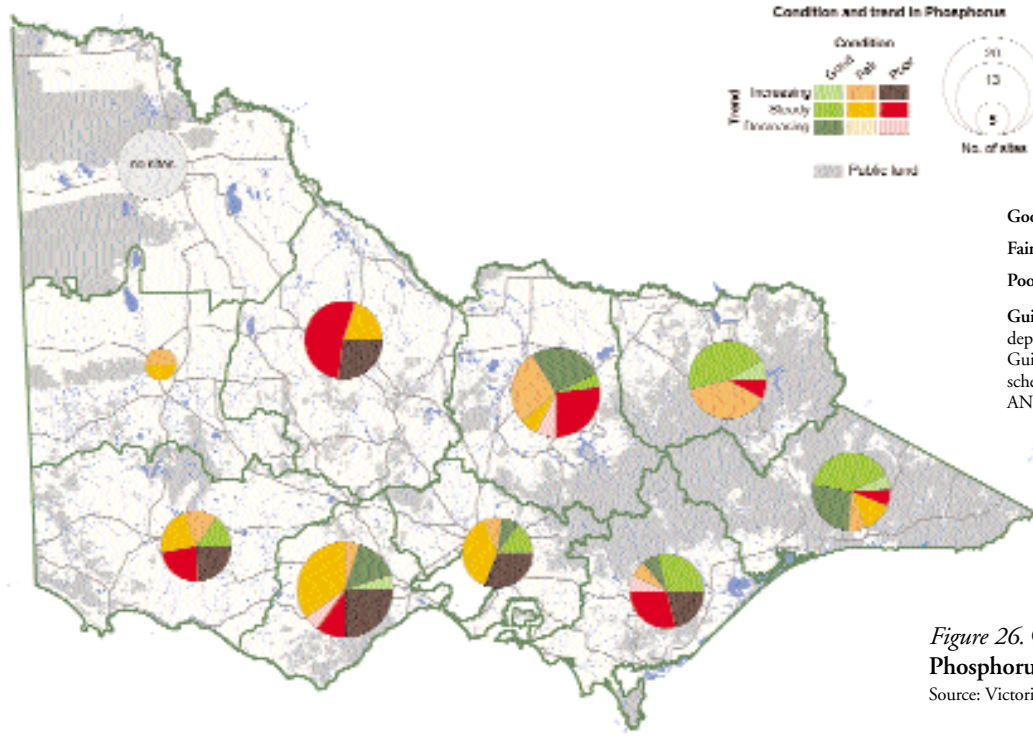
**CONDITION**
**State Status**


Figure 26. Condition and trend in total Phosphorus.

Source: Victorian Water Resources Data Warehouse.

**State Trend**  
**Results and Interpretation**

For total phosphorus there were too few data sets to draw substantial conclusions regarding trends across the state. For total phosphorus, the majority of trends were zero directional with a scattering of decreasing and increasing trends.

Generally, decreasing trends are found in the north of the state and increasing trends in the south.

It should be noted that some of the non-zero trends were relatively substantial (eg. an increasing trend of 109  $\mu\text{L}/\text{yr}$  in the Port Phillip region).

Nutrients were not recorded for the Wimmera and Mallee regions.

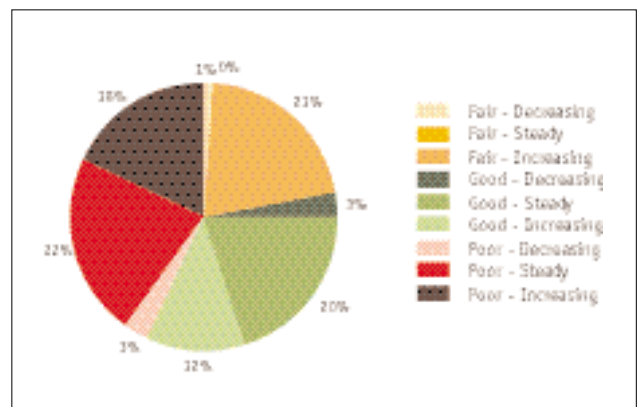


Figure 27. Proportion of water monitoring sites in each condition and trend category for Victoria - Phosphorus.

Source: Victorian Water Resources Data Warehouse.

**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	n/a	East Gippsland
				North Central

**Condition Legend**

OPTIMAL  
GOOD  
MODERATE  
POOR

**Trend Legend**

Increasing  
Decreasing  
STABLE  
UNKNOWN

**Indicator Definition** This indicator documents condition, change and trend in median monthly stream Total Phosphorus at 108 sampling sites within Victoria. **Rationale** Phosphorus is an important water quality parameter that is currently used by national water quality guidelines, National State of the Environment reporting, Catchment Management Authorities and Water Authorities. Measuring concentrations of this parameter enables us to establish the condition and trend of water quality in streams at the regional and statewide level. It is important to establish long-term trends as this will flag where problems may arise and enable stream water quality targets to be set for specific river basins and streams. Long-term aspirational targets set through the State Environment Protection Policy, Waters of Victoria and medium term resource condition targets will be set through regional Water Quality, Nutrient and Salinity Management Plans.

## MANAGEMENT RESPONSE

41

### State Management Response

- S** Victorian River Health Strategy (VRHS)<sup>31</sup> and the Nutrient Management Strategy for Victorian Inland Waters.
- Pm** The VRHS suggests that by 2011, 95 percent of all highland and all lowland monitoring sites will meet SEPP objectives.
- C** Commitment exists at State (NRE) and regional level through the CMA Regional River Health Strategies implemented across each region. The CMA Strategies will be supported by Water Quality and Nutrient Management Action Plans.
- me** CMAs in partnership with NRE will report on stream condition in their regions every five years using the Index of Stream Condition. The Victorian Water Resources Data Warehouse keeps up-to-date information on water quality indicators.

For phosphorus, Figure 27 indicates that 43 per cent of Victorian water quality monitoring sites are considered to be in poor condition and 22 per cent are in fair condition.

Only 35 per cent of water quality monitoring sites are considered to be in good condition.

Overall, 51 per cent of water quality monitoring sites have registered an increasing trend in phosphorus.

The CMA-based condition and trend assessment provided has been determined by the VCMC. This has been achieved by aggregating the results of compliance monitoring against SEPP and ANZECC water quality guidelines in each region.

### Regional Case Study

#### Wimmera Stormwater Quality

Five local governments and two Catchment Management Authorities are working together to clean up urban drains. Wimmera and North Central CMAs are working with Horsham Rural City Council and Hindmarsh, Yarriambiack, West Wimmera and Northern Grampians shires in a joint effort to improve stormwater quality.

Special interest groups such as Waterwatch, river improvement committees and Little Desert Fringe waste management group are also involved in the project. It is the only regional project of its kind in the state. Other municipalities are doing similar projects in isolation.

The project involves surveys of urban stormwater systems throughout the municipalities and the impact of these systems on rivers, lakes and wetlands. The project is part of a statewide Victorian Stormwater Action Program.

The Wimmera project will result in a plan that meets state accreditation guidelines. The final plan will recommend regional and local activities that improve urban stormwater quality. The Wimmera project is the only one in the state approaching urban stormwater issues on a regional scale.

For more information contact the Wimmera Catchment Management Authority.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes & In prep	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes & In prep	In prep	In prep	In prep
West Gippsland CMA	yes	In prep	In prep	In prep
Wimmera CMA	yes	yes	yes	yes



**theme RIVERS, WETLANDS  
AND ESTUARIES**

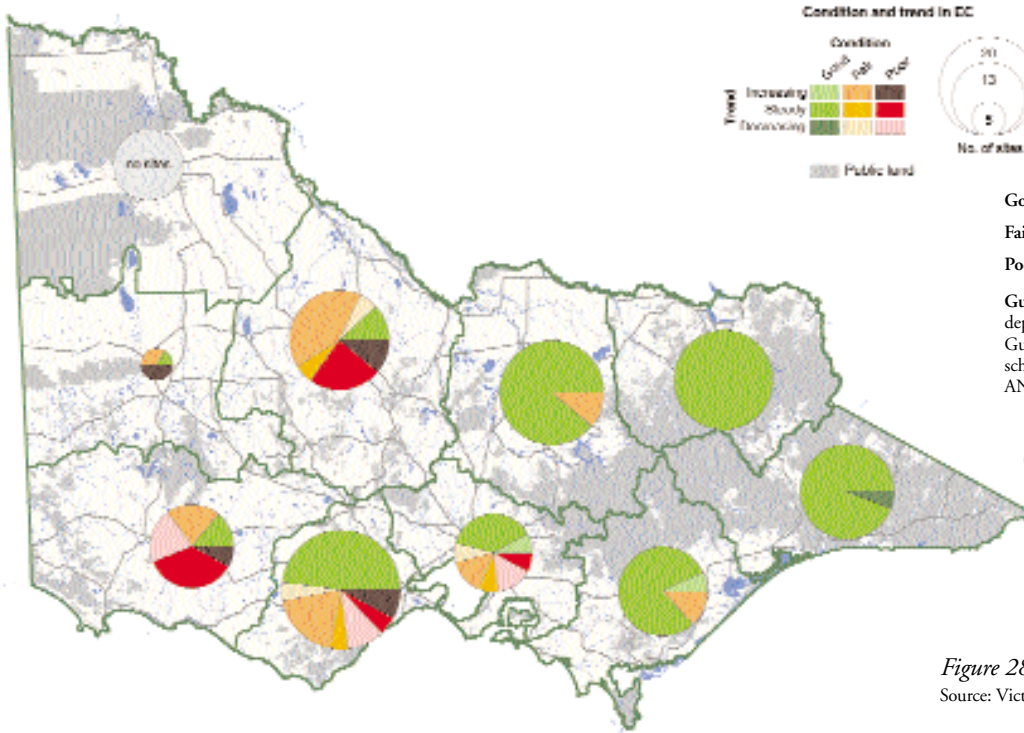
Indicator

**Water quality  
Electrical conductivity**

Indicator Information Confidence Rating



42

**CONDITION**
**State Status**


**Good** = <5% of samples exceeded guideline values  
**Fair** = 5-15% of samples exceeded guideline values  
**Poor** = >15% of samples exceeded guideline values

**Guideline:** Guidelines vary in some regions depending on expected natural conditions. Guidelines used were SEPP Waters of Victoria and schedules. Where SEPP was not available, default ANZECC Water Quality Guidelines were used.

Figure 28. Condition and trend in EC.

Source: VictorianWater Resources Data Warehouse.

**State Trend**
**Results and Interpretation**

Electrical conductivity did not have any consistent statewide trend.

Decreasing trends were common in the southern central region of the State (Port Phillip CALP and Corangamite CMA regions).

Conversely, in the western and northwestern regions (North Central, Wimmera and Glenelg CMA regions), the trends were predominantly for increasing electrical conductivity.

In the eastern half of the State, the trends were predominantly stable.

There was insufficient data to determine regional trends for the Mallee CMA region.

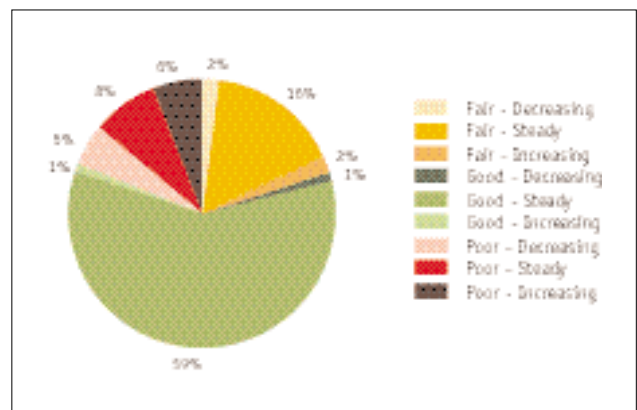


Figure 29. Proportion of water monitoring sites in each condition and trend category for Victoria - Electrical Conductivity.

Source: Victorian Water Resources Data Warehouse.

**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	n/a	East Gippsland
				North Central

**Condition Legend**

OPTIMAL  
GOOD  
MODERATE  
POOR

**Trend Legend**

Increasing  
Decreasing  
STABLE  
UNKNOWN

**Indicator Definition** This indicator documents condition, change and trend in median monthly stream Electrical Conductivity (EC) at 108 sampling sites within Victoria. **Rationale** Electrical conductivity (EC) is an important water quality parameter that is currently used by national water quality guidelines, National State of the Environment reporting, Catchment Management Authorities and Water Authorities. Measuring concentrations of this parameter enables us to establish the condition and trend of water quality in streams at the regional and statewide level. It is important to establish long-term trends as this will flag where problems may arise and enable stream water quality targets to be set for specific river basins and streams. Long-term aspirational targets set through the State Environment Protection Policy, Waters of Victoria and medium-term resource condition targets will be set through regional Water Quality, Nutrient and Salinity Management Plans.

## MANAGEMENT RESPONSE

43

### State Management Response

- S** The Victorian River Health Strategy (VRHS)<sup>31</sup> and the Victorian Salinity Management Framework.<sup>32</sup>
- Pm** The VRHS suggests that by 2011, 95 percent of all highland and all lowland monitoring sites will meet SEPP objectives.
- C** Commitment exists at State (NRE) and regional level through the CMA Regional River Health Strategies implemented across each region. The CMA Strategies will be supported by Water Quality and Nutrient Management Action Plans.
- me** CMAs in partnership with NRE will report on stream condition in their regions every five years using the Index of Stream Condition. The Victorian Water Resources Data Warehouse keeps up to date information on water quality indicators.

For electrical conductivity, Figure 29 indicates that 61 per cent of Victorian water quality monitoring sites are considered to be in good condition, while 20 per cent are in fair condition and 19 per cent in poor condition.

Importantly, 60 per cent of the sites in good condition show either a steady or declining trend for electrical conductivity.

Overall, only nine per cent of water quality monitoring sites have registered an increasing trend in electrical conductivity.

The CMA-based condition and trend assessment provided has been determined by the Victorian Catchment Management Council. This has been achieved by aggregating the results of compliance monitoring against State Environment Protection Policy and Australia and New Zealand Environment Conservation Council water quality guidelines in each region.

### Regional Case Study

#### Glenelg-Hopkins CMA EC trends

The Glenelg-Hopkins CMA is made up of the Glenelg, Hopkins and Portland Coast catchments.

Large increasing trends in electrical conductivity occurred along the Hopkins River.

Small but significant increasing trends also occurred along the Portland Coast.

There is generally a decreasing trend in electrical conductivity in the Glenelg and Wannon Rivers.

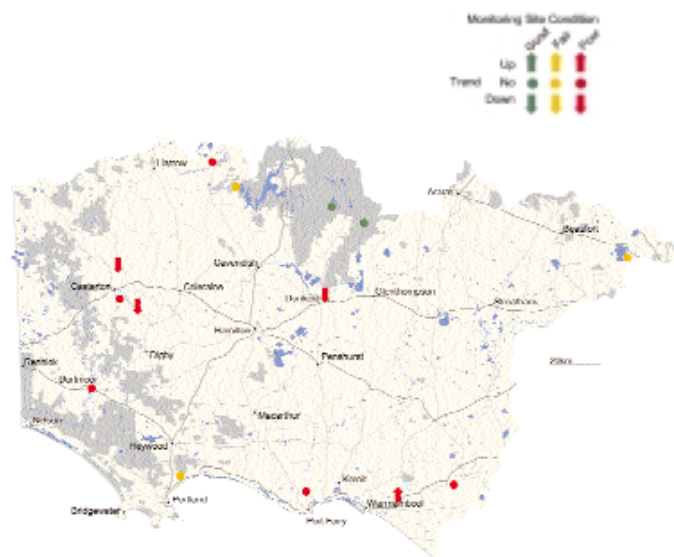


Figure 30. Condition and trend in electrical conductivity in the Glenelg-Hopkins CMA region.

Source: Victorian Water Resources Data Warehouse.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	yes	yes
North East CMA	yes	no	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	no	no	no
Port Phillip CaLP	yes & In prep	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	yes & In prep	In prep	In prep	In prep
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	no	no	no

**theme RIVERS, WETLANDS  
AND ESTUARIES**

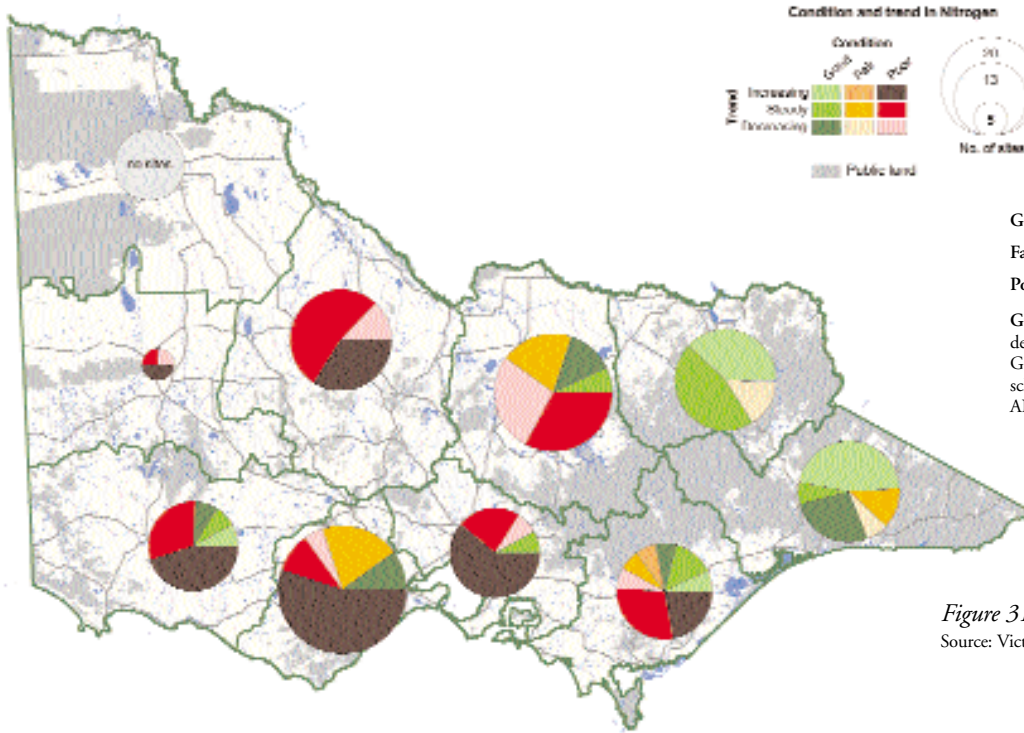
Indicator

**Water quality  
Nitrogen**

Indicator Information Confidence Rating



44

**CONDITION**
**State Status**


Good = <5% of samples exceeded guideline values  
Fair = 5-15% of samples exceeded guideline values  
Poor = >15% of samples exceeded guideline values

**Guideline:** Guidelines vary in some regions depending on expected natural conditions. Guidelines used were SEPP Waters of Victoria and schedules. Where SEPP was not available, default ANZECC Water Quality Guidelines are used.

Figure 31. Condition and trend in Nitrogen.

Source: Victorian Water Resources Data Warehouse.

**State Trend  
Results and Interpretation**

For total nitrogen there were too few data sets to draw substantial conclusions regarding trends across the State.

The regions for which nutrients were monitored tended to exhibit trends of decreasing total nitrogen levels of small magnitude, particularly in the eastern half of the State.

Corangamite CMA region had two stations with large increases and the Glenelg-Hopkins CMA region had a small increase in total nitrogen levels overall.

Nutrients were not recorded for the Wimmera and Mallee regions.

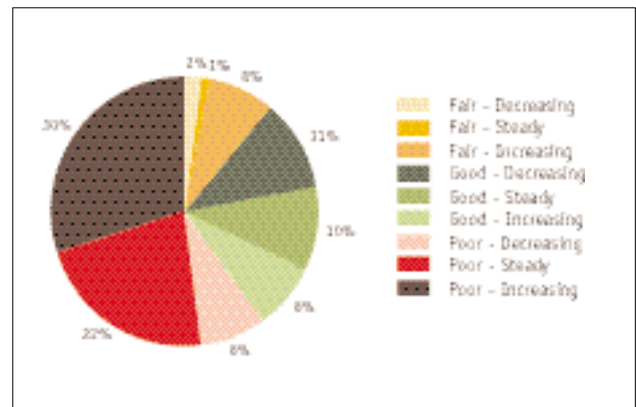


Figure 32. Proportion of water monitoring sites in each condition and trend category for Victoria - Nitrogen.

Source: Victorian Water Resources Data Warehouse.

**Regional Condition and Trend**

Corangamite	▲	Port Phillip	▲	Wimmera	▲	West Gippsland	▲	North East	▼
Goulburn Broken	—	Glenelg-Hopkins	▲	Mallee	n/a	East Gippsland	▼	North Central	▲

**Condition Legend**

OPTIMAL  
GOOD  
MODERATE  
POOR

**Trend Legend**

▲ Increasing  
▼ Decreasing  
— STABLE  
? UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)

**Indicator Definition** This indicator documents condition, change and trend in median monthly stream Total Nitrogen at 108 sampling sites within Victoria. **Rationale** Nitrogen is an important water quality parameter that is currently used by national water quality guidelines, National State of the Environment reporting, Catchment Management Authorities and Water Authorities. Measuring concentrations of this parameter enables us to establish the condition and trend of water quality in streams at the regional and statewide level. It is important to establish long-term trends as this will flag where problems may arise and enable stream water quality targets to be set for specific river basins and streams. These targets can then be included in Salinity Management Plans (SMPs), State Environment Protection Policies (SEPPs), Water Quality Strategies and Nutrient Management Plans.

## MANAGEMENT RESPONSE

45

### State Management Response

- S** The Victorian River Health Strategy (VRHS) <sup>31</sup>
- Pm** The VRHS suggests that by 2011, 95 percent of all highland and all lowland monitoring sites will meet SEPP objectives.
- C** Commitment exists at State (NRE) and regional level through the CMA Regional River Health Strategies implemented across each region. The CMA Strategies will be supported by Water Quality and Nutrient Management Action Plans.
- me** CMAs in partnership with NRE will report on stream condition in their regions every five years using the Index of Stream Condition. The Victorian Water Resources Data Warehouse keeps up to date information on water quality indicators.

For nitrogen, Figure 32 indicates that 60 per cent of Victorian water quality monitoring sites are considered to be in poor condition, while 29 per cent are in good condition and 11 per cent in fair condition.

Overall, 46 per cent of water quality monitoring sites have registered an increasing trend for nitrogen.

Of some concern is the fact that 8 per cent of sites rated in good condition, and 8 per cent of sites rated in fair condition show an increasing trend for nitrogen.

The CMA-based condition and trend assessment provided on page 44 has been determined by the VCMC. This has been achieved by aggregating the results of compliance monitoring against SEPP and ANZECC water quality guidelines in each region.

### Regional Case Study

#### Port Phillip Region - Melbourne Water Stream Frontage Management Program achieves high success

The 2001/02 Stream Frontage Management program has been finalised with outstanding results. Overall, the program, which covers the majority of the Western Port and Yarra catchments, saw over 100km of fencing construction and 112,225 plants provided. In addition \$190,000 was spent on weed management, \$24,000 on minor stabilisation works, \$11,000 on provision of alternate stock watering and \$ 29,000 on a range of support services to the landowners. The increase in effort from 2001/02 program was substantial with 339 landowners being engaged this year.

A feature of the program this year was the initiation of offers into the Lower Mornington Peninsula as part of the price rise commitments. The program in this area achieved a slower response than had been hoped, with a shortfall against the ambitious targets. Of the \$200,000 allocated for grants into this area only \$151,507 was distributed. Encouragingly, this rate of uptake in the initiating year is higher than that previously experienced for start up in new catchments.

Other features of the program this year included a partnership with Gipps Dairy to target water quality improvements from dairy farms adjoining stream systems, and the support of the Amcor Corridors of Green program with an additional \$93,000 for projects with Councils along urban waterway frontages. The overall expenditure for 2001/02 was \$1.4 million.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CalP	yes & In prep	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes & In prep	In prep	In prep	In prep
West Gippsland CMA	yes	In prep	yes	yes
Wimmera CMA	yes	yes	yes	yes



**theme RIVERS, WETLANDS  
AND ESTUARIES**

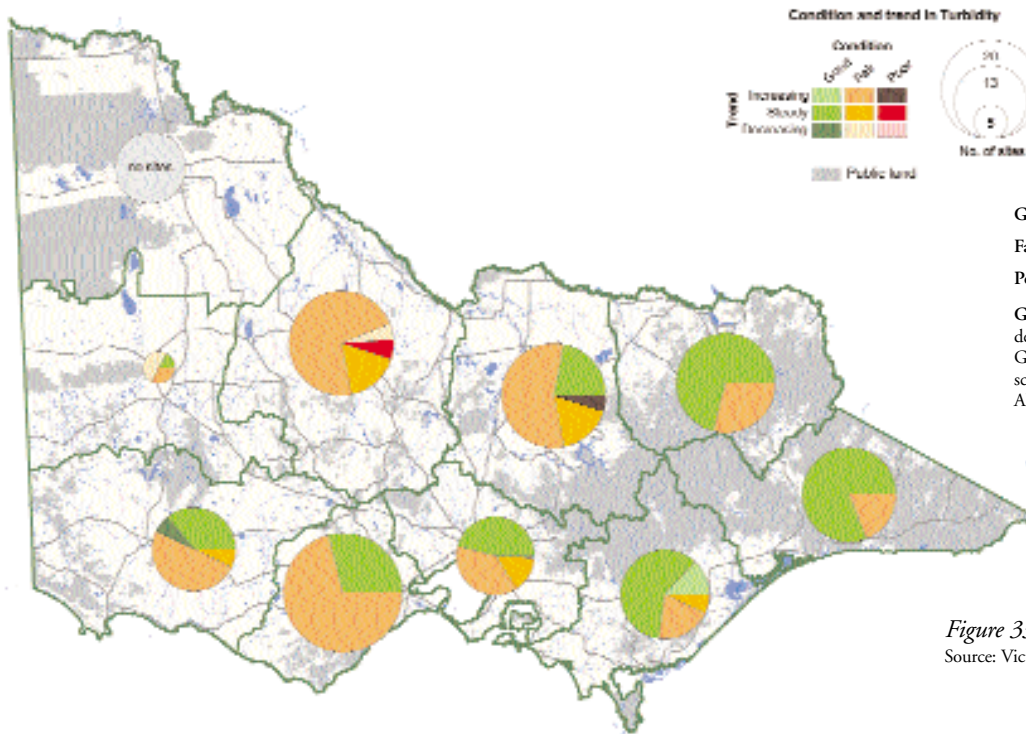
Indicator

**Water quality  
Median stream turbidity**

Indicator Information Confidence Rating



46

**CONDITION**
**State Status**


**Good** = <5% of samples exceeded guideline values  
**Fair** = 5-15% of samples exceeded guideline values  
**Poor** = >15% of samples exceeded guideline values

**Guideline:** Guidelines vary in some regions depending on expected natural conditions. Guidelines used were SEPP Waters of Victoria and schedules. Where SEPP was not available, default ANZECC Water Quality Guidelines were used.

*Figure 33. Condition and trend in Turbidity.*  
 Source: Victorian Water Resources Data Warehouse.

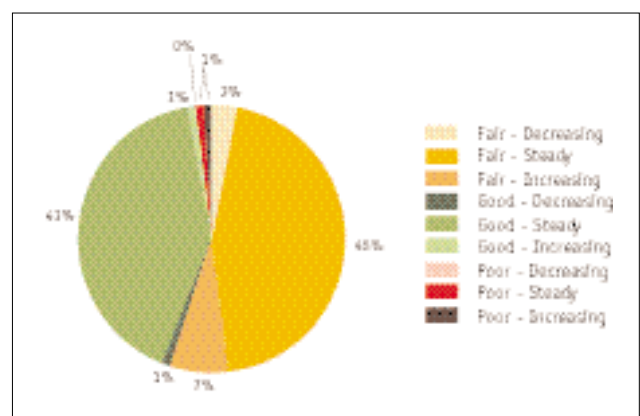
**State Trend  
Results and Interpretation**

Statewide patterns were not readily evident for turbidity with approximately equal numbers of increasing and decreasing trends.

Generally, the east and north east of the State (North East and East Gippsland CMA regions) exhibited stable turbidity levels (zero directional trends).

The northern central areas of the State (Goulburn Broken and northern North Central CMA regions) exhibited a pattern of increasing turbidity, strongest in the Goulburn Broken CMA region.

The southern and western areas of the State (particularly Wimmera and West Gippsland) generally exhibited trends of stable or decreasing turbidity.



*Figure 34. Proportion of water monitoring sites in each condition and trend category for Victoria - Turbidity.*

Source: Victorian Water Resources Data Warehouse.

**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	n/a	East Gippsland
				North Central

**Condition Legend**

OPTIMAL  
 GOOD  
 MODERATE  
 POOR

**Trend Legend**

Increasing  
 Decreasing  
 STABLE  
 UNKNOWN



**Indicator Definition** This indicator documents condition, change and trend in median monthly stream turbidity at 108 sampling sites within Victoria. **Rationale** Turbidity is an important water quality parameter that is currently used by national water quality guidelines, National State of the Environment reporting, Catchment Management Authorities and Water Authorities. Measuring concentrations of this parameter enables us to establish the condition and trend of water quality in streams at the regional and statewide level. It is important to establish long-term trends as this will flag where problems may arise and enable stream water quality targets to be set for specific river basins and streams. Long-term aspirational targets set through the State Environment Protection Policy, Waters of Victoria and medium-term resource condition targets will be set through regional Water Quality, Nutrient and Salinity Management Plans.

## MANAGEMENT RESPONSE

47

### State Management Response

- S** The Victorian River Health Strategy (VRHS).<sup>31</sup>
- Pm** The VRHS suggests that by 2011, 95 percent of all highland and all lowland monitoring sites will meet SEPP objectives.
- C** Commitment exists at State (NRE) and regional level through the CMA Regional River Health Strategies implemented across each region. The CMA Strategies will be supported by Water Quality and Nutrient Management Action Plans.
- me** CMAs in partnership with NRE will report on stream condition in their regions every five years using the Index of Stream Condition. The Victorian Water Resources Data Warehouse keeps up to date information on water quality indicators.

For turbidity, Figure 34 indicates that 55 per cent of Victorian water quality monitoring sites are considered to be in fair condition and 43 per cent are in good condition.

Only 2 per cent of water quality monitoring sites are in poor condition.

Overall, 9 per cent of water quality monitoring sites have registered an increasing trend in turbidity, however sites in good condition are generally not affected.

The CMA-based condition and trend assessment provided on page 46 has been determined by the VCMC. This has been achieved by aggregating the results of compliance monitoring against SEPP and ANZECC water quality guidelines in each region.

### Regional Case Study

#### Cardinia Catchment Biolink

The Cardinia Environment Coalition Inc., on behalf of a Landcare network of six groups, has received \$159,000 in 2001/2002 for the Biolink project. This follows earlier projects which received \$372,200 from Bushcare over the three years from 1998/99 to 2000/2001 and \$94,000 from the NHT National Landcare Program for salinity control.

The long-term objective of this project is to establish a continuous network of streamside native vegetation corridors linking the Bunyip State Park in the north with the main river corridor to the south that leads to Westernport Bay – a Ramsar listed wetland. To protect remnant streamside vegetation and provide links between remnants, fencing is being erected. The 'gaps' between remnants are being revegetated. This will result in enhanced biodiversity and improved water quality and aquatic health within the streams and less pollutants and sediments leaving the catchment. The Coalition encourages community participation through field days, community education and newsletter distribution.

Significant progress has been made, with up to 50 per cent of the stream frontages in some sub-catchments now fenced out and the protected native vegetation being carefully managed in a manner to encourage restoration.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	no	no	no	no
Port Phillip CalP	yes & In prep	In prep	In prep	In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	yes & In prep	In prep	In prep	In prep
West Gippsland CMA	yes	In prep	In prep	In prep
Wimmera CMA	yes	yes	yes	yes

**theme RIVERS, WETLANDS  
AND ESTUARIES**

Indicator

**Estuary condition**

Indicator Information Confidence Rating



48

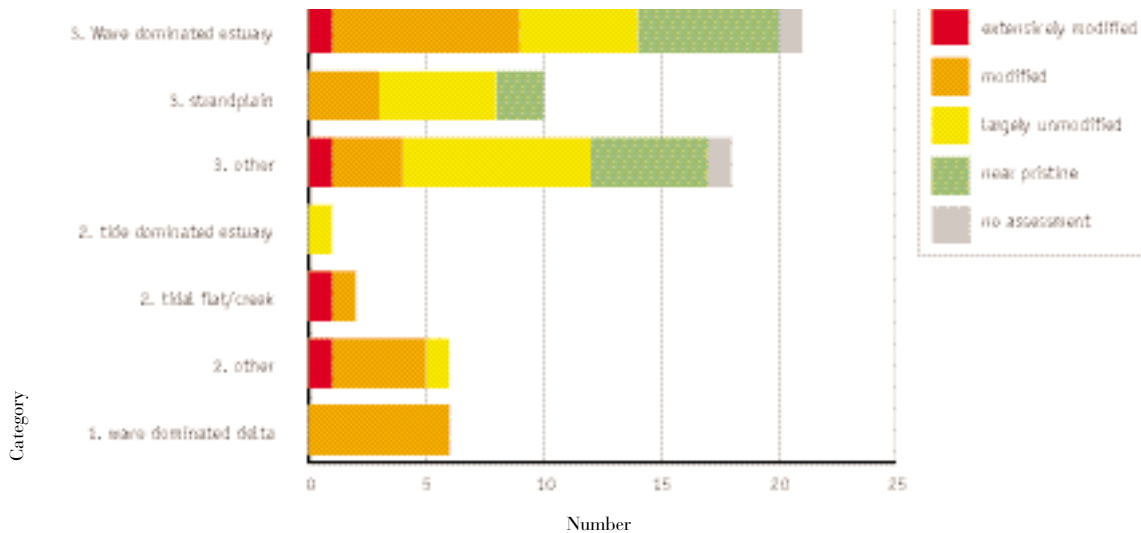
**CONDITION**
**State Status**


Figure 35. Victorian Estuary type and condition.

Source: NLWRA 2002.<sup>33</sup>

**State Trend**
**Results and Interpretation**

With the exception of Port Phillip Bay, Gippsland Lakes and Western Port Bay there is little available data on the condition of estuaries. Outside the areas mentioned there is no biological monitoring of condition conducted.

Victorian estuaries (approximately 60) vary from small wave- and river-dominated estuaries in the west, to several large embayments such as Port Phillip Bay and Western Port in central Victoria, to a network of small wave-dominated estuaries in the east.

The condition of estuaries varies regionally, primarily because of the differences in the size and morphology of the surrounding catchment, and the dominant land use practices. Many of the estuaries in eastern Victoria are located within National Parks and are in near-pristine condition. These are valuable conservation and wilderness areas.

The small wave-dominated estuaries common in western Victoria are at risk from inappropriate land use practices and are in need of targeted management. As many of these estuaries have ephemeral openings to the coast, and the adjacent catchment is often steep and predominantly agricultural, nutrients, sediment and toxins can accumulate in these estuaries.

Urbanisation, industry, agriculture, forestry and water diversions and extractions have resulted in major modifications to many Victorian estuaries.

Pressures on estuaries will increase with a trend to increasing coastal development.

Information on condition and trends for estuaries is not available.

Source: NLWRA 2002.<sup>33</sup>

**State Condition and Trend ?**
**Regional Condition and Trend**

Corangamite	?	Port Phillip	?	Wimmera	N/A	West Gippsland	?	North East	N/A
Goulburn Broken	N/A	Glenelg-Hopkins	?	Mallee	N/A	East Gippsland	?	North Central	N/A

Condition Legend	Trend Legend
● OPTIMAL	▲ POSITIVE
● GOOD	▼ NEGATIVE
● MODERATE	— STABLE
● POOR	? UNKNOWN

For further information refer to the following website [www.ozestuaries.org](http://www.ozestuaries.org)

**Indicator Definition** This indicator is a qualitative measure of the condition of Victorian estuaries. **Rationale** Estuaries are valued for their scenic beauty, recreation opportunities, tourism potential, residential development, fisheries and port facilities. At the lower end of river catchments, estuaries also reflect the general health of the catchment. It is therefore important that estuary condition be monitored to enable the impact of catchment-based land use to be assessed. This will enable land and waterway managers to link estuary management objectives with Regional Catchment Strategies, Nutrient Management Plans and Water Quality Management Plans.

## MANAGEMENT RESPONSE

49

### State Management Response

- S** Victorian Coastal Strategy.<sup>34</sup>
- Pm** No specific targets for estuaries. The State Strategy provides a framework for Regional Coastal Boards to develop clear local strategies for managing and protecting estuaries.
- C** Clear commitment exists through planning and implementation activities of Regional Coastal Boards and partners such as Parks Victoria and NRE.
- me** Unknown at this stage.

### Regional Case Study

#### Swan Bay Integrated Catchment Management Project.

The Swan Bay community over a number of years had become concerned with the degradation of the bay and catchment. Issues include seagrass loss, degradation of estuaries, poor water quality, weeds, unsustainable agricultural practices and increasing urban population.

The project aimed to build on the activities conducted by community organisations but in a more cooperative and coordinated approach. A three-year action plan was developed with practical on-ground tasks that address the major environmental and land management issues across the catchment.

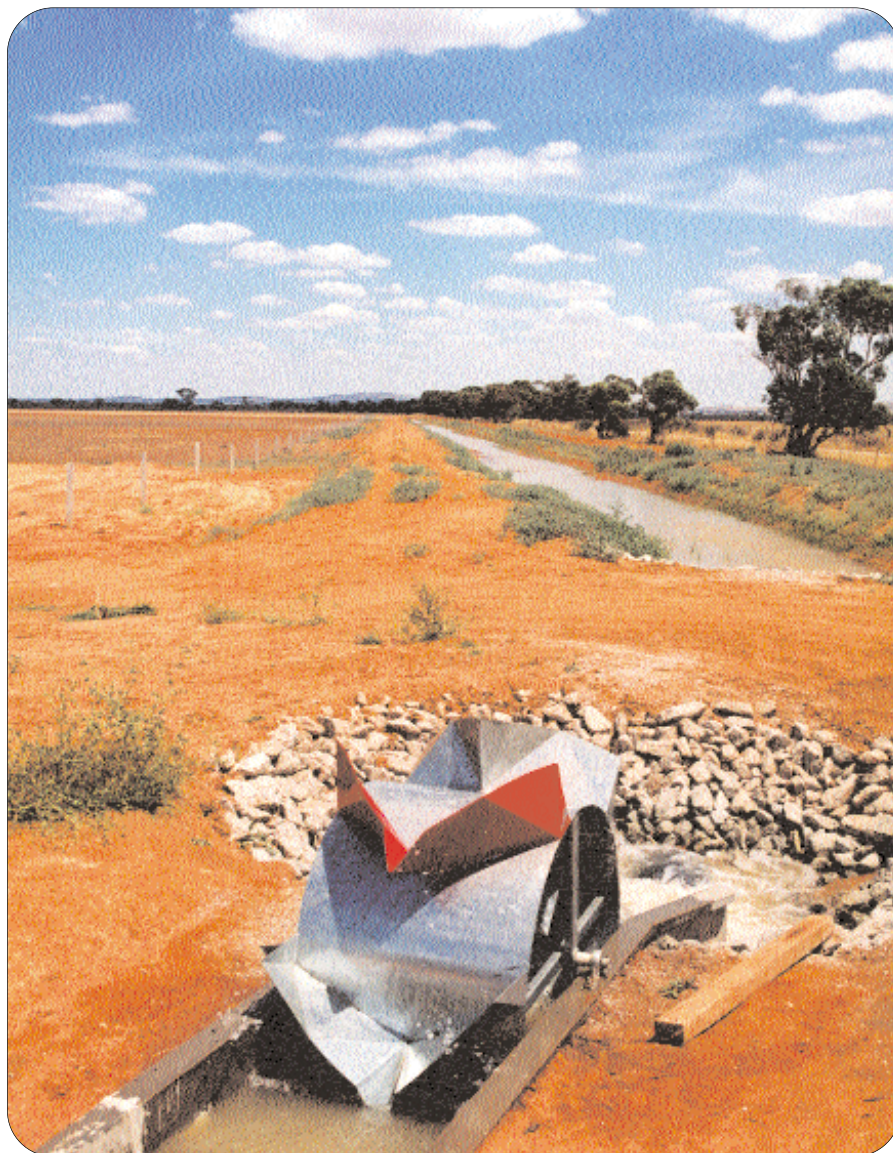
With support of Coast Action/Coastcare (\$78,714 funding over three years) the project has achieved outstanding community support and a number of significant outcomes in a short period of time including: school education programs highlighting the link between stormwater and environmental issues, planting and fencing of waterways; fencing and revegetation of saline areas community awareness and water quality monitoring of all catchment creeks and stormwater outlets to Swan Bay.

The strengths of the Swan Bay Integrated Catchment Management Project lie in raising community awareness about the values of Swan Bay and links with land use in the catchment. This has resulted in increased volunteer participation, as well as networking across a broad range of groups to identify, plan and implement integrated approaches to catchment action.

Regional Management Response	Regional Action or Implementation Plan	<b>Pm</b>	<b>C</b>	<b>me</b>
Corangamite CMA	no	no	no	no
North East CMA	n/a			
Mallee CMA	n/a			
North Central CMA	n/a			
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	n/a			
Glenelg-Hopkins CMA	yes	no	no	no
East Gippsland CMA	yes	yes	yes	yes
West Gippsland CMA	yes	In prep	In prep	In prep
Wimmera CMA	n/a			

## 3.7 theme 4 MANAGING WATER RESOURCES

50



The water provided by our rivers currently supports a population of over 4 million people and enables \$5.2 billion worth of food and fibre to be generated from irrigated agriculture. This development would not have been possible without harnessing rivers to supply both a secure and high quality resource. This has involved the introduction of dams, diversions and other regulating structures to manage streamflow. Unfortunately though, this development has come at a cost to the ecology of rivers, floodplains and estuaries.

With many of our most important river systems now in decline, what has become most apparent is that the quality of our water is dependent upon a healthy river ecosystem. Importantly, we moved to identify those river systems that are reaching, or in some cases, have exceeded the limits of the resource, and are now attempting to restore environmental flows to maintain the ecological health of our rivers. This will be particularly important given that there is continued pressure for rivers to

supply additional water to meet our expanding population and agricultural industries. For example, Victoria is aiming to more than double production from irrigated agriculture to \$12 billion by the year 2010, while urban growth trends in Melbourne indicate that capacity of the current system could be reached in around 11 years (Water Resources Strategy Committee for the Melbourne Area 2001).

These agricultural targets have been set within the context of the State Government's goal of reversing the decline in the extent and quality of native vegetation, a cap on water diversions in northern Victoria that has been implemented by the MDBC Ministerial Council, and a return of 28 per cent of streamflow to the Snowy River. Because of these current controls, and more fundamentally because there is a natural limit to the availability of both water and productive agricultural land, the agricultural targets will need to be met through more efficient production methods, or through changing land and water use to more



productive industries. Whilst there is a cap on water diversions in the north of the State, further diversions are allowed in the south. The construction of large new public irrigation dams in southern Victoria is very unlikely, but there may be some limited increase in the total water diverted from unregulated streams to meet these agricultural targets.

In Victoria, there is now a realisation that there is likely to be less rather than more water available in the future. The challenge will be to manage this finite resource in an environmentally responsible way, balancing the needs of current and future users and the health of the river ecosystem. In many cases the environmental condition of rivers will need to improve if they are to sustain current levels of use. Therefore, the management focus for the future will be on the development of water markets, improvements in water use efficiency and restoration of environmental flows. The development of water markets and improvements in water use efficiency and water re-use are considered the most important mechanisms to meet our future water use needs. Water markets will enable the transfer of water from low-value uses to higher-value uses, while gains in water use efficiency and re-use will deliver water savings to meet increased agricultural and urban needs.

To manage future water needs, a water allocation framework has been evolving rapidly to meet Victorian water management objectives. The framework is being implemented in the following types of water management systems:

- > Regulated systems
- > Unregulated systems
- > Groundwater systems.

The framework is based on a hierarchy of legal entitlements to water that grant the right of the Crown to control all groundwater and any water within a waterway. In regulated systems with dams or weirs, Bulk Entitlements (BEs) are established for both urban and rural water authorities. BEs for rural water authorities also cover the rights held by irrigators in authority supplied irrigation districts, plus any losses from the supply system. In unregulated systems, BEs are issued to water authorities, while individuals must have a licence issued by the Minister to divert water from a stream. Streamflow Management Plans (SFMPs) or 'Management Rules' are being developed for unregulated streams on a priority basis.





This water allocation framework has provided the means to measure some of our progress in meeting our water management objectives. The development of BEs and SFMPs have given us information on the volume of water available within a river system and the amount of water authorised for consumptive use. We can therefore measure compliance of water authorities with the specified limits and operating rules. Compliance will also be measured from a groundwater perspective, as Permissible Annual Volumes (PAVs) have been established for groundwater extraction and metering of groundwater bores will be delivered through groundwater management plans.

In regards to the future, new indicators will be required that enable us to measure the progress of industry and agriculture in achieving water savings. Without this type of indicator, planning for future urban and rural growth will become increasingly difficult as Victoria's water supplies become fully committed.




The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:

-  = This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.
-  = This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.
-  = This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.
-  = This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend

-  A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;
-  An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;
-  A Red symbol represents poor or limited data collection and interpretation.



**theme MANAGING WATER  
RESOURCES**

Indicator

**Urban water consumption**

Indicator Information Confidence Rating



52

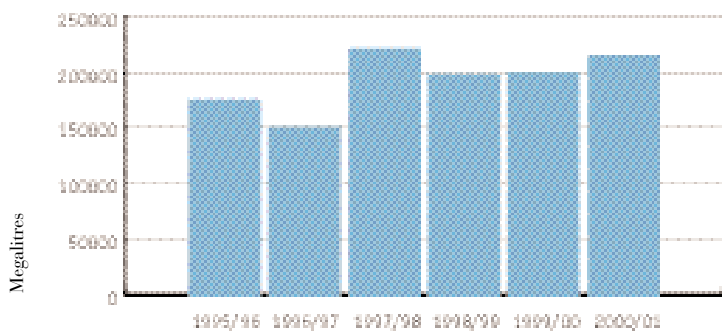
**CONDITION**
**State Status**


Figure 36. Victorian Urban Water Consumption 1995-2001

Source: CaW, NRE.

**State Trend**
**Results and Interpretation**
**Victorian water use**

Total surface water yield from Victorian rivers and reservoirs is approximately 6862 Gigalitres (GL).

Based on 1996/97 figures, Victorian surface water allocations represent 5,469 GL or 80 per cent of surface water yield. However an additional 814 GL is allocated to NSW and this brings total surface water allocation to 92 per cent of sustainable yield.

Irrigation accounts for 77 per cent of total water use, while urban-industrial uses account for 17 per cent and rural use 6 per cent.

Water use in metropolitan Melbourne represents 8 per cent of the states total water use.

There has been a 27 per cent increase in surface use between 1983/4 and 1996/7.

Source: CaW, NRE.

**Victorian urban water use 1995-2001**

Rate of growth in annual urban water demand has gradually fallen since the 1980s. This is due to factors such as user pays pricing systems and community education programs aimed at reducing water demand.

Urban water use trends for 1995-2001 support this reduced growth in demand. However, consumer behaviour and population growth will impact upon future water demands. Therefore urban water consumption will continue to increase but at a slower rate than the population increases.

The projected growth rate in water demand for metropolitan Melbourne is 0.9 per cent. The population growth in 2000/01 was 1.5 per cent. To maintain a sustainable water supply in Melbourne for the next 50 years, increased water conservation measures will be required to avoid the need for additional supply.

No condition and trend assessment has been conducted for this indicator.

**State Trend**

?

**Regional Condition and Trend**

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

Condition Legend	Trend Legend
<span style="color: blue;">●</span> OPTIMAL	<span style="color: black;">▲</span> POSITIVE
<span style="color: green;">●</span> GOOD	<span style="color: black;">▼</span> NEGATIVE
<span style="color: yellow;">●</span> MODERATE	<span style="color: black;">—</span> STABLE
<span style="color: red;">●</span> POOR	<span style="color: black;">?</span> UNKNOWN

**Indicator Definition** Urban water consumption refers to the total non-irrigation water use from metropolitan Melbourne and regional townships outside Melbourne. Total water use includes residential, commercial, institutional, industrial and unaccounted for water use within townships. **Rationale** Urban water consumption fluctuates with seasonal changes, longer-term climatic fluctuation and changing user needs. Given this change, it is important to create secure water supplies and manage changing patterns of water use so that water resources are used efficiently. Monitoring urban water consumption at the supply district level can help us determine if residential or non-residential consumption is growing or falling.

## MANAGEMENT RESPONSE

53

### State Management Response

- S** There is a range of strategies developed by the various urban water providers. Melbourne has a Water Resources Strategy and all metropolitan water businesses are required to develop water conservation plans annually. All water authorities and water businesses have drought response plans to manage water shortages.
- Pm** Performance measures and targets exist in all water business plans. The strategy for Melbourne discusses options and preferred scenarios for consumption savings over the next 50 years.
- C** Clear resourcing and program commitment is displayed through water business corporate plans annually.
- me** Implementation of water conservation plans will be monitored through NRE.

### Victorian residential water use 1995-2001

The average annual consumption per household across Victoria in 2001 was 256 kilolitres (kL). Metropolitan Melbourne consumption per household was 240 kL. In general, annual consumption per household is between 320 and 250 kL in the north and west of Victoria, and between 220 kL and 150 kL in the south and east of Victoria.

Total residential water consumption has continued to increase during the past six years (1995-2001).

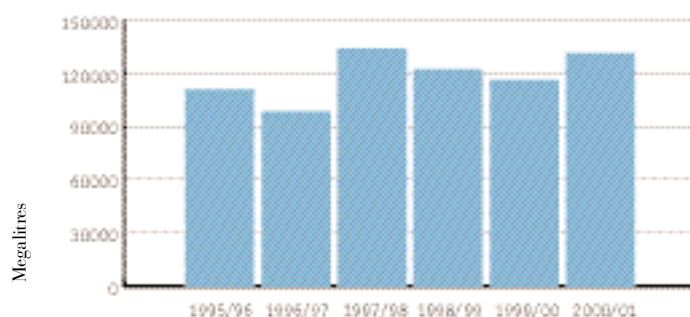


Figure 37. Victorian residential water consumption 1995-2001

Source: CaW, NRE.

### Victorian non-residential water use 1995-2001

Non-residential water use includes major manufacturing and commercial users, hospitals, universities and local governments. Total non-residential water consumption has continued to increase during the past six years (1995-2001).

Retail water company data suggests that general industrial users are the most efficient sector with respect to water conservation.

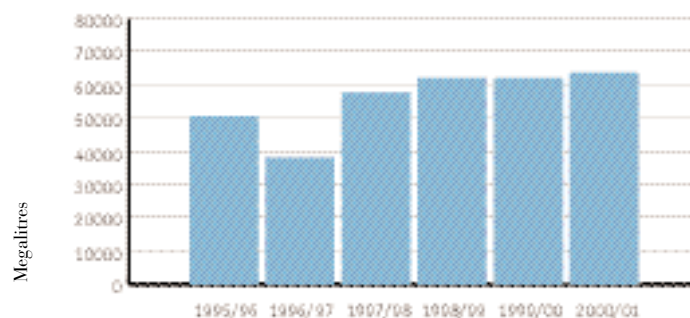


Figure 38. Victorian non-residential water consumption 1995-2001

Source: CaW, NRE.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	yes	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes	yes	yes	yes
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes	yes	yes	yes
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

**theme** MANAGING WATER RESOURCES

Indicator

# Groundwater allocation and use

Indicator Information Confidence Rating



54

**CONDITION**

## State Status and Trend

### Results and Interpretation

As of 2001 the total volume of groundwater allocated for use was 938,210 megalitres per year. 85 per cent of the allocation occurs within Groundwater Management Areas, mainly to irrigation agriculture, industry and commercial users.

Groundwater supports 60 urban communities, 45,000 domestic and stock users and 5,000 irrigation, dairy and industrial users. Groundwater also makes an important and significant contribution to the base flow of Victorian rivers and streams.

### Groundwater Management Areas

There are 61 areas across the state identified where groundwater is attractive for future development or where development is already taking place. 36 of these areas are termed Groundwater Management Areas and Permissible Annual Volumes have been set for allocation. Of the 36 areas with PAVs, 33 have allocations and use levels that fall below Permissible Annual Volumes (refer Figure 39).

### Water Supply Protection Areas

Another 25 areas within the state are declared as Water Supply Protection Areas. In these areas management plans are being drafted or have been developed (refer Table 2).

In areas where Groundwater Management Plans exist and meters are installed annual usage is less than Permissible Annual Volume.

Combined petroleum, mine de-watering, and increased groundwater use is causing a decline in groundwater levels of approximately one metre per year in the Gippsland Basin. Management of this issue is being negotiated by both State and Commonwealth Governments.

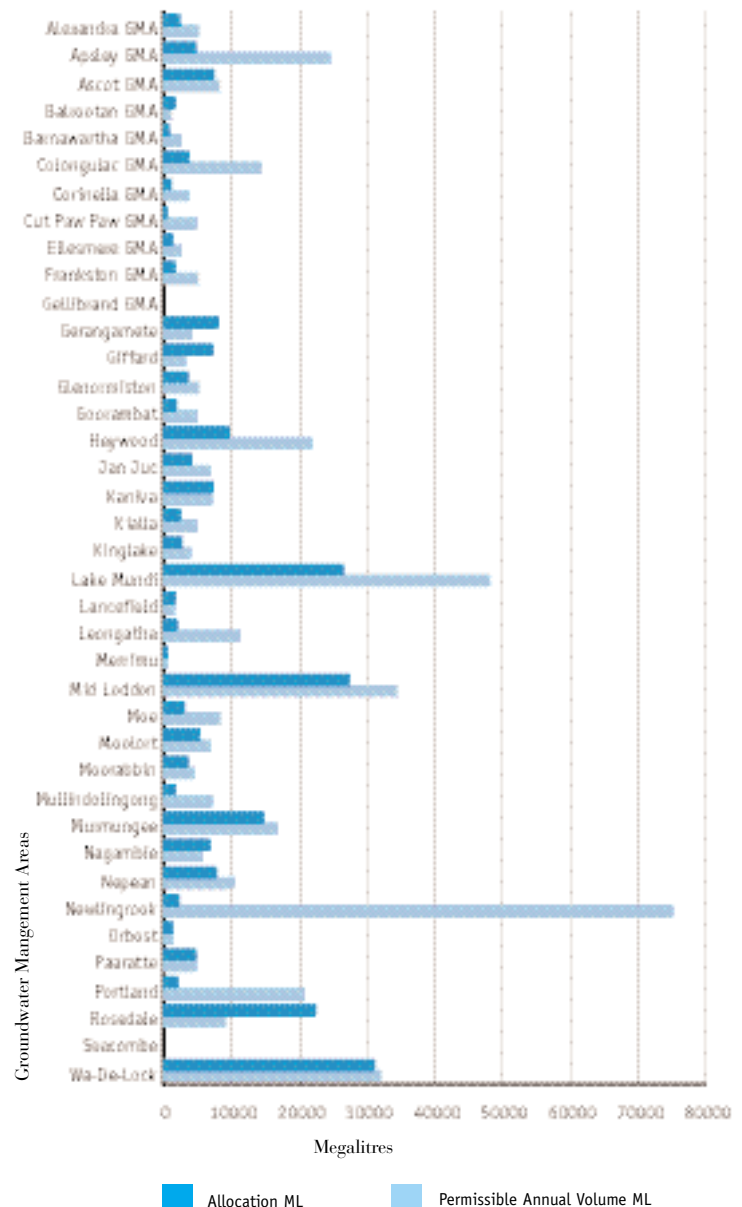


Figure 39. Groundwater allocation and sustainable yield in Groundwater Management areas.

Source: CaW, NRE

## State Condition and Trend

### Regional Condition and Trend

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	East Gippsland	North Central

#### Condition Legend

- OPTIMAL
- GOOD
- MODERATE
- POOR

#### Trend Legend

- POSITIVE
- NEGATIVE
- STABLE
- UNKNOWN

**Indicator Definition** Annual total volume from metered groundwater pumps (ML) as compared with Permissible Annual Volume (ML) within a Groundwater Supply Protection Area (GSPA) or Groundwater Management Area (GMA). **Rationale** Victoria has 61 Groundwater Management Areas, of which 25 are declared Water Supply Protection Areas (WSPAs) under the Water Act 1989. Where groundwater allocations exceeded, or approached the groundwater available for use, (known as the Permissible Annual Volume or PAV) it was recognised that special management of the groundwater resource is required. Guidelines for Groundwater Management Plans have since been developed as means to improve groundwater management in these areas. Monitoring of groundwater allocation and use is considered to be a key indicator in the assessment of sustainable groundwater pumping. The indicator will provide an overview of available groundwater resources within the state, and the extent to which development has committed the resource.

## MANAGEMENT RESPONSE

55

### State Management Response

- S** Groundwater management structure and cost sharing arrangements.
- Pm** Outlines priorities and processes for management. Trigger level of 70 per cent of sustainable yield for the development of Groundwater Management Plans. 16 groundwater management plans completed by 2003.
- C** Through the 'State Groundwater Initiative' and the 'Water for Growth' Program.
- me** Monitoring of the groundwater resource is conducted through management plans. Implementation of the program is reported to the Minister and public on an annual basis.

Water Supply Protection Areas currently drafting management plans	Ascot, Condah, Wandin Yallock, Warrion, Telopea Downs, Bungaree, Denison, Sale, Wy Yung, Balrootan, Moolort, Deutgam, Campaspe Deep Lead, Katunga, Seacombe
Water Supply Protection Areas with approved management plans	Shepparton, KWR Dalmore, Nullawarre, Yangery, Spring Hill, Murrayville, Neuarpur

*Table 2. Water Supply Protection Areas.*

Source: Caw, NRE.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	In prep	In prep	In prep
North East CMA	no	In prep	In prep	In prep
Mallee CMA	yes	yes	yes	yes
North Central CMA	no	no	no	no
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	yes	no	no	yes
Glenelg-Hopkins CMA	yes	no	no	yes
East Gippsland CMA	yes	no	no	no
West Gippsland CMA	yes	In prep	In prep	In prep
Wimmera CMA	yes	yes	yes	yes

**theme MANAGING WATER  
RESOURCES**

Indicator

# Compliance with bulk (water) entitlements

Indicator Information Confidence Rating



56

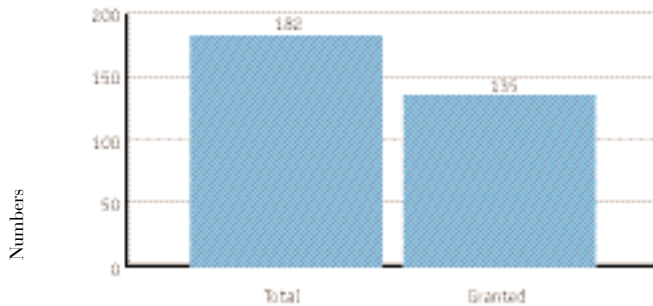
**CONDITION**
**State Status**


Figure 40. Number of Bulk Entitlements granted.

Source: CaW, NRE 2002.

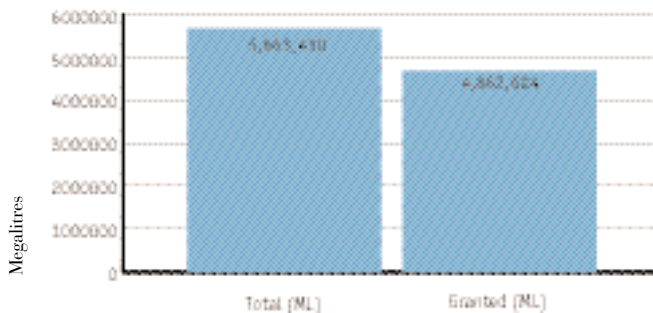


Figure 41. Volume of Bulk Entitlements granted.

Source: CaW, NRE 2002.

**State Trend**
**Results and Interpretation**
**Bulk Entitlements**

Bulk Entitlements (BEs) clearly define existing rights to water both in volume and security.

There are 182 water supply systems across Victoria that have been identified as requiring a BE (refer Figure 40). To date, BEs have been written for approximately 135 or 74 per cent of these water supply systems, however this accounts for 83 per cent of the total volume of water (refer Figure 41). Without BEs or limits to water diversion within a river system, both the river environment and protection for existing users can be undermined.

**Streamflow Management Plans**

Streamflow Management Plans (SFMPs), provide recommended operating rules for managing rivers including the maximum rate of diversion and minimum environmental flow.

As many as 113 SFMPs or improved management rules may be required for unregulated catchments or streams where diversions impact on river health.

The preparation of SFMPs began in 1996, with three SFMPs now operational and 30 in preparation. SFMPs are currently being developed on a priority basis.

It can take up to three years to develop a SFMP and a further three years before any major change to environmental flows are possible.

The Bulk Entitlement Conversion Project is an evolving process, with the current focus on setting limits (or caps) to growth in water diversions for all regulated streams. As BEs are negotiated, the focus will shift towards compliance monitoring. Up to this point in time there have only been a small number of non-compliance reports. Over time, as demands for water grow, the incidence of non-compliance is expected to increase. At this stage no condition and trend assessment can be offered.

**State Condition and Trend ?**
**Regional Condition and Trend**

Corangamite ?	Port Phillip ?	Wimmera ?	West Gippsland ?	North East ?
Goulburn Broken ?	Glenelg-Hopkins ?	Mallee ?	East Gippsland ?	North Central ?

Condition Legend	Trend Legend
<span style="color: blue;">●</span> OPTIMAL	<span style="color: black;">▲</span> POSITIVE
<span style="color: green;">●</span> GOOD	<span style="color: black;">▼</span> NEGATIVE
<span style="color: yellow;">●</span> MODERATE	<span style="color: black;">—</span> STABLE
<span style="color: red;">●</span> POOR	<span style="color: black;">?</span> UNKNOWN



**Indicator Definition** The compliance of Water Authorities with management objectives developed under Bulk Water Entitlement (BE) and Streamflow Management Plan (SFMP) agreements. **Rationale** Under the Water Act 1989, Bulk Entitlements of water (BEs) are being issued to Water Authorities throughout Victoria. BEs define existing rights to water in both volume and security. BEs will be completed for all regulated rivers and townships in Victoria. For licensed diverters on unregulated streams, Streamflow Management Plans (SFMPs) or 'Management Rules' are being developed to control the sharing of the resource between consumptive and environmental needs. Without BEs or 'Management Rules' to limit water diversion, both the river environment and the rights of existing users can be undermined. Eventually, this indicator will be used to determine whether a catchment has specified limits to surface water diversions, and if so whether there is compliance within these limits.

## MANAGEMENT RESPONSE

57

### State Management Response

- S** Bulk Entitlements are covered through the Victorian River Health Strategy.<sup>31</sup>
- Pm** Designated Resource Managers are responsible for ensuring water authorities comply with their BE.
- C** Commitment and programs exist through NRE at State level and regional water authorities.
- me** Water authorities report annually on Basin Water Accounts outcomes to the Resource Manager. Based on this information, Resource Managers prepare water accounts on a catchment (or basin) level. These Basin Water Accounts detail the volumes of water diverted and traded, and the compliance with reporting and operational obligations under each water account within the basin.

### Regional Case Study

#### Latrobe River Basin

Extending south to north from the Strzelecki Ranges to the Great Dividing Range, and west to east from Warragul to Lakes Wellington and Victoria and the Gippsland Coast, the Latrobe River Basin covers 521,386 hectares which is 2.1 per cent of the State's area.

Its mean annual flow of 980,000 ML is 4.4 per cent of total State discharge.

All the 26 Bulk Water Entitlement sites in the basin have undergone the conversion process.

# theme MANAGING WATER RESOURCES

Indicator

## Irrigation induced drainage flows

Indicator Information Confidence Rating



58

### CONDITION

This indicator provides a regional representation of drainage water generated by irrigation from selected drainage catchments. Further interpretation and analysis is required to determine the relationship between drainage flows and water use efficiency.

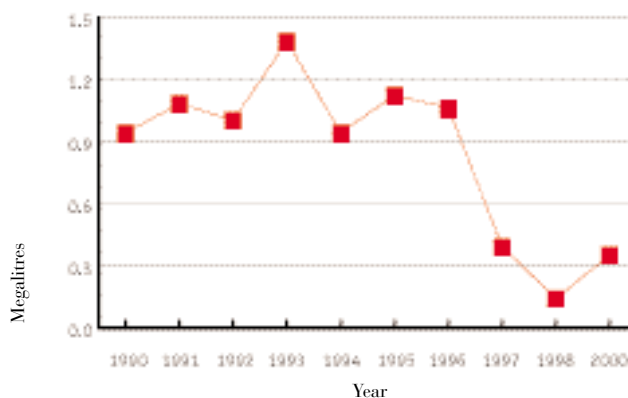


Figure 42. Site No. 406704: Deakin Main Drain.  
Source: CaW, NRE.



Figure 43. Site No. 407252: Barr Creek Main Drain Capels Crossing.  
Source: CaW, NRE.

### State Trend



### Regional Trend

Corangamite	n/a	Port Phillip	n/a	Wimmera	?	West Gippsland	?	North East	n/a
Goulburn Broken	▲	Glenelg-Hopkins	n/a	Mallee	▲	East Gippsland	n/a	North Central	▲

Condition Legend	Trend Legend
● OPTIMAL	▲ POSITIVE
● GOOD	▼ NEGATIVE
● MODERATE	— STABLE
● POOR	? UNKNOWN

### Regional Case Study

#### Deakin Main Drain Site No. 406704

##### Description of Drainage Catchment

This monitoring station monitors flows from the Deakin Main Drain system. This system collects drainage from 56,114 ha of land within the Central Goulburn and Rochester Irrigation Areas. Approximately 50 per cent is irrigated. The irrigation component of the catchment is predominantly flood irrigated dairying and mixed farming. Flows in the drain originate from surface runoff, groundwater and channel outfalls. It also receives flood water from upstream dryland. The drain flows into the River Murray near Echuca.

##### Results and Interpretation

Dry month drainage flow has consistently dropped in last three years. This has been influenced by less irrigation induced rainfall runoff. Reduced irrigation could be due to less available irrigation supplies.

Note that high flood events sometimes last more than one month and give the indicator a higher reading. This has been corrected where possible.

#### Barr Creek Main Drain Capels Crossing Site No. 407252

##### Description of Drainage Catchment

This monitoring station monitors flows from the Barr Creek drainage system. The Barr Creek collects drainage from 60,000 ha of land within the Torrumbarry Irrigation supply system. The Barr Creek drainage catchment is predominantly flood irrigated dairying and mixed farming. Flows in the Barr Creek originate from groundwater discharge, surface runoff and channel outfalls. It also receives flood water from upstream dryland and other irrigation areas within the Loddon catchment. The Barr Creek flows into the River Murray and contributes a large salt load. The salt impact on the Murray is controlled by diversion to Lake Tutchewop and also by drainage reuse.

##### Results and Interpretation

Dry month drainage flow has consistently dropped in the last five years. This has been influenced by less irrigation-induced rainfall runoff. Reduced irrigation could be due to less available irrigation supplies. In two of these years there has been reduced water availability but not to the extent of restrictions in the Goulburn system.

Note that high flood events sometimes last more than one month and give the indicator a higher reading. This has been corrected where possible.

**Indicator Definition** This indicator describes the amount of drainage water generated by irrigation within a drainage catchment.

**Rationale** There is considerable public and private investment in improving water use efficiency within Victoria's irrigation industries. The amount of drainage water generated from irrigation is a key measure of the offsite environmental impact of irrigation drainage. The information generated by this indicator will enable managers to develop a set of benchmarks. These benchmarks can then be used to broadly measure improved irrigation performance.

## MANAGEMENT RESPONSE

59

### State Management Response

- S** Victoria's Salinity Management Framework.<sup>32</sup> A general framework underpinned by detailed regional implementation strategies. Also partly addressed by the Nutrient Management Strategy for Victorian Inland Waters.
- Pm** No specific measurable performance measures/targets. General strategy target of a quarter of agricultural production will be produced from natural resources managed within their capacity by 2005, increasing to half by 2015. Major targets and measures are in the regional plans.
- C** Mainly addressed through the State Sustainable Irrigation Development Program and Regional Land and Water Management and Nutrient Plans.
- me** Evaluation and monitoring of the irrigation program is carried out by Goulburn-Murray Water, and consultant groups under the auspice of the CMAs.

### Regional Case Study

#### FMIT North East Drain 414702

##### Description of Drainage Catchment

This monitoring station monitors sub-surface drainage flows collected from 516 ha of land within the First Mildura Irrigation Trust District. Approximately 80 per cent of this is irrigated. Buried pipe (tile drains) are used to lower the water table to safe levels under irrigated crops. This drainage water is collected and transported via the North East Drain to the River Murray.

The land use in this drainage catchment is predominantly furrow and sprinkler irrigated grape vines.

Flows in the drain originate from perched groundwater that is derived from irrigation and rainfall. Some drains may also receive channel outfalls from the irrigation supply system.

Drainage systems in Sunraysia are currently being reviewed by the Second Generation of Salinity Management Plan being prepared by the Mallee CMA.

##### Results and Interpretation

Dry month drainage flow shows little change in last five years. Not influenced by water sales availability.

Long-term drainage flows have fallen by an estimated 30 per cent to 40 per cent over the last decade within the Sunraysia Salinity Management Plan area due to improvements to the on-farm and off-farm irrigation systems.

Note: high rainfall events in the previous month and earlier may sometimes give the indicator a higher reading.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	n/a			
North East CMA	n/a			
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes & In prep	yes	no	yes
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	n/a			
East Gippsland CMA	no	no	no	no
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

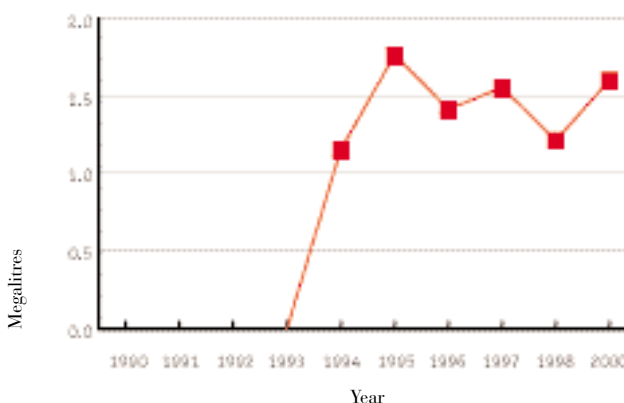


Figure 44. Site No. 414702: FMIT North East at First Street Drain.

Source: CaW, NRE.

**theme MANAGING WATER  
RESOURCES**

Indicator

**Irrigation area requiring  
drainage**

Indicator Information Confidence Rating



60

**CONDITION**

Shepparton Irrigation Area			Estimated area requiring drainage	
supply system	drainage system	total area (ha)	1995 (ha)	2000 (ha)
Rochester	Lockington	20440	5400	3620
Rochester	Barmawm	11570	1740	1550
Rochester	Wharparilla	9470	9470	3290
Rochester	Campaspe	11180	7400	7400
Rochester	Strathallan	9240	4360	4360
Central Goulburn	Deakin	46230	21210	19320
Central Goulburn	Corop Lakes	48620	38850	34450
Central Goulburn	Tongala	14930	2160	2160
Central Goulburn	Mosquito	45990	34120	24200
Central Goulburn	Coram	7100	1660	1660
Central Goulburn	Wyuna	22750	14340	12910
Central Goulburn	Rodney	17230	10680	4200
Central Goulburn	Coomboona	15360	8900	6870
Central Goulburn	Ardmona	9420	5730	3330
Central Goulburn	Toolamba	8740	4410	1470
Shepparton South	Kialla	17100	5970	4930
Shepparton South	Shepparton	9800	540	540
Shepparton South	Tallygaroopna	37100	27500	27300
Shepparton South	Invergordon	19180	5480	5480
Shepparton South	Kaarimba	8900	5830	5830
Murray Valley	Barhma/Nathalia	55200	27340	26940
Murray Valley	Strathmerton	33630	8310	6510
Murray Valley	Muckatah	40040	34640	33190

**Regional Case Study**
**Shepparton Irrigation Area**

The Shepparton Irrigation Region Land and Water Management Plan has been implementing surface drainage schemes in several major catchments.

More than 44,500 ha of land has been protected by drainage installed in the last five years.

It is estimated that a further 241,510 ha still requires drainage in the Shepparton Irrigation Region Land and Water Management Plan area. This does not include groundwater pumping for sub-surface drainage control.

The trend is the change in the amount of land protected from waterlogging and rising saline watertables.

*Table 3. Shepparton Irrigation Drainage System.*

Source: CaW, NRE.

**State Trend**

**Regional Trend**

Corangamite	n/a	Port Phillip	n/a	Wimmera	?	West Gippsland	?	North East	n/a
Goulburn Broken	▲	Glenelg-Hopkins	n/a	Mallee	▲	East Gippsland	n/a	North Central	▲

**Condition Legend**

- OPTIMAL
- GOOD
- MODERATE
- POOR

**Trend Legend**

- ▲ POSITIVE
- ▼ NEGATIVE
- STABLE
- UNKNOWN



**Indicator Definition** This indicator describes the total area of land within an irrigation supply system that requires access to surface or sub-surface drainage. **Rationale** Surface and sub-surface drainage schemes are required to protect irrigated agriculture, natural assets and public infrastructure from waterlogging and rising saline watertables. Government, community and industry have put considerable effort into the development of salinity, water quality and nutrient management plans to overcome these issues. To support this investment, it is important that we evaluate the effectiveness of current drainage schemes, identify areas in need of further drainage, and monitor the impact of changing land use on existing or proposed drainage schemes.

## MANAGEMENT RESPONSE

61

### State Management Response

- S** Victoria's Salinity Management Framework. A general framework underpinned by detailed regional implementation strategies. Also partly addressed by the Nutrient Management Strategy for Victorian Inland Waters.
- Pm** No specific measurable performance measures/targets. General strategy target of a quarter of agricultural production will be produced from natural resources managed within their capacity by 2005, increasing to half by 2015. Major targets and measures are in the regional plans.
- C** Mainly addressed through the State Sustainable Irrigation Development Program and Regional Land and Water Management and Nutrient Plans.
- me** Evaluation and monitoring of the irrigation program is carried out by Goulburn-Murray Water, and consultant groups under the auspice of the CMAs.

### Regional Case Study

#### Loddon Catchment

A review of irrigation drainage strategies is currently underway for the Loddon catchment (North Central CMA). It covers the Kerang-Swan Hill, Tragowel Plains, Torrumbarry East Of Loddon and Boort West of Loddon Land and Water Management Plans.

Large areas of community surface drainage were completed in the early 1990's, especially in the Tragowel Plains Land and Water Management Plan area.

Construction of new drains in Koondrook-Murrabit is planned to occur shortly. Other areas are awaiting the development of an integrated drainage strategy, currently in preparation.

Loddon Catchment			Estimated area requiring drainage		
supply system	drainage system	total area (ha)	1990 (ha)	1995 (ha)	2000 (ha)
Pyramid Boort	Boort West of Loddon	89,000	34,600	31,600	31,000
Pyramid inc Boort	Tragowel Plains	120,000	80,000	21,400	20,000
Torrumbarry	Torrumbarry East of Loddon	130,000	20,000	20,000	20,000
Torrumbarry	Kerang Swan Hill	110,000	31,500	31,000	31,000

Table 4. Loddon Catchment and Drainage Systems.

Source: CaW, NRE.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	n/a			
North East CMA	no	no	no	no
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes & In prep	yes	no	yes
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	n/a			
East Gippsland CMA	no	no	no	no
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

### 3.8 theme 5 MANAGING LAND

62



Leading up to the turn of this century, the majority of the Victorian landscape has been extensively utilised for agriculture, mining, timber and energy production. This landscape has continued to provide Victorians with significant economic wealth, however it is now widely recognised that we must carefully conserve our existing soil and water resources.

We have seen how inappropriate land management has resulted in salinity, poor river health, pest invasion and declining biodiversity. It is vital that with an expanding population and changing rural landscape, we are better equipped to respond to existing and emerging resource management issues.

In particular, agriculture has doubled the productive capacity of many landscapes by adding nutrient and water inputs and developing improved crop varieties. However, in many parts of the landscape current agricultural production systems are not sustainable. Even recognised best management practices have not been successful in controlling excess leakage of water to groundwater systems or minimising soil and nutrient loss to rivers and estuaries. In some areas we therefore continue to accelerate dryland salinity and contribute to declining water quality off-farm.

Agricultural productivity is at risk. Loss of topsoil, soil nutrient balance, salinity, soil acidity and soil structure decline are serious management issues for farmers. Without efforts to manage the nutrient and water balance and control soil loss, the productive capacity of land will decline. The scale of some issues such as salinity and acidity will involve entire landscapes.

Due to the vast area of land at risk and the potential damage to ecosystems, biodiversity and agriculture it will be necessary to develop and implement new and improved production systems. Government can fast track the development of sustainable production systems by providing access to information that will underpin research, catchment modelling, policy formation, program development, monitoring and evaluation.

The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:



= This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.



= This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.



= This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.



= This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend



A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;



An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;



A Red symbol represents poor or limited data collection and interpretation.

theme **MANAGING LAND**

Indicator

**Land use impact - dryland salinity**

Indicator Information Confidence Rating



64

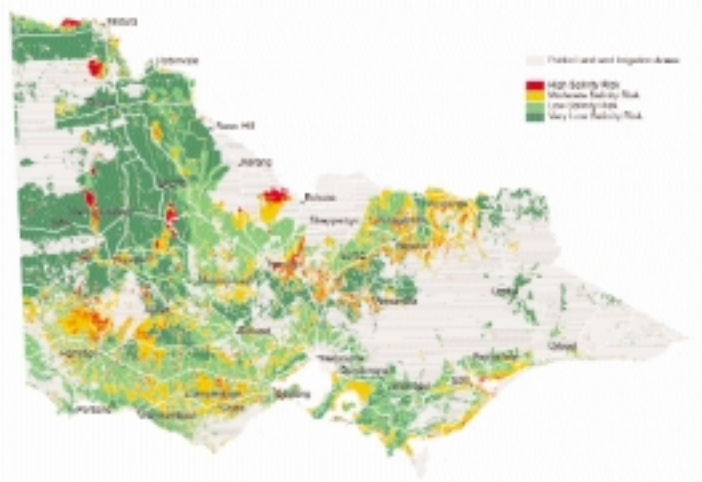
**CONDITION****State Status**

Figure 45. Salinity risk in Victoria - 1998

Source: NLWRA 2000.<sup>35</sup>**State Trend****Results and Interpretation**

Current salinity risk areas are based on 1:250,000 scale mapping of land affected by dryland salinity and shallow saline watertables prepared for the Murray Darling Basin Salinity Audit and the National Land and Water Resources Audit.

In Victoria, the current area at risk from dryland salinity is 670,000 hectares. Worst case groundwater modelling suggests up to 3.1 million hectares of privately owned land will be affected by salinity in 2050.

Between 8 and 18 per cent of the State's agricultural land is predicted to be within a high salinity risk category, while 47 per cent may fall in the moderate salinity risk category.

Agricultural losses related to salinity are expected to increase from approximately \$27 million per year to between \$77 million and \$166 million per year in 2050.

High risk areas are concentrated in the Goulburn Broken, North Central, Wimmera, Mallee, Glenelg-Hopkins and Corangamite Catchment Management Authority (CMA) regions.

The damage resulting from salinity and high watertables on infrastructure may double by 2050.

Shallow watertables are expected to have a major impact upon wetlands in the North Central, Goulburn Broken, Corangamite, Wimmera and Glenelg-Hopkins CMA regions.

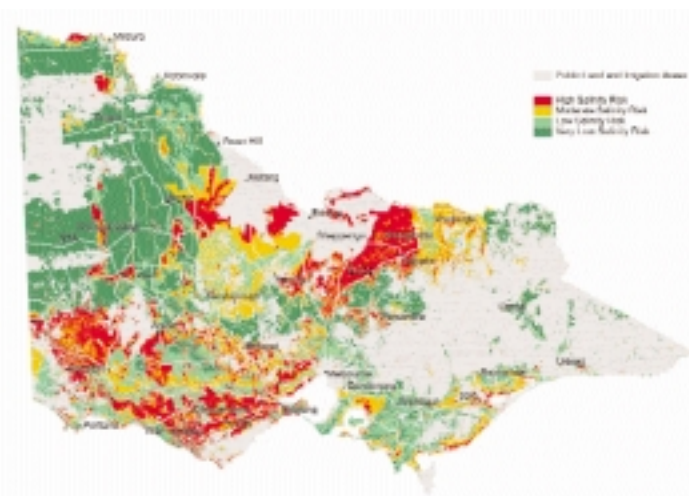
Source: NLWRA 2000.<sup>35</sup>

Figure 46. Salinity risk in Victoria - 2050

Source: NLWRA 2000.<sup>35</sup>**State Condition and Trend****Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	East Gippsland	North Central

Condition Legend	Trend Legend
OPTIMAL	POSITIVE
GOOD	NEGATIVE
MODERATE	STABLE
POOR	UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)



**Indicator Definition** The change over time in the area of agricultural land in Victoria at risk from accelerated dryland salinity.

**Rationale** Government and the community have invested heavily in the control and management of dryland salinity throughout Victoria, however salinity continues to impact upon agricultural production, natural ecosystems and public infrastructure. Monitoring and mapping the spread of dryland salinity is therefore needed to answer the following important questions: What Victorian catchments have expanding salinity problems? What is the rate of expansion within Victorian catchments? How effective are our current salinity control options? Government and the community can then use the results of this monitoring to evaluate the effectiveness of policy, programs, and targets negotiated within regional Land and Water Management Plans.

## MANAGEMENT RESPONSE

65

### State Management Response

- S** Victoria's Salinity Management Framework.<sup>32</sup>  
An overarching document setting direction for regional detailed Salinity Management Plans.
- Pm** By 2015 there will be a real reduction in the environmental and economic impacts of salinity. Complete modelling of land and water salinity levels for all Victorian catchments by 2005.  
By 2005, critical recharge zones within catchments will be identified with 50 per cent of these critical areas revegetated by 2015.  
By 2015 Victoria will have reduced the impact of rising groundwater on the riverine environment and key wetlands.
- C** Commitment through the \$1.4 billion National Action Plan (NAP) for Salinity and Water Quality in the six priority CMA regions.  
Regions currently reviewing their Salinity Management Plans (SMPs) through NRE and the CMAs.
- me** Regional monitoring and evaluation to be determined through SMPs. NAP evaluation and monitoring strategy also being finalised.

### Regional Case Study

Figure 47 indicates areas in Victoria where salinity risk is accelerated by land management practices. This mapping is derived from the Land Use Impact Model (LUIM).

Within the area where mapping has been completed, 52 per cent of agricultural land is currently in the high to very high risk category as a result of current land management. Nine per cent is in the moderate risk category, with 39 per cent in the negligible to low categories.

The major areas of land at high risk occur north of the divide on the Riverine and Wimmera Plains, where both the inherent potential for salinity and contributing land management practices coincide. There are several smaller areas in the Corangamite and Glenelg regions also in the high and very high risk categories under current land management.

Note: Public land has been excluded. Information for the Mallee, Port Phillip and Gippsland areas will become available in the next couple of years.

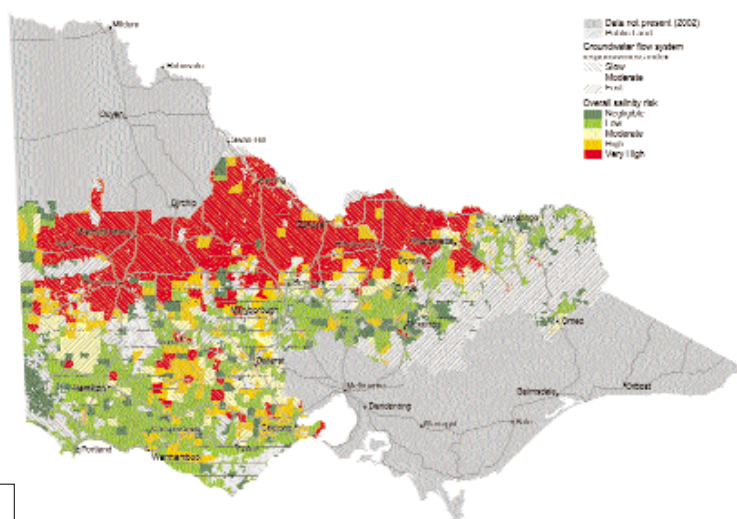


Figure 47. Groundwater flow system responsiveness index.

Source: Centre for Land Protection Research 2002.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	yes	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes	yes	yes	yes
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	no	no	no	no
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

## theme MANAGING LAND

Indicator

## Land use impact - soil acidification

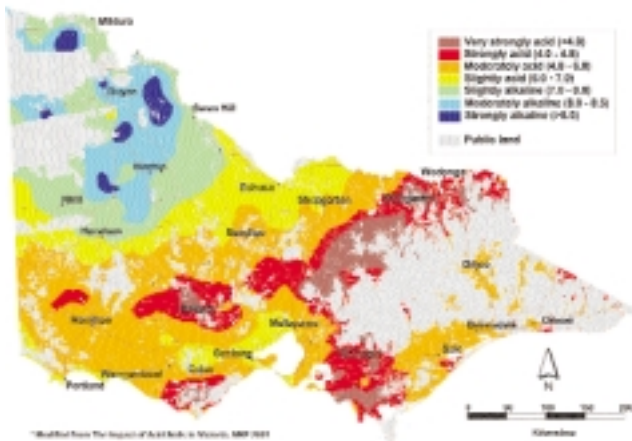
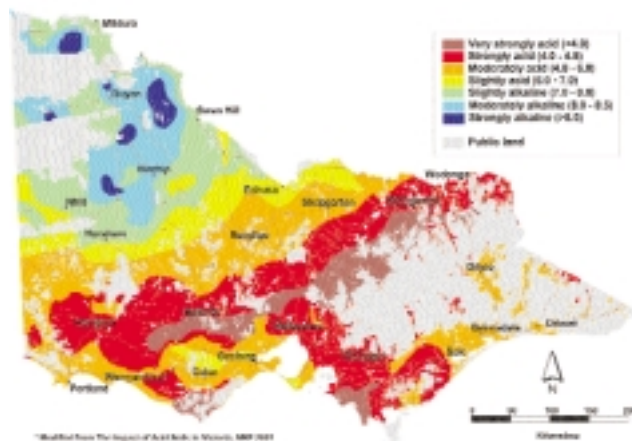
Indicator Information Confidence Rating



66

## CONDITION

## State Status

Figure 48. Surface soil pH<sub>CaCl2</sub> present.Source: NRE 2001.<sup>36</sup>Figure 49. An estimation of the surface soil pH<sub>CaCl2</sub> in the year 2050.Source: NRE 2001.<sup>36</sup>

## State Trend

## Results and Interpretation

In Victoria, approximately three million hectares or 23 per cent of the State's agricultural land is losing productivity due to soil acidification.

Although acid soils occur naturally, current land management practices are accelerating the rate of acidification. In some areas productive soils have been irreversibly damaged.

More than half of the affected agricultural land is in north east Victoria.

Under current land management practices and rates of acidification, this area is expected to double within the next 50 years despite liming efforts to control the decline.

Total lime applied to agricultural soils has tripled in the past 12 years, however this is approximately 12 per cent of the total lime required to maintain a soil pH of 4.8 or higher.

The offsite impacts of soil acidification are significant. Soil acidification is contributing to an increase in stream turbidity and a decline in stream pH in Victoria. This may have a long term impact upon stream biodiversity.

By 2050 it is estimated that lost agricultural production resulting from soil acidity will be in excess of \$1.2 billion dollars.

In the future soil acidity will be a major issue for agricultural production. The scale of the impact will rival that of salinity.

## State Condition and Trend



## Regional Condition and Trend

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	East Gippsland	North Central

Condition Legend	Trend Legend
OPTIMAL	POSITIVE
GOOD	NEGATIVE
MODERATE	STABLE
POOR	UNKNOWN

**Indicator Definition** The change over time in the area of agricultural land in Victoria at risk from accelerated soil acidity.

**Rationale** Soil acidity is one of a suite of soil health issues that can be influenced by land management practices. The causes of soil acidification are many and varied, however past and present farming systems continue to accelerate the decline in soil pH through nitrate leaching and removal of produce. This indicator will identify where improved land management practices are required. Stakeholders may also use this indicator to measure the success of strategies and actions included in the Impact of Acid Soils in Victoria document.

## MANAGEMENT RESPONSE

67

### State Management Response

- S** Draft 'Impact of Acid Soil in Victoria'<sup>36</sup> document released in 2001. Awaiting State response.
- Pm** The draft identifies a range of ways to reduce soil acidity but contains no measurable targets.
- C** Conducted by Agriculture Victoria research institutes at Rutherglen and Bendigo on a project-by-project basis.
- me** No ongoing program. Information collected by Agriculture Victoria research institutes at Rutherglen and Bendigo on a project-by-project basis.

### Regional Case Study

Risk rating	CMA region
<b>high</b>	North East Goulburn Broken Glenelg-Hopkins West Gippsland North Central (southern portion) Wimmera (southern portion)
<b>medium</b>	Corangamite Port Phillip North Central (northern portion) Wimmera (northern portion)
<b>low</b>	Mallee East Gippsland

*Table 5. Soil acidification risk for each Catchment Management Authority region in Victoria.*

Source: NRE 2001<sup>31</sup>.

Rainfall	Plant species	Acidification rate	Lime equivalent
High rainfall (annual rainfall > 550mm)	Lucerne hay	high	0.60
	Crop/pasture	high	0.35
	Grass/Legume	high	0.30
	Annual pasture	medium	0.25
	Wheat/lupin	medium	0.20
	Perennial pasture	medium	0.20
	Grapes	low	0.10
	Eucalyptus	low	0.07
	Eucalyptus/acacia spp.	low	0.04
	Tobacco	low	-0.02
Low rainfall (annual rainfall > 300mm )	Wheat/legume	medium	0.15
	Annual pasture	low	0.05
	Wheat/pasture	low	0.02

*Table 6. Acidification rates and annual lime requirements for different farming systems in high and low rainfall environments of Victoria.*

Source: NRE 2001<sup>31</sup>.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	yes	yes	no	no
Mallee CMA	n/a			
North Central CMA	yes	yes	no	yes
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	yes	yes	yes	yes

theme **MANAGING LAND**

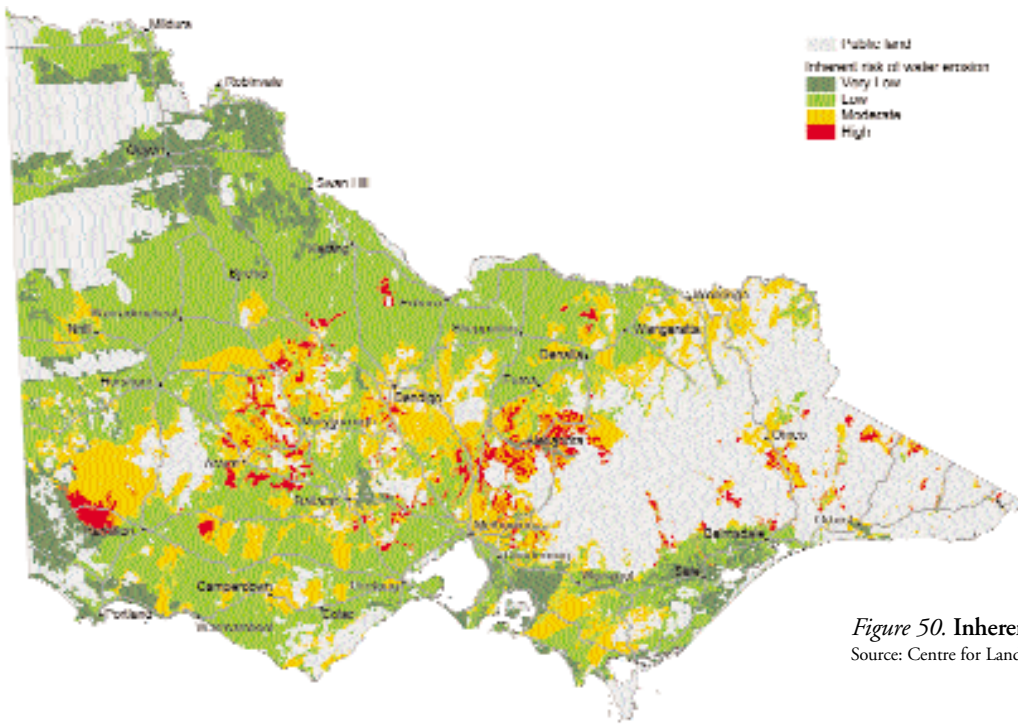
Indicator

**Land use impact - water erosion**

Indicator Information Confidence Rating



68

**CONDITION****State Status**

*Figure 50. Inherent risk of water erosion.*  
Source: Centre for Land Protection Research 2002.

**State Trend**  
 Results and Interpretation

Figure 50 outlines those areas with a high susceptibility to water erosion that face additional risk due to unsustainable land management practices. The map is derived from the Land Use Impact Model (LUIM). Figures on actual area degraded by water erosion are currently unavailable and thus an indicator of current condition is derived by identifying the area that is potentially eroding under current land management conditions.

Figure 50 and 51 can be compared to see the impact land management has in increasing or decreasing the risk of water erosion. At this point in time the risk of water erosion is not

significantly increased in many areas by current land management. This can be attributed to the fact that the land management practices used in the risk assessment occur mainly in the north west of the State where the risk is reduced by the low rainfall rate.

Model results are available for the years 1995 and 1997. Due to the short interval (two years) between the two sets of results, valid trend analysis is not possible. This information will provide a baseline for future trend analysis.

**State Condition and Trend**

?

**Regional Condition and Trend**

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

Condition Legend	Trend Legend
● OPTIMAL	▲ POSITIVE
● GOOD	▼ NEGATIVE
● MODERATE	— STABLE
● POOR	? UNKNOWN



**Indicator Definition** The change over time in the area of agricultural land in Victoria at risk from accelerated water erosion.

**Rationale** Water erosion is a natural process that is accelerated by land management practices that disturb the soil or leave it bare of vegetation. Where accelerated water erosion continues to occur, there will be long-term implications for biodiversity, water quality and agricultural productivity. This indicator is useful to land managers as it will identify where inappropriate land management occurs, and where improved management practices or a change in land use is required.

## MANAGEMENT RESPONSE

69

### State Management Response

- S** There is no Statewide strategy for soil issues and management at this stage. The impact of turbidity and nutrients entering waterways means soil erosion is addressed by many regional water quality and nutrient management plans.
- Pm** The performance measures and targets exist in regional water quality and nutrient management plans.
- C** Commitment at a regional level through the CMA water quality and nutrient management plans. At a State level the issue is in part addressed through various related strategies but no ongoing soil management program. Most information is developed by Agriculture Victoria research institutes at Bendigo and Rutherglen.
- me** Most information is collected and interpreted by Agriculture Victoria research institutes at Bendigo and Rutherglen.

### Regional Case Study

Figure 52 indicates the percentage of agricultural land in Victoria at risk from water erosion. Twenty-one per cent of agricultural land is currently in the high to very high risk category as a result of current land management. Two per cent is in the moderate risk category, with 77 per cent in the negligible to low risk categories under current land management.

The significant areas of land at high and very high risk occur predominantly in the central and western areas of Victoria, where highly susceptible landscapes and contributing land management practices coincide. These areas of high risk were found to be relatively small for the State.

The land management practices considered in the risk assessment included conventional tillage, stubble burning and cultivation fallow. If other land management practices were to be included in the assessment, the risk ratings for the State may change.

Soil fertility and water quality will continue to be at greater risk where land management practices accelerate water erosion.

Note: Public land has been excluded. Results are based on parish areas.

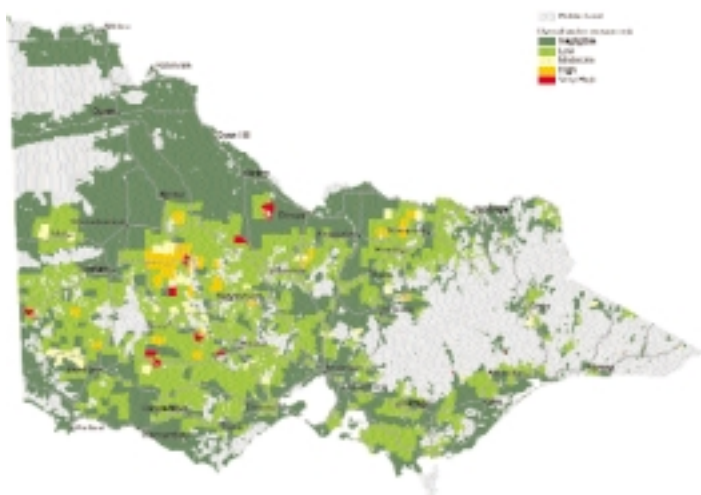


Figure 51. Overall water erosion risk in Victoria.

Source: Centre for Land Protection Research 2002.

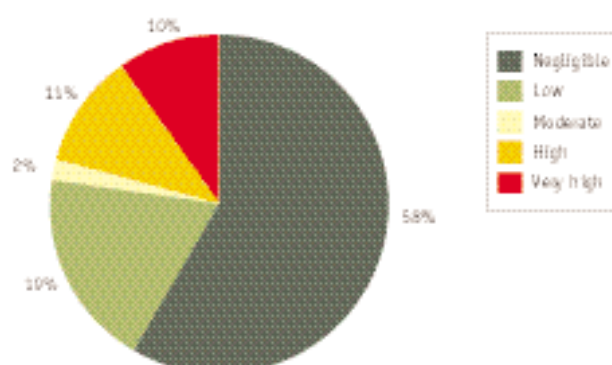


Figure 52. Percentage of Victoria's agricultural land at risk of water erosion, 1997.

Source: Centre for Land Protection Research 2002.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	yes	yes	yes	yes
Mallee CMA	no	no	no	no
North Central CMA	yes	yes	no	yes
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	yes	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	yes	yes	yes	yes

theme **MANAGING LAND**

Indicator

## Land use impact - wind erosion

Indicator Information Confidence Rating



70

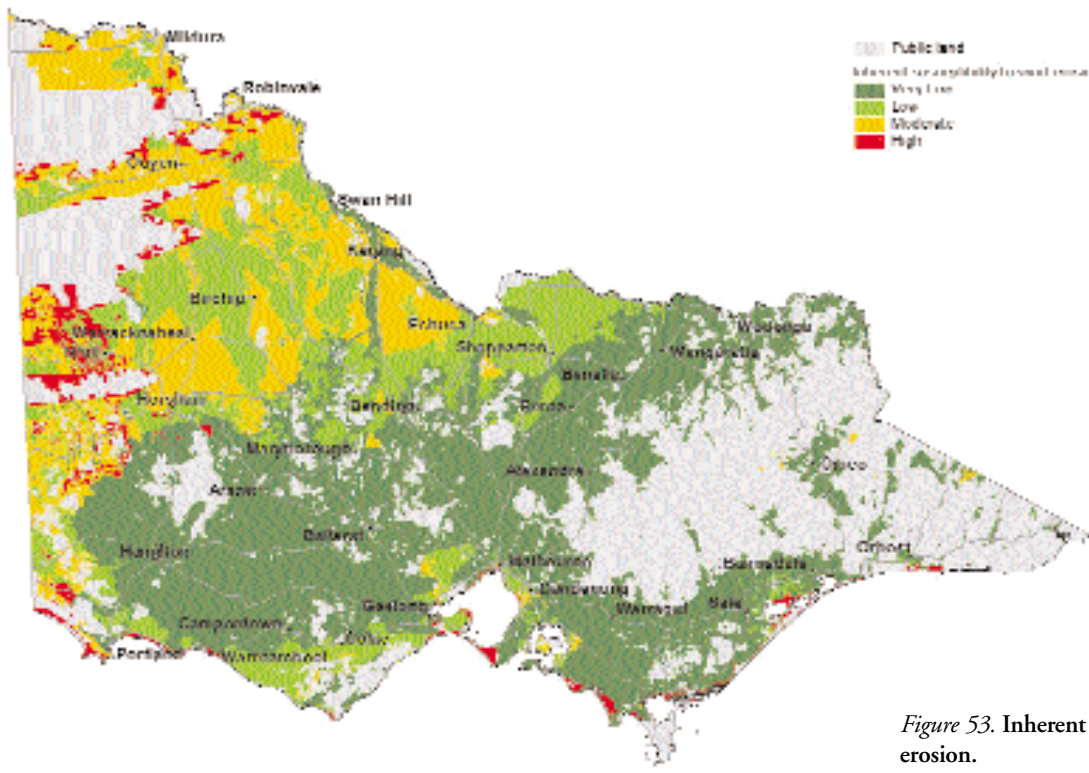
**CONDITION****State Status**

Figure 53. Inherent susceptibility to wind erosion.

Source: Centre for Land Protection Research 2002.

**State Trend**  
 Results and Interpretation

Figure 53 outlines those areas with a high susceptibility to wind erosion. The map is derived from the Land Use Impact Model (LUIM). Figures on actual area degraded by wind erosion are currently unavailable and thus an indicator of current condition is derived by identifying the area that is potentially degrading under current land management conditions.

Figure 53 and 54 can be compared to see the impact land

management has in increasing or decreasing the risk of wind erosion. In some cropping areas in the north west of the state, current land management practices are increasing the likelihood of wind erosion occurring.

Model results are available for the years 1995 and 1997. Due to the short interval (two years) between the two sets of results, valid trend analysis is not possible. This information will provide a baseline for future trend analysis.

**State Condition and Trend**

?

**Regional Condition and Trend**

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

Condition Legend	Trend Legend
● OPTIMAL	▲ POSITIVE
● GOOD	▼ NEGATIVE
● MODERATE	— STABLE
● POOR	? UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)

**Indicator Definition** The change over time in the area of agricultural land in Victoria at risk from accelerated wind erosion.

**Rationale** Wind erosion is a natural process that is accelerated by land management practices that disturb the soil or leave it bare of vegetation for periods of time. Dust storms have the capacity to create large sand drifts that may cover roads, bury fences and block water supply channels and drainage systems. From an agricultural perspective, wind erosion events remove productive topsoils leading to declining yields. This indicator is useful to land managers as it will identify where inappropriate land management occurs, and where improved management practices or a change in land use is required.

## MANAGEMENT RESPONSE

71

### State Management Response

- S** There is no Statewide strategy for soil issues and management at this stage. The impact of turbidity and nutrients entering waterways means soil erosion is addressed by many regional water quality and nutrient management plans.
- Pm** The performance measures and targets exist in regional water quality and nutrient management plans.
- C** Commitment at a regional level through the CMA water quality and nutrient management plans. At a State level the issue is in part addressed through various related strategies but no ongoing soil management program. Most information is developed by Agriculture Victoria research institutes such as Bendigo and Rutherglen.
- me** Most information is collected and interpreted by Agriculture Victoria research institutes such as Bendigo and Rutherglen.

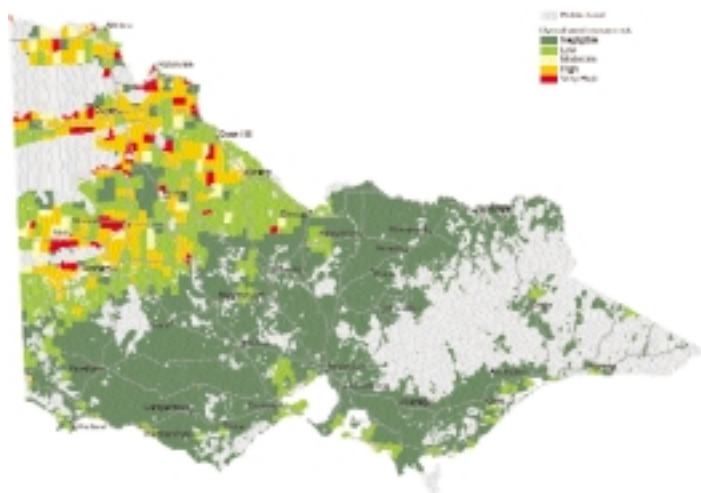


Figure 54. Overall wind erosion risk in Victoria.

Source: Source: Centre for Land Protection Research 2002.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	no	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	yes	yes	no	yes
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	yes	yes	yes	yes

Figure 55 indicates the percentage of agricultural land in Victoria at risk from wind erosion. Twenty-one per cent of agricultural land is currently in the high to very high risk category as a result of current land management. Two per cent is in the moderate risk category, with 77 per cent in the negligible to low risk categories under current land management.

Areas of land at risk occur predominantly in the north west of the State in the Mallee and Wimmera regions of Victoria where both highly susceptible landscapes and contributing land management practices coincide.

The land management practices included in the risk assessment included conventional tillage, stubble burning and cultivation fallow. If other land management practices were to be included in the assessment, the risk ratings for the State may change.

While not a significant issue for much of the State, wind erosion is of key importance in the north west cropping areas of Victoria. Soil loss resulting from wind erosion has the potential to impact significantly upon the future productivity of this region.

Note: Public land has been excluded. Results are based on parish areas.

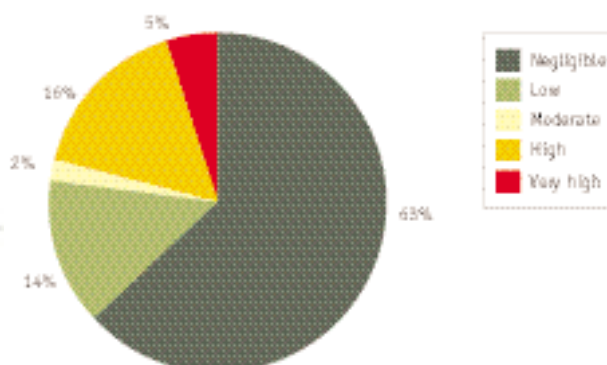


Figure 55. Percentage of Victoria's agricultural land at risk of wind erosion, 1997.

Source: Source: Centre for Land Protection Research 2002.

theme **MANAGING LAND**

Indicator

**Land use impact - soil structure decline**

Indicator Information Confidence Rating



72

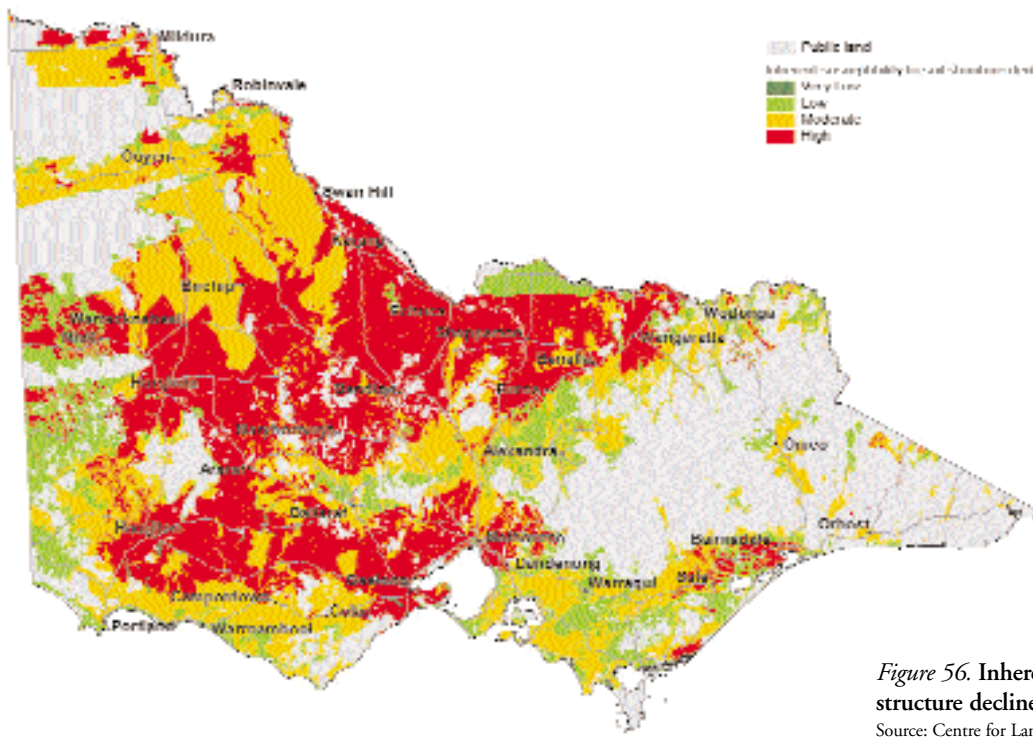
**CONDITION****State Status**

Figure 56. Inherent susceptibility to soil structure decline.

Source: Centre for Land Protection Research 2002.

**State Trend****Results and Interpretation**

Figure 56 outlines those areas with a high susceptibility to soil structure decline. The map is derived from the Land Use Impact Model (LUIM). Figures on actual area degraded by soil structure decline are currently unavailable and thus an indicator of current condition is derived by identifying the area that is potentially degrading under current land management conditions.

Figures 56 and 57 can be compared to see the impact land management has in increasing or decreasing the risk of soil structure decline. In this case soil structure decline is being accelerated across a large proportion of Victoria.

Model results are available for the years 1995 and 1997. Due to the short interval (two years) between the two sets of results, valid trend analysis is not possible. This information will provide a baseline for future trend analysis.

**State Condition and Trend**

?

**Regional Condition and Trend**

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

**Condition Legend**

- OPTIMAL
- GOOD
- MODERATE
- POOR

**Trend Legend**

- ▲ POSITIVE
- ▼ NEGATIVE
- STABLE
- UNKNOWN



**Indicator Definition** The change over time in the area of agricultural land in Victoria at risk from accelerated soil structure decline. **Rationale** Soil structure decline is one of a suite of soil health issues that can be influenced by land management practices. The structural decline of soils can occur through a number of land management practices including compaction by farm machinery, pugging from hard hoofed animals, and aggregate breakdown from soil tillage practices. From a production perspective, soil structure decline can lead to reduced water infiltration and aeration, reduced plant germination and increased wind or water erosion. This indicator is useful to land managers as it will identify where inappropriate land management occurs, and where improved management practices or a change in land use is required.

## MANAGEMENT RESPONSE

73

### State Management Response

- S** No State response.
- Pm** N/A
- C** No ongoing program. Information collected by Agriculture Victoria research institutes at Rutherglen and Bendigo on a project by project basis.
- me** No ongoing program. Information collected by Agriculture Victoria research institutes at Rutherglen and Bendigo on a project by project basis. A current and future major issue for agriculture production.

Figure 58 indicates the percentage of Victoria's agricultural land at risk from soil structure decline. Sixty-nine per cent of agricultural land is currently in the high to very high risk category as a result of current land management. Four per cent is in the moderate risk category, with 38 per cent in the negligible to low risk categories under current land management.

Significant areas of land at high and very high risk occur predominantly in the Wimmera and Mallee regions, with smaller areas in the Riverine plains and Corangamite regions.

The land management practices included in the risk assessment included conventional tillage, stubble burning and cultivation fallow. If other land management practices were to be included in the assessment, the risk ratings for the State may change.

Soil structure decline is a land degradation issue that affects a large proportion of the State's agricultural land and as such has the potential to impact greatly on agricultural productivity.

Note: Public land has been excluded. Results are based on parish areas.

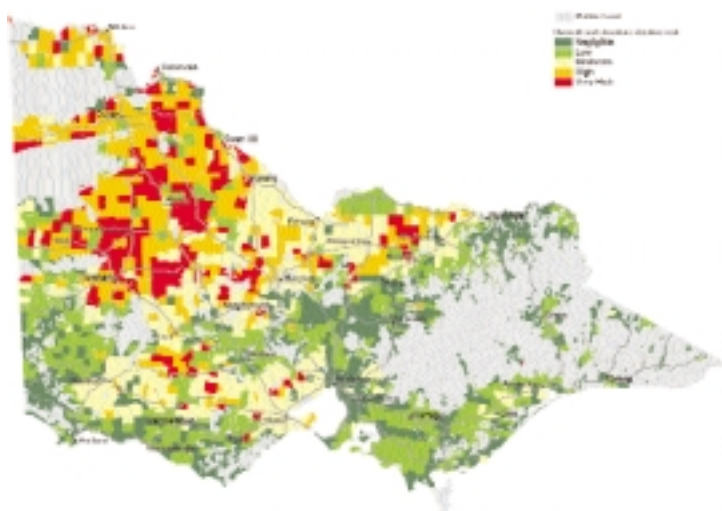


Figure 57. Overall soil structure decline risk in Victoria.

Source: Centre for Land Protection Research 2002.

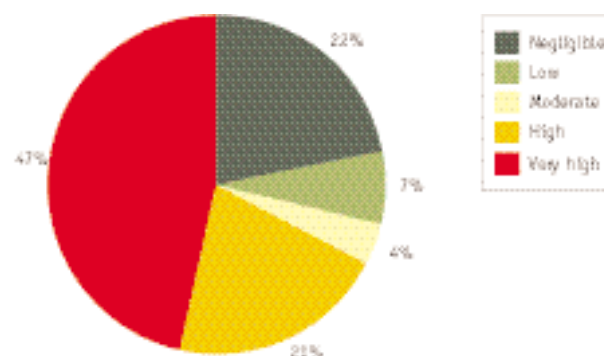


Figure 58. Percentage of Victoria's agricultural land at risk from soil structure decline, 1997.

Source: Centre for Land Protection Research 2002.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	yes	yes	no	no
Mallee CMA	no	no	no	no
North Central CMA	yes	yes	no	yes
Port Phillip CalP	no	no	no	no
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	no	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	yes	yes	yes	yes

### 3.9 theme 6 MANAGING PEST PLANTS AND ANIMALS

74



The Australian landscape has been changing for millions of years in response to climatic, geological and biological factors. Since European settlement, the scale and rate of change has been extensive and rapid. Of the 90 species of non-marine mammals known to have inhabited Victoria upon European arrival, 23 are now extinct in the State. Five of these are now totally extinct. Many other species have much-diminished populations and distributions. More than 1000 species of Victorian plants are either rare or threatened. Invasion by introduced terrestrial and aquatic animal and weed species has been a significant component of this change.

More than a thousand species of weeds in Victoria have been estimated to cause hundreds of millions of dollars worth of damage annually to Victorian agriculture and aquaculture. Pest animals also have a significant impact on the value and quality of the State's land and water resources. The impact that pests have on natural ecosystems is significant. Weeds such as blackberry and boneseed and pest animals such as foxes and rabbits have the potential to destroy the biodiversity values of highly prized ecosystems. Exotic weed species now comprise 28 per cent of Victoria's flora.

Management of pests is principally the responsibility of each land and waterway manager. Despite considerable government and private sector investment, invasion of terrestrial and aquatic (freshwater and marine) weeds and vertebrate pests, such as rabbits, still represent a major threat to both the productive capacity of land and water and the integrity of our natural ecosystems.

#### Rabbits

Rabbits have been estimated to cost Victoria up to \$130 million per annum in lost production. Since the introduction and establishment of Rabbit Haemorrhagic Disease (RHD), major declines in rabbit numbers have occurred (66 per cent to 99 per cent) compared to population densities recorded prior to its outbreak in 1996. These declines have been maintained through the combined effects of coordinated, conventional control programs concentrating on the removal of rabbit harbour, and the movement of RHD and Myxomatosis through rabbit populations over time.

Rabbit numbers have fluctuated throughout 2001/02 in conjunction with seasonal conditions and rabbit breeding cycles. High levels of immunity to RHD are being detected at sites

where populations have been continually challenged by the virus, but it must be remembered that these populations are at very low levels compared to pre-RHD. The potential for populations to increase where high levels of immunity exist is of major concern and places emphasis on the need for implementation of other control activities to keep populations low and minimise rabbit impact.

Nine of the ten Rabbit Action Plans have been released and are being implemented across the State.

Complacency by the community and Government is a major threat to the ongoing decline of rabbit impact across Victoria. Rabbits have a remarkable history of recovery from the most lethal poisons and virulent diseases employed against them. Failure in the past by both the community and Government to take advantage over the long-term of the results of these controls has been a major and costly mistake.

The community and Government must dedicate sufficient resources to maintain gains achieved and extend effective, long-term rabbit management techniques, such as harbour destruction and fumigation. Unless rabbit control is accepted as a priority issue and matched with adequate resources, effective and long-term control will never be achieved in Victoria.

### Weeds

Weeds are a serious threat to primary production and biodiversity in Victoria. They reduce farm and forest productivity, displace native species and contribute significantly to land and water degradation. The most recent estimate puts the direct cost of weeds to Victorian agriculture at more than \$360 million per year. Additional costs are borne by public land managers, industry, local government and utility companies. The impact that weeds have on natural ecosystems is significant but the ways of understanding this impact are still being developed.

It is not reasonable to expect that weeds will be eradicated from a region or a State where they are well established. Established weeds, however, need to be prevented from spreading into other valued areas at risk to limit their impact. In addition, isolated infestations of serious weeds need to be prevented from becoming established. This is particularly important, as the threat of new weeds becoming established in Victoria is serious and increasing.

While considerable effort is being undertaken by the community and Government to manage and prevent the spread of established weeds, early identification and intervention provides opportunities to minimise, or even eradicate, specific weeds from the State or a region.

Ongoing vigilance, action and commitment are required from both the community and Government for priority weeds. Programs must be thoroughly planned and resourced, ensuring the ability to undertake immediate action on new incursions in much the same way as is used for controlling the release of exotic diseases into Victoria.





Additional effort will be required to improve the knowledge of the declared weeds in Victoria in relation to their occurrence and treatment, and improved program evaluation. New plant species with pest potential need to be assessed based on risk analysis assessing both economic and environmental impacts before applying resources to major eradication programs. For new weeds, priorities need to be established based on the likelihood of introduction and the threat posed. For established weeds, priorities will be developed based on CMA Weed Action Plans, seven of which are released and being implemented with the other three being finalised following extensive community consultation.

As part of this process, the risks of introduction and spread must be communicated to the community so that attitudes and behaviour are modified, partnerships developed, community vigilance increased and cooperative mechanisms developed to minimise these risks.




The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:

-  = This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.
-  = This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.
-  = This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.
-  = This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend

-  A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;
-  An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;
-  A Red symbol represents poor or limited data collection and interpretation.



**theme MANAGING PEST  
PLANTS AND ANIMALS**

Indicator

**Rabbit activity (potential  
impact of rabbits)**

Indicator Information Confidence Rating



76

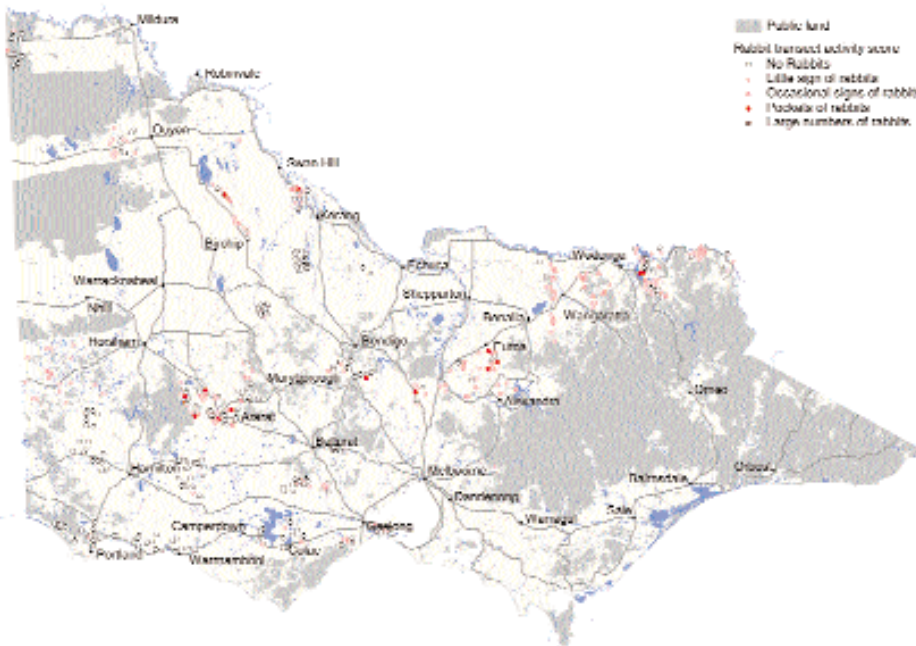
**CONDITION**
**State Status**


Figure 59. Rabbit activity in Victoria.

Source: Integrated Pest Management System (IPMS), NRE, 2002.

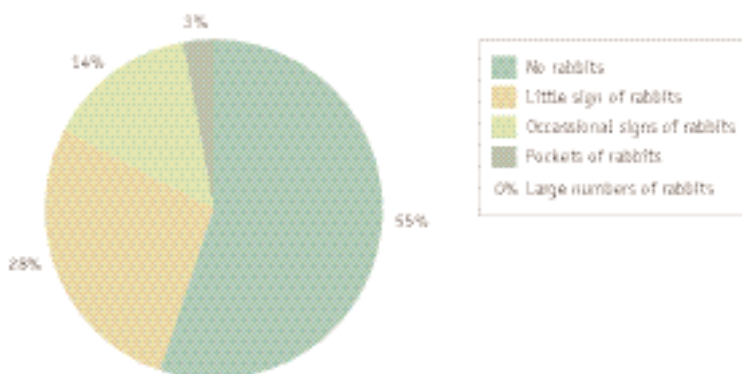


Figure 60. Percentage of transects showing rabbit activity for Victoria.

Source: Integrated Pest Management System (IPMS), NRE, 2002.

**State Condition and Trend**

**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	East Gippsland	North Central

**Condition Legend**

- OPTIMAL
- GOOD
- MODERATE
- POOR

**Trend Legend**

- POSITIVE
- NEGATIVE
- STABLE
- UNKNOWN

**State Trend**
**Results and Interpretation**

The condition assessment for rabbit activity is considered generally good. Large areas of the State (55 per cent) are showing no signs of rabbit activity, reflecting the success of rabbit management programs.

A further 28 per cent is showing signs of little activity indicating that rabbits are at populations that should be maintainable if intervention continues.

Fourteen per cent of the surveyed area shows occasional signs of rabbits which indicates that in these areas populations could be virtually eradicated if vigilance is maintained.

Only 3 per cent of the areas surveyed had rabbits at population levels that present an immediate threat to rapidly escalate.

No large numbers of rabbits were detected.

Figure 60 indicates that rabbit populations are at very low levels. Despite this, vigilance by the community and NRE must be maintained to consolidate previous control efforts and minimise potential risk of increased activity.

Assessments of rabbit activity were conducted during the winter months when rabbits are not breeding and post control programs.

**Indicator Definition** The Rabbit Activity Indicator describes rabbit abundance and potential for reinfestation.

**Rationale** Rabbits cause significant damage to both human wealth and the natural environment. Figures for Victoria indicate a potential increase in agricultural profits of \$133.34 million if the impact of rabbits were removed (NRE, 2000). Regional Rabbit Action Plans have been developed to combine government and community efforts to control rabbit infestations. However, until recently there has been no means to determine the overall effectiveness of the Plans and rabbit control programs. Therefore, this indicator has been designed to provide feedback to land managers on the risk of re-infestation by rabbits, target areas for rabbit control measures, and the effectiveness of rabbit control activities.

## MANAGEMENT RESPONSE

77

### State Management Response

- S** Victorian Pest Management Framework.<sup>37</sup> Rabbit Management Strategy.
- Pm** Both the above documents set the strategic direction for Rabbit management at a Statewide level. Strategic actions and targets are detailed in the Rabbit Action Plans developed by the CMAs.
- C** Development of Rabbit Action Plans in each CMA region. On-going partnership between local communities, NRE and the CMAs.
- me** NRE regions report back to NRE Head Office quarterly on the area in each region covered by control programs and the area successfully treated by control programs.

### Regional Case Study

#### Rabbit Control

The Black Range is a granite outcrop of hills of some 3,000 hectares near Stawell in the Wimmera region of Victoria. The range is covered with open woodlands incorporating Yellow Box, Yellow Gum, Scent Bark, Long Leaf Box, Red Gum and Swamp Gum communities.

Overgrazing has seen the richly diverse understorey of the area seriously depleted. Some native plant species have been lost altogether, with up to 70 other species under threat. The Black Range Land Management Group has undertaken an understorey vegetation restoration program which began in the late 1980s. A critical part of this program is to restore genetic diversity of understorey species.

The first priority has been to protect a number of rare and threatened species by excluding rabbit grazing. This has been achieved by erecting rabbit exclusion plots using rabbit-proof netting. Cuttings and seed have been propagated to reintroduce these plants into areas where they have disappeared.

Intensive and ongoing rabbit control through the Rabbit Buster Program has been the number one priority of the group. Rabbit numbers have been reduced by 85 per cent which has resulted in significant regeneration of native plant species and communities.

Source: Victorian Rabbit Buster Report and Evaluation Stage 1,(2000).

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	yes	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes/In prep	yes/In prep	yes/In prep	yes/In prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes	no	yes	no
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes



**theme MANAGING PEST  
PLANTS AND ANIMALS**

Indicator

# Extent and severity of State Prohibited Weed species.

Indicator Information Confidence Rating



78

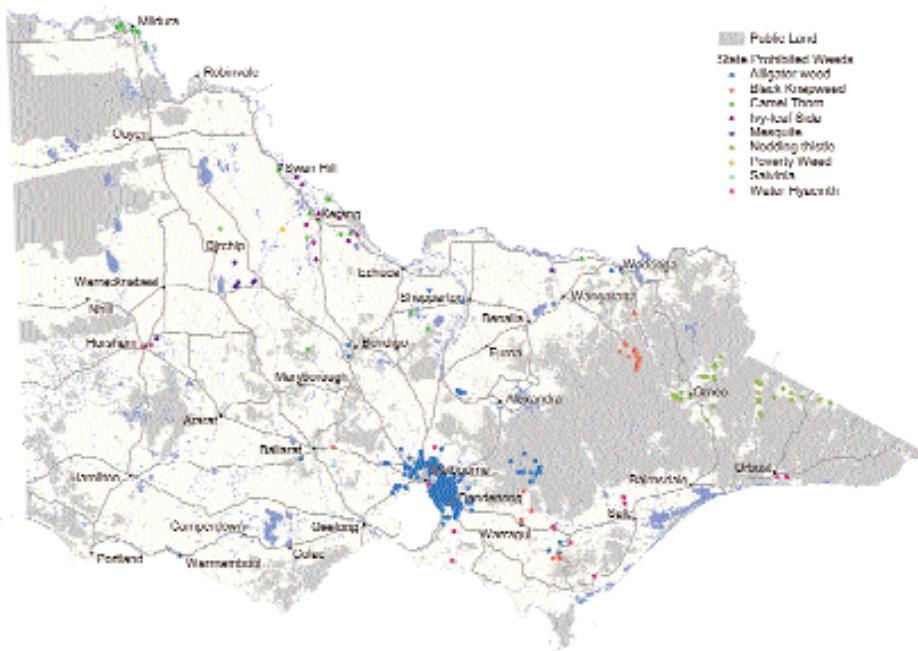
**CONDITION**
**State Status**


Figure 61. State Prohibited Weed occurrence.

Source: NRE, Integrated Pest Management System (IPMS).

**State Trend**
**Results and Interpretation**

In Victoria there are fourteen declared State Prohibited Weeds. Of these, the infestation sites of nine species found in the State have increased over a five year period since 1997. These species are Alligator Weed, Black Knapweed, Camelthorn, Ivy-leaf Sida, Mesquite, Nodding Thistle, Poverty Weed, Salvinia and Water Hyacinth. In addition, considerable effort has been taken by NRE to provide rapid response action against Branched Broomrape, which is a serious economic weed located in South Australia, but as yet not found in Victoria.

1,066 infestations have been identified and 1,350 hectares treated through an ongoing program to control new infestations.

Occasional Marijuana findings have been reported to Victoria Police for destruction.

There has been a 100 per cent increase in the number of infestations since 1997. This is in part due to increased and more comprehensive surveillance techniques.

Despite an increased number of infestations, condition across the State is considered moderate and trends stable as known infestations of Prohibited Weeds are under active management. Control remains a constant challenge as new weeds are emerging all the time.

**State Prohibited Weed Species**

Alligator Weed	<i>Alternanthera philoxeroides</i>
Black Knapweed	<i>Centaurea nigra</i>
Camelthorn	<i>Alhagi maurorum</i>
Ivy-leafed Sida	<i>Sida leprosa</i>
Lagarosiphon	<i>Lagarosiphon major</i>
Marijuana	<i>Cannabis sativa</i>
Mesquite	<i>Prosopis spp.</i>
Nodding Thistle	<i>Carduus nutans</i>
Parthenium Weed	<i>Parthenium hysterophorus</i>
Perennial Ragweed	<i>Ambrosia psilostachya</i>
Poverty Weed	<i>Iva axillaris</i>
Salvinia	<i>Salvinia molesta</i>
Tangled Hypericum	<i>Hypericum triquetrifolium</i>
Water Hyacinth	<i>Eichhornia crassipes</i>

**Other priority weeds:**

Ragwort	<i>Senecio jacobaea</i>
Serrated tussock	<i>Nassella trichotoma</i>

Table 7. State Prohibited Weeds.

Source: CaW, NRE.

**State Condition and Trend**

**Regional Condition and Trend**

Corangamite	Port Phillip	Wimmera	West Gippsland	North East
Goulburn Broken	Glenelg-Hopkins	Mallee	East Gippsland	North Central

**Condition Legend**

- OPTIMAL
- GOOD
- MODERATE
- POOR

**Trend Legend**

- POSITIVE
- NEGATIVE
- STABLE
- UNKNOWN

For further information refer to the website [www.nre.vic.gov.au/vcio](http://www.nre.vic.gov.au/vcio)

**Indicator Definition** The extent and severity of State Prohibited Weed infestations in Victoria. **Rationale** On present day figures it has been estimated that weeds cost Australia in excess of \$3,300 million every year. Weeds also have a significant impact on natural ecosystems and biodiversity. Internationally, invasive species are recognised as the second most significant threat to natural ecosystems. In Victoria, 16 priority weeds pose a major Statewide threat and strategies have been developed to control these species. This indicator will provide information regarding effectiveness of these strategies in controlling State Prohibited Weeds only. Over time, improved information will be collected on all priority weeds in each region to document progress and evaluate management efforts.

## MANAGEMENT RESPONSE

79

### State Management Response

- S** Victorian Pest Management Framework.<sup>37</sup> State Weed Management Strategy.
- Pm** Both the above documents set the strategic direction for weed management at a Statewide level. Priority actions and targets for control of priority weeds are detailed in Regional Weeds Action Plans, developed by all CMAs.
- C** Development of Weed Action Plans in each CMA region. On-going partnership between local communities, NRE and the CMAs.
- me** NRE regions provide monitoring and evaluation services. Reporting back to NRE Head Office quarterly on the area in each region covered by control programs and the area successfully treated by control programs.

### Regional Case Study

#### Alligator Weed

Alligator Weed (*Alternanthera philoxeroides*) is a serious weed of waterways in many parts of the world. It was first discovered in Victoria in 1996. It became apparent soon after that the weed was being grown as a leafy vegetable predominantly by the Sri Lankan community, who mistakenly believed it to be the popular Sri Lankan leafy vegetable Mukunuwenna, or Sessile Joy Weed.

A control program commenced in 1997. All identified infestations were prioritised according to the risk of naturalisation, using proximity to waterways, size of the infestation and land situation as risk factors. Over 800 sites were treated with herbicide between 1997-2002.

Implementing education and awareness was an important step in the control process, and providing a replacement vegetable was the key to public participation. Common joy weed (*Alternanthera denticulate*) was selected as the replacement vegetable and made available to the Sri Lankan community.

The Alligator weed story is a good example of a community-government partnership to control a serious noxious weed. It demonstrates that preventive management can be successful where it has active community involvement and support.

Source: Lalith Gunasekera (Winter 2002) Victorian Landcare & Catchment Management Magazine, A Case of Mistaken Identity – the Alligator Weed Story. Issue 24, Victoria.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	yes	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	In prep	In prep	In prep	prep
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes	no	yes	no
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

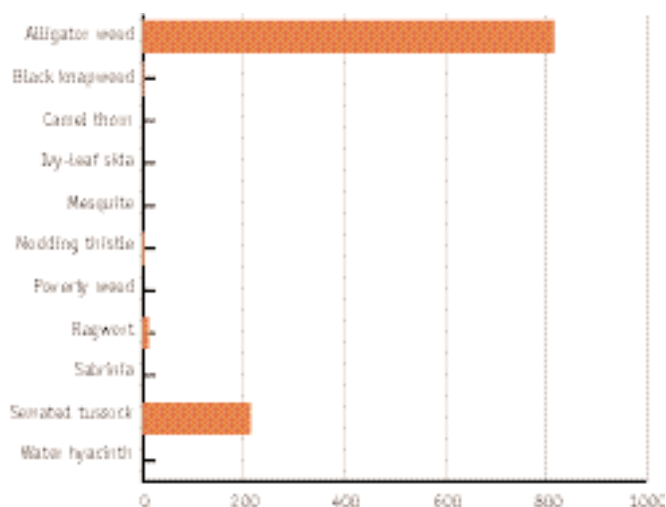


Figure 62. Number of previous infestations (May 1997) eradicated as of May 2002.

Source: CaW, NRE.

### 3.10 theme 7 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

80



Human activities (e.g. the burning of fossil fuels, land clearing, and the development of more intensive agricultural systems) during the past 200 years have led to an increase in the concentration of greenhouse gases in the atmosphere. This is resulting in an increase in the amount of heat that is trapped by the atmosphere - leading to a change in the earth's climate.

The 1990s was the warmest decade and 1998 the warmest year in instrumental record (since 1861). Climate scientists have projected that, over this century, the surface temperature of the earth will increase by 1.4 to 5.8°C and sea levels will rise by 0.09 to 0.88 metres. Rainfall patterns are also expected to change. These changes are expected to have a significant impact on water resources, agricultural systems, coastal areas, native flora and fauna, snow cover and human health.

Regional areas have an important part to play in dealing with issue of greenhouse / climate change in three main ways. Firstly, the impacts of a changing climate will need to be planned for and programs developed to assist land-based enterprises and managers to adapt to climate change. Secondly, initiatives to



minimise the land-based emissions, particularly resulting from land clearing and agricultural practices, need to be tailored to each regional area. And thirdly, there is potential to increase carbon dioxide sequestration by changing agricultural and forestry practices and to reduce emissions from land clearing and soil disturbance but this potential is not unlimited. Carefully planned, revegetation for carbon sequestration in catchments, will not only remove carbon dioxide from the atmosphere but will contribute to catchment protection, biodiversity enhancement and salinity mitigation.

In order to develop a land management policy framework and initiatives that encourage the reduction of greenhouse gas emissions, detailed information on sources of emissions and trends over time is required. Accurate information is required on native vegetation clearing, revegetation, and emissions from agricultural sources, particularly methane from enteric fermentation and nitrous oxide from agricultural soils.

To be helpful for policy and program development at the catchment level, this information needs to be available at a local or regional scale. To enable management prescriptions to be developed for agricultural systems, information about methane and nitrous oxide emissions at a paddock-scale are required.

There is significant current investment in collecting data on greenhouse gas emissions from land-based sources. The Commonwealth Government has recently released data from the National Carbon Accounting System that shows emissions on a State-by-State basis. For catchment condition reporting it will be necessary to develop and maintain data bases that present and analyse similar information on clearing and revegetation at a larger scale.

Investment in the establishment of plantations for carbon sequestration is reliant on high quality and easy-to-use tools to accurately measure on-site carbon.

Australia is developing tools and information required to tackle climate change. Work is needed to ensure the required information on clearing and revegetation is available at the State and regional levels and Victoria is investing in this work. Specifically the ability to estimate the carbon content of the range of native vegetation types and plantations in different climate zones and land systems, so that remote-sensed vegetation cover information can easily be converted to carbon stock. Similarly we need to develop the ability to project growth rates of the full range of vegetation classes in terms of carbon, so that the future benefit of revegetation for carbon sequestration can be estimated more accurately.

Research into gaining a better understanding of nitrous oxide and methane emissions is just beginning and needs to be extended. Without a more precise knowledge of how and where these emissions are generated it is not possible to develop land management policies, prescriptions or guidelines that will mitigate them. For example, our estimation of nitrous oxide emissions is calculated by applying a simple relationship with nitrogen-based fertiliser application. We know that there is no

such simple relationship and that moisture content of soils and animal wastes are also important variables, but our understanding is insufficient. This situation leads to the unacceptable situation where the only management response we have is to alter the amount of nitrogen-based fertiliser applied, when there might be additional and more effective responses related to livestock or timing of fertiliser application.





In order to understand the implications of a changing climate, it is important to develop models that predict climate change at a sufficiently detailed spatial scale. These climate projections need to become the basis for further detailed studies that interpret the consequences of an altered climate for catchment conditions, water resource management, agricultural land use, biodiversity resources, and infrastructure needs.

Victoria has invested in a partnership with CSIRO that is delivering spatially relevant high resolution regional climate projections for Victoria, and supporting supplementary studies that build on this information to better understand implications for alpine systems, selected agricultural commodities, and selected biodiversity resources. This work needs to be extended on a regional or catchment basis. Of particular priority are studies to understand future water availability on a catchment basis and consequent effects on natural and agro-ecosystems.




The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:

-  = This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.
-  = This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.
-  = This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.
-  = This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend

-  A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;
-  An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;
-  A Red symbol represents poor or limited data collection and interpretation.

**theme GREENHOUSE GAS  
EMISSIONS AND CLIMATE CHANGE**

Indicator

**Victorian greenhouse gas  
emissions**

Indicator Information Confidence Rating



82

**CONDITION**
**State Status**

Source	Megatonnes (Mt) CO <sub>2</sub> -equivalent 1999	Percentage of total Victorian emissions	Change from 1990 to 1999	
			Mt CO <sub>2</sub> -equivalent	Percentage
Stationary energy	80.9	71.8%	19.5	31.7%
Transport	18.2	16.1%	2.0	12.6%
Fugitive emissions from fuels	3.0	2.7%	-1.5	-33.4%
Industrial processes	1.6	1.4%	-1.8	-52.9%
Agriculture	14.2	12.6%	-0.4	-2.7%
Forestry and other	-11.6	-10.3%	1.4	-11.0%
Land clearing	2.5	2.2%	-3.8	-60.1%
Waste	3.9	3.5%	-0.1	-1.0%
<b>Total</b>	<b>112.8</b>	<b>100%</b>	<b>15.4</b>	<b>15.9%</b>

**State Trend**
**Results and Interpretation**

Victoria's total greenhouse gas emissions increased by 15.4 megatonnes or 15.9 per cent between 1990 and 1999 – emissions growth was particularly strong over the period 1995 to 1999.

Greenhouse gas emissions from the stationary energy sector (primarily the production of electricity and the use of gas) grew by nearly 32 per cent over this period – within this sector, emissions from electricity production increased by 18.1 megatonnes (41 per cent).

The stationary energy sector was responsible for nearly 72 per cent of Victoria's total emissions in 1999.

Emissions from transport increased by 12.6 per cent from 1990 to 1999.

*Table 8. Victorian greenhouse gas emissions by sector.*

Source: Victorian Greenhouse Gas Inventory 1999.<sup>38</sup>

	1990	1995	1999
Stationary energy	61.4	65.4	80.9
Transport	16.2	16.6	18.2
Fugitive emissions	4.5	4.3	3.0
Industrial processes	3.4	1.8	1.6
Agriculture	14.6	14.4	14.2
Forestry and other	-13.0	-12.9	-11.6
Land clearing	6.3	3.3	2.5
Waste	4.0	4.3	3.9
<b>Total</b>	<b>97.4</b>	<b>97.2</b>	<b>112.7</b>

*Table 9. Trends in Victorian greenhouse gas emissions by sector - 1990, 1995 and 1999.*

Source: Victorian Greenhouse Strategy 2002.<sup>38</sup>

Emissions from the agriculture and waste sectors both declined marginally over this period.

Emissions from industrial processes declined significantly – albeit from a relatively small base – from 1990 to 1999, falling from 3.4 to 1.6 megatonnes – a reduction in emissions of PFCs from aluminium production was a key reason for this.

The net greenhouse sink provided by the forestry sector declined from 13 megatonnes in 1990 to 11.6 megatonnes in 1999.

Emissions from land clearing declined from 6.3 megatonnes in 1990 to 2.5 megatonnes in 1999.

The 1999 National Greenhouse Gas Inventory (NGGI) showed an increase in Australia's total greenhouse gas emissions of 7.3 per cent from 1990 to 1999. As noted above, Victoria's emissions growth over this period was 15.9 per cent – consequently, Victoria's share of total national emissions increased from 19.7 per cent in 1990 to 21.3 per cent in 1999.

Regional trend assessment not sourced at time of publishing.

**State Trend**

**Regional Condition and Trend**

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

**Condition Legend**

- OPTIMAL
- GOOD
- MODERATE
- POOR

**Trend Legend**

- ▲ POSITIVE
- ▼ NEGATIVE
- STABLE
- ? UNKNOWN



**Indicator Definition** This indicator measures the volume and trend in Victorian greenhouse gas emissions by sector. **Rationale** Human activity has added to the emission of greenhouse gases. The increase in greenhouse gases is contributing to global warming and climate change. The Victorian Greenhouse Strategy has been developed to help reduce the level of greenhouse gas emissions. Therefore, the identification and monitoring greenhouse gas emissions will be very important in measuring the success of the Victorian Greenhouse Strategy and measures implemented to reduce emissions.

## MANAGEMENT RESPONSE

83

### State Management Response

- S** Victorian Greenhouse Strategy.<sup>38</sup>
- Pm** The strategy outlines a vision for 2010 and identifies key actions to reduce emissions.  
The combined effect of actions in the strategy will deliver greenhouse gas emissions savings of between 5 and 8.3 megatonnes CO<sub>2</sub>-equivalent per annum over 2008-2012.
- C** The Government has allocated \$100 million to climate change programs over the period to 2004.
- me** Will be monitored annually on a financial year basis. Progress report will include trends in Victoria's greenhouse gas emissions and progress in implementing the actions contained in the strategy.  
A formal review of the Strategy will occur biennially.

### Regional Case Study

North Central CMA has developed a draft action plan titled 'A Regional Response to Climate Change'. The action plan seeks to respond to climate change by sequestering carbon through revegetation activities and changed land use.

Under the Kyoto Protocol (1997) strong consideration has been given to carbon sinks. The NCCMA action plan provides guidance on how to establish vegetation that is likely to be eligible as a carbon sink. Attracting investment to fund land use change and revegetation is essential to meet regional targets for landscape change. Carbon sinks offer potential investors returns through carbon credits.

A 20-year timeframe is proposed for the revegetation program and an investment of many millions of dollars is required. The plan considers how best to use the current investment in NAP and NHT2 to promote longer-term investment in carbon sinks. The target audiences for this action plan include investors, landholders, policy makers and NCCMA and NRE staff involved in implementing regional native vegetation programs.

Source: 'A regional response to Climate Change. Land use change and revegetation in North Central Victoria.' Draft NCCMA.

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	no	no	no	no
North East CMA	no	no	no	no
Mallee CMA	no	no	no	no
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	yes	yes	yes
Glenelg-Hopkins CMA	no	no	no	no
East Gippsland CMA	no	no	yes	no
West Gippsland CMA	no	no	no	no
Wimmera CMA	no	no	no	no



## CONDITION

## State Status



Figure 63. Temperature Change.

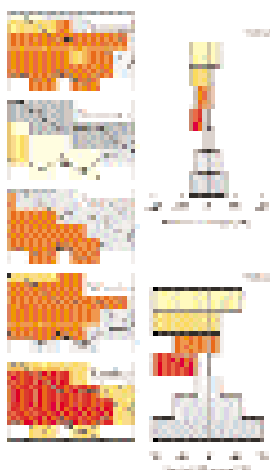
Source: Victorian Greenhouse Strategy 2002.<sup>38</sup>

Figure 64. Rainfall Change.

Source: Victorian Greenhouse Strategy 2002.<sup>38</sup>

## State Trend

## Regional Condition and Trend

Corangamite ?	Port Phillip ?	Wimmera ?	West Gippsland ?	North East ?
Goulburn Broken ?	Glenelg-Hopkins ?	Mallee ?	East Gippsland ?	North Central ?

Condition Legend	Trend Legend
● OPTIMAL	▲ POSITIVE
● GOOD	▼ NEGATIVE
● MODERATE	— STABLE
● POOR	? UNKNOWN

## State Trend

## Results and Interpretation

The Victorian Government is supporting work by CSIRO Atmospheric Research to develop regional climate change projections for Victoria. The latest findings of this work (May 2002) are summarised below for the year 2030 and 2070.

Victoria is likely to be between 0.3°C and 1.6°C warmer by 2030, and 0.8°C to 5.0°C warmer by 2070 as compared with average temperatures in 1990.

The warming is expected to be greatest in summer and least in winter.

The frequency of extreme maximum temperatures will increase by 2070, with 15-40 per cent more hot summer days under the lowest projected warming, and 50-250 per cent more hot summer days under the highest projected warming.

Frosts will decrease in frequency by 2070. There is likely to be a reduction of 33-75 per cent under the lowest projected warming and much of the State will be frost-free under the highest projected warming.

Less rainfall is likely across most regions of Victoria. Projected changes in annual rainfall range from -9 per cent to 3 per cent for 2030, and from -25 per cent to +9 per cent for 2070.

Projected rainfall decreases are strongest in spring through most of the State, with dry springs likely to become more common. Rainfall trends are uncertain in northern Victoria over the summer to autumn period and southern Victoria during the winter.

Extreme daily rainfall events will become more intense and more frequent in many regions.

Warmer conditions will lead to increased evaporation. When combined with reduced rainfall, this is likely to increase moisture stress.

For 2030-2070 there is a projected trend towards reduced rainfall across Victoria. Despite possible positive impacts from climate change in some areas (eg. faster crop growth) overall the VCMC considers reduced rainfall as a negative trend for the State.

**Indicator Definition** The predicted change in temperature and rainfall for Victoria based upon regional climate change projections. **Rationale** Changes in rainfall and temperature patterns, and in the frequency of extreme weather events (eg. storms, droughts), could effect water resources, coastal environments, native flora and fauna, agriculture and forestry. It is important therefore that governments and the community have access to the best possible information on the likely future climate to help plan for and adapt to changing climatic conditions.

## MANAGEMENT RESPONSE

85

### State Management Response

- S** Victorian Greenhouse Strategy.<sup>38</sup>
- Pm** The strategy outlines a vision for 2010 and identifies key actions to reduce emissions.  
The combined effect of actions in the strategy will deliver greenhouse gas emissions savings of between 5 and 8.3 megatonnes CO<sub>2</sub>-equivalent per annum over 2008-2012.
- C** The government has allocated \$100 million to climate change programs over the period to 2004.
- me** Will be monitored annually on a financial year basis. Progress report will include trends in Victoria's greenhouse gas emissions and progress in implementing the actions contained in the strategy.  
A formal review of the Strategy will occur biennially.

### Regional Case Study

Tables 10 and 11 are the results of CSIRO climate modelling. The tables provide a snapshot of predicted temperature change across Victoria over the next 70 years.

Site	Summer days over 35°C		
	present	2030	2070
Ballarat	4	4-7	5-17
Donald	12	13-19	15-38
Echuca	16	17-25	20-49
Hamilton	6	6-9	7-19
Mangalore	11	12-18	14-41
Melbourne	8	9-12	10-20
Mildura	23	24-33	27-56
Omeo	2	2-5	3-20
Orbost	5	6-9	7-21
Sale	4	5-7	6-16
Swan Hill	20	20-30	24-55
Tatura	8	9-16	11-41
Wangaratta	15	16-25	20-56

*Table 10. The average number of summer days over 35°C at Victorian centres for present conditions, 2030 and 2070.*

Source: Victorian Greenhouse Strategy 2002.<sup>38</sup>

Site	Winter days below 0°C		
	present	2030	2070
Ballarat	10	5-8	0-6
Donald	7	2-6	0-4
Echuca	10	3-8	0-5
Hamilton	8	3-6	0-5
Mangalore	13	4-11	0-8
Melbourne	1	0-1	0-0
Mildura	4	1-3	0-1
Omeo	44	29-40	7-35
Orbost	3	0-2	0-1
Sale	11	4-9	0-7
Swan Hill	3	1-2	0-1
Tatura	15	6-13	0-9
Wangaratta	18	8-15	0-12

*Table 11. The average number of winter days below 0°C at Victorian centres for present conditions, 2030 and 2070.*

Source: Victorian Greenhouse Strategy 2002.<sup>38</sup>

### 3.11 theme 8 COMMUNITY ATTITUDES AND INVOLVEMENT IN NATURAL RESOURCE MANAGEMENT

86



Whether the issue is road safety, immunisation or catchment management, there is an underlying assumption in all public communication campaigns that an informed community is more likely to heed the desired message. It follows that this increases the likelihood of community participation and generates greater support for public policy to address the issue.

Since 1987 Victoria has seen a range of formal and informal programs implemented to raise the level of awareness and understanding of natural resource management issues in all sectors and groups within the catchment community. These programs have aimed to both raise general awareness and help facilitate local ownership of catchment management issues.

In a democratic society, sound land and water management is best achieved through the informed action of the individual users and managers of these resources. Awareness programs are an important adjunct to developing mechanisms that effectively involve catchment management communities in understanding the problems within a catchment and in developing goals, objectives, priorities and action plans.

The draft report "Proposed Catchment Indicators for Victoria"<sup>39</sup>, includes a full list of recommended indicators, including: 'level of community awareness of catchment issues' and 'number of community groups monitoring waterway health'. Three questions arise; How successful have we been in Victoria? How important is community awareness to the future of catchment management? What level of awareness do we want by 2020?

A review of Australian and overseas experience of community participation in catchment management clearly demonstrates that effective management outcomes, sharing of the management burden, and community ownership of problems and solutions, requires community participation in the development of integrated catchment management policies. In fact, community participation is at the very basis of catchment management.<sup>40</sup>

For every dollar invested by the Victorian Government in natural resource management, the community invests an additional five dollars.<sup>41</sup> Enlisting the continued support of the



community is vital to our collective success, that requires on-going communication and awareness raising. Setting targets and monitoring progress is core to the task. In 2001 Victoria's Catchment Management Authorities combined resources to initiate a survey of community attitudes. 2000 phone interviews (approximately 200 in each CMA region) were conducted in mid-2001. The results provide an important benchmark for public awareness about catchment management issues.

Primarily, the survey sought to understand land, water and vegetation management awareness and to determine the level of awareness of the CMA in the community and how people found out about them. The survey results should be used to understand where the best return on investment will be gained with communication in future. Such a survey could become a formal evaluation tool, repeated every two to three years, to help monitor progress with the communication effort and to provide new data for continuous improvement in communication campaigns.

If we are going to use this data to inform policy then we need to know whether the quality and strategic nature of our statewide communication effort is improving and whether this is translating to improved community awareness and understanding of catchment management issues.

**Landholders and managers are central to natural resource management issues on private land. The first Landcare group in Australia was established at Winjallock near St Arnaud in central Victoria in 1986. The Landcare program heralded a significant shift in community working with government to reverse land degradation. Landcare is considered the connection between private land managers and public benefit.**<sup>42</sup>

Landcare has significantly contributed to increased awareness of conservation issues in rural and urban areas and increased community participation in environmental activities. It has been identified as the most important mechanism in the nation for integrating biodiversity conservation and agricultural production. Landcare represents a significant source of social capacity to manage changing circumstances. It is informal, has the ability to address its members' issues and is flexible in its range of activities.<sup>42</sup>

In Victoria, legislative reform was undertaken to support the Landcare approach for more integrated land and water





management and to improve community consultative processes. This led to the *Catchment and Land Protection Act 1994* which, following further reform in 1997, resulted in the creation of the Catchment Management Authorities (CMAs). The CMAs consolidated many existing land and water management, community advisory and service delivery groups.<sup>42</sup>

The three elements of Landcare are based in the Landcare partnership, the relationship between the community, government and business. This partnership is the basis of Landcare's success and is vital in facing current environmental, social and economic imperatives.<sup>42</sup> A large-scale survey assessing the participation rate of people in Landcare has recently been completed for the first time. This benchmarking exercise is presented as a new indicator in this theme.




The legends below apply to all indicators in this theme.

#### Management response assessment legend

The legend of S, Pm, C, and me is used to introduce discussion on management responses at both the State and regional level:

-  = This symbol describes if a State strategy (or regional action plan), of relevance to the indicator, exists or is in preparation.
-  = This symbol outlines if the above Strategy/Plan contains clear performance measures and targets.
-  = This symbol describes if the above Strategy/Plan is supported by a State/regional commitment to an implementation program with resourcing.
-  = This symbol outlines if the Strategy/Plan contains a clear process for monitoring and evaluation.

#### Quality of data legend

-  A Green symbol represents good consistent data collection and interpretation (>5 years) on condition and trends;
-  An Orange symbol represents some consistent data collection and interpretation (<5 years) on either condition or trend but not both;
-  A Red symbol represents poor or limited data collection and interpretation.



## CONDITION

## State Status

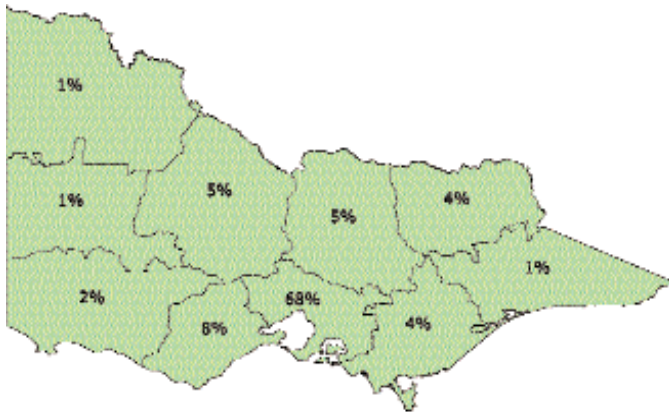


Figure 65. Population of CMA regions as percentage of total Victorian population

Source: Scarlet Consulting Australasia 2001

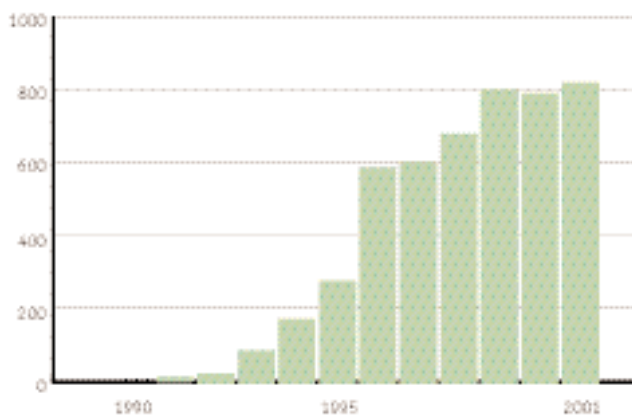


Figure 66. Participation in Waterwatch Victoria.

Source: Waterwatch Victoria, 2002.

## State Trend

## Results and Interpretation

Figure 65 shows the distribution of Victoria's population by CMA region, revealing the scale of the rural/urban divide.

Figure 66 reveals that participation in community monitoring programs such as Waterwatch continues to increase. Providing the community with opportunities to participate in natural resource management is important in raising awareness.

Table 12 shows unprompted awareness of organisations who manage natural resources.

The data reveals that Landcare and NRE occupy the lion's share of the community's "share of mind". The CMAs rank equal fourth after Local Water Authorities.

In another question interviewees were asked if they had heard of their local CMA. By comparison with the 11 per cent unprompted awareness, the overall 'prompted awareness' of CMAs is a healthy 54 per cent.

Further analysis of the data reveals that those most likely to be aware of CMAs are farmers, people residing in rural areas (particularly those living on the land), and people aged 30-69 years.

Those less likely to be aware of CMAs are townspeople, particularly labourers, tradespersons and people not currently in the workforce.

Figure 67 reveals that water quality (40%) is clearly considered to be the leading natural resource issue.

Other important issues include salinity management (19%), protecting waterways and wetlands (16%), and environmental flows (14%).

This is a benchmarking study only. No condition or trend is yet available.

## State Trend



## Regional Condition and Trend

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

Condition Legend	Trend Legend
<span style="color: blue;">●</span> OPTIMAL	<span style="color: black;">▲</span> POSITIVE
<span style="color: green;">●</span> GOOD	<span style="color: black;">▼</span> NEGATIVE
<span style="color: yellow;">●</span> MODERATE	<span style="color: black;">—</span> STABLE
<span style="color: red;">●</span> POOR	<span style="color: black;">?</span> UNKNOWN

**Indicator Definition** This indicator will determine the level of awareness in the community of natural resource management issues and natural resource management organisations. **Rationale** For every dollar invested by the Victorian Government in natural resource management, industry and landholders invest an additional five dollars.<sup>41</sup> So enlisting the continued support of the community is vital to our collective success. Raising the awareness of catchment management issues requires an on-going commitment to communication. This will involve setting targets and monitoring the progress of our communication strategies. Therefore, the results of a statewide 2001 survey provide an important benchmark for measuring public awareness of catchment management issues and the performance of natural resource management organisations. Subsequent surveys will be vital to maximising the value of this indicator.

## MANAGEMENT RESPONSE

89

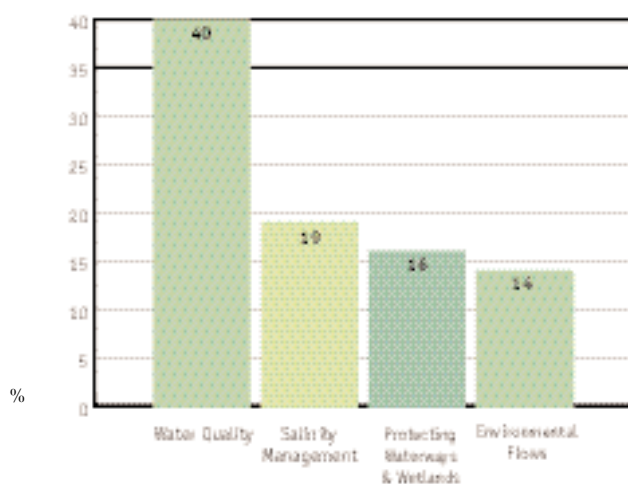


Figure 67. Statewide hierarchy of importance of natural resource issues.

Source: Taylor, Nelson, Sofres & Scarlet Consulting Australasia (2001).<sup>43</sup>

## State Management Response

- S** No State response.
- Pm** Unsure – diffuse sectional targets and measures between organisations.
- C** There is a range of community awareness activities underway across the State. Many CMAs have communication strategies and NRE and its different divisions have communications plans. The NAP office has also developed a communications strategy.
- me** Unsure – Effort at a CMA regional level is probably most comprehensive (and relevant). Little coordination across the state to actually target specific audiences about environmental issues.

Much of the current activity focuses on communicating with those actually involved in natural resource management. There is an important niche to be filled communicating environmental messages at a state level to the broader community and other potential partners.

Regions	Landcare	DNRE	Local Water Authority	CMA	Water boards	Local Govt (unspec)
	%	%	%	%	%	%
Mallee	23	26	6	4	15	6
North East	37	21	10	10	7	10
Wimmera	39	28	10	9	10	10
Glenelg-Hopkins	36	31	11	17	10	11
East Gippsland	30	41	8	27	17	8
West Gippsland	28	29	11	11	15	4
North Central	33	26	13	6	7	8
Goulburn Broken	37	29	29	13	10	10
Corangamite	27	23	15	9	14	13
Port Phillip	4	5	20	-	11	24
<b>Overall Awareness</b>	<b>30</b>	<b>26</b>	<b>16</b>	<b>11</b>	<b>11</b>	<b>10</b>

Table 12. Unprompted awareness of organisations by region.

Source: Taylor, Nelson, Sofres & Scarlet Consulting Australasia (2001).<sup>43</sup>

Regions	Water Quality	Salinity Management	Protecting Waterways & Wetlands	Environmental Flows
	%	%	%	
Mallee	37	44	13	15
North East	45	16	16	16
Wimmera	45	27	20	17
Glenelg-Hopkins	31	20	15	11
East Gippsland	49	8	17	23
West Gippsland	30	8	21	11
North Central	42	29	14	9
Goulburn Broken	36	27	14	14
Corangamite	43	11	3	13
Port Phillip	30	3	13	8
<b>Overall Awareness</b>	<b>40</b>	<b>19</b>	<b>16</b>	<b>14</b>

n=2001

Table 13. The hierarchy of importance of natural resource issues by region.

Source: Taylor, Nelson, Sofres & Scarlet Consulting Australasia (2001).<sup>43</sup>

Regional Management Response	Regional Action or Implementation Plan	Pm	C	me
Corangamite CMA	yes	yes	yes	yes
North East CMA	no	no	no	no
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	In prep	In prep	In prep
Port Phillip CaLP	no	no	no	no
Goulburn Broken CMA	no	no	no	no
Glenelg-Hopkins CMA	yes	yes	no	no
East Gippsland CMA	yes	yes	no	yes
West Gippsland CMA	no	no	no	no
Wimmera CMA	yes	yes	yes	yes



## CONDITION

## State Status

CMA Region	Groups	Networks	FTE
Corangamite	60	10	33
East Gippsland	41	3	4
Glenelg-Hopkins	117	9	21
Goulburn Broken	100	8	22
Mallee	22	8	9
North Central	120	15	13
North East	53	4	15
Port Phillip	43	2	40
West Gippsland	79	5	14
Wimmera	52	4	35
<b>Total</b>	<b>687</b>	<b>68</b>	<b>206</b>

FTE - Full Time Equivalent is based on an individual working a 38-hour week.

*Table 14. Landcare Groups, Networks and FTE Support positions per CMA region, May 2001.*

Source: CaW, NRE.

## State Trend

## Results and Interpretation

## Statewide Landcare Participation

Preliminary data from the ABS 2000/01 Agricultural Commodity Census showing that 36.2 per cent of respondents answering the question "Are you or a representative of your holding a member of a Landcare group?" consider themselves to be members of a Landcare group. The ABS 2000/01 Agricultural Census was distributed to 38,950 farming establishments in Victoria.

Although using much smaller sample sizes than the ABS Agricultural Census, similar surveys on Landcare participation conducted by different research institutes indicate that, Landcare has maintained over 30 per cent participation by representatives of agricultural holdings over the past ten years.

## Number of Landcare Groups operating in Victoria

There is an estimated 687 Landcare Groups across Victoria. There are also 673 non-Landcare groups in Victoria including Agroforestry, Bushcare, Friends of groups, CoastCare and FarmTree groups.

## Number of Networks in Victoria

A Landcare network is defined as a group of Landcare groups. 68 Landcare networks exist across Victoria. There are also 37 non-Landcare networks in Victoria.

## FTE Landcare Support Positions

There are a total of 322 individuals providing support to Landcare in Victoria which equates to the equivalent of 206 FTE positions across the State. It should be noted that data for support roles does not reflect paid FTE, because unpaid hours were also included in assessing support to Landcare.

This is a benchmarking report on participation. No condition or trend is available.

## State Trend



## Regional Condition and Trend

Corangamite	?	Port Phillip	?	Wimmera	?	West Gippsland	?	North East	?
Goulburn Broken	?	Glenelg-Hopkins	?	Mallee	?	East Gippsland	?	North Central	?

Condition Legend	Trend Legend
<span style="color: blue;">●</span> OPTIMAL	<span style="color: black;">▲</span> POSITIVE
<span style="color: green;">●</span> GOOD	<span style="color: black;">▼</span> NEGATIVE
<span style="color: yellow;">●</span> MODERATE	<span style="color: black;">▬</span> STABLE
<span style="color: red;">●</span> POOR	<span style="color: black;">?</span> UNKNOWN



**Indicator Definition** Landcare participation (Baseline reporting of Landcare data). The Landcare movement encapsulates networks of voluntary community groups, individuals and organisations who are generally concerned about Landcare and subscribe to a broad Landcare ethic. The Victorian State Government provides support to the Landcare community through the Landcare Program and Second Generation Landcare Grants. Landcare underwent a review by the Ministerially appointed Second Generation Landcare Taskforce at the end of the Decade of Landcare (1990 – 2000). Baseline data on Landcare was collected from CMAs, the ABS and through NRE research to inform the Taskforce in developing recommendations for strategic policy directions and actions for Landcare into the future. **Rationale** Collection of baseline data on participation of Victorians in Landcare and support for Landcare groups was conducted in 2001 to inform policy directions outlined in "Healthy Landscapes – Sustainable Communities: Victorian Action Plan for Second Generation Landcare" and to develop an appropriate indicator for monitoring Landcare in the future.

## MANAGEMENT RESPONSE

### State Management Response

- S** "Healthy Landscapes – Sustainable Communities: Victorian Action Plan for Second Generation Landcare"<sup>42</sup> launched on 17th May 2002. Establishment of regional Landcare coordinator positions across all CMA regions. Establishment of a Statewide Landcare position to provide leadership of the regional Landcare coordinators.
- Pm** To be developed through implementation of "Healthy Landscapes – Sustainable Communities".
- C** 2002/03 Second Generation Landcare Grants and Landcare Program funded \$5.2 million. Additional \$1.5 million funding for implementation of the Victorian Action Plan for Second Generation Landcare.
- me** Ongoing monitoring and evaluation to be developed in conjunction with implementation of "Healthy Landscapes – Sustainable Communities".

### Regional Case Study

#### South Gippsland Landcare Network

Key community members representing five Landcare groups in 1995 formed the South Gippsland Landcare Network. Motivation for the five groups to form a network came from the Landcare groups' desire to improve communication about land management issues groups were facing. Today, there are 32 Landcare groups from the Westernport (Port Phillip CaLP) region and the West Gippsland CMA region that form the South Gippsland Landcare Network. The Network has approximately 1,400 members and is managed by community members, maintaining a grassroots approach.

The Network publishes a widely circulated newsletter and employs 6 staff, including a Landcare Network Coordinator and project support staff. The Network is successful in continually attracting more Landcare groups and together, attracting grants and corporate sponsorship for implementing regional and strategic projects. Examples of South Gippsland Landcare Network's primary ongoing activities are the Hills to Ocean (H2O) project and a community pest plants and animal control project that promotes community awareness and coordinated control programs. Partnerships between Local Government and regional resource management agencies are recognised as part of the success in contributing to South Gippsland Landcare Network's continued growth and development.

Contact: Joanne Greenwood, joanne.greenwood@nre.vic.gov.au  
Case Study information from Emma Bennett, emma@landcare.net

Regional Management Response	Regional Action of Implementation Plan	Pm	C	me
Corangamite CMA	yes	yes	yes	yes
North East CMA	yes	yes	yes	yes
Mallee CMA	yes	yes	yes	yes
North Central CMA	yes	yes	yes	yes
Port Phillip CaLP	yes	yes	yes	yes
Goulburn Broken CMA	yes	yes	yes	yes
Glenelg-Hopkins CMA	yes	yes	yes	yes
East Gippsland CMA	yes	yes	yes	yes
West Gippsland CMA	yes	yes	yes	yes
Wimmera CMA	yes	yes	yes	yes

## OVERALL RESULTS AND FUTURE ISSUES FOR CONDITION AND MANAGEMENT

### 4.1 Overview of indicator condition and trend results

#### Theme - Changing socio-economic landscapes

Geography, climate, settlement patterns and policies have influenced the demographics of agriculture. Victoria has a significantly higher percentage of small farms, both in terms of area and gross value of product. There has been a marked change in the role played by agriculture in the rural landscape with a continuous deterioration in the terms of trade, the consequent fall in agricultural employment and the increasing average age of farmers. The size of farms, together with the high ratio of land value to production, means that it is difficult for farmers to increase productivity to meet the decline in terms of trade. In many areas, this pressure coupled with the increasing age of farmers may change traditional inter-generational transfer of land ownership.

#### Theme - Biodiversity

The nature and pattern of European settlement, reflecting geography and climate, has resulted in clearing of 70 per cent of native vegetation. Of the remaining 30 per cent, 1.1 million hectares are found on private land and we continue to lose some 2,500 hectares per annum. 23 native animals and 48 native plants are presumed to no longer occur in the State. 152 vertebrate species and 721 plant species are considered endangered or vulnerable. Pressures on biodiversity result from fragmentation and continued degradation of habitat through processes such as overgrazing, introduced predators, herbivores and weeds, altered fire and water regimes, salinity, climate change, habitat disturbance and loss.

The *State's Biodiversity Strategy 1997* and *Native Vegetation Management Framework 2002* make a serious attempt to reverse this but, overall, the condition of biodiversity is considered moderate to poor. Trends at this stage require further analysis.

#### Theme - Rivers, Wetlands and Estuaries

The Index of Stream Condition provides an integrated assessment of stream condition and reveals that, while 22 per cent of river length is in good to excellent condition, 46 per cent of river basins have less than 10 per cent of stream length in

good to excellent condition. In respect of water quality, most indicators were stable with the strongest trend a decline in pH in the north east of the State. Conductivity increased in the north and west of the State and nitrogen increased in waterways within the Corangamite and Glenelg-Hopkins regions. The dry conditions of the past five years have meant that flow has been minimal in some areas. Estuaries have come under increasing pressure, especially in the west of the State.

Government support of the Victorian River Health Strategy and related Streamflow Management and Nutrient Plans address key issues in rivers, wetlands and will impact on estuaries. Completion of the Bulk Entitlement process and the Water Act (Irrigation Farms Dams) amendment will have a major positive impact on protection and enhancement of environmental flows, however further investment will be required to restore environmental flows in some stressed rivers.

#### Theme - Managing Water Resources

Victoria's surface water allocation is 92 per cent of sustainable yield and in some areas exceeds sustainable yield, putting pressure on flows required to maintain ecological integrity. Irrigation accounts for 77 per cent of water use with 8 per cent for urban use in Melbourne. Growth in urban water consumption has fallen, but increased conservation measures will be required to provide a sustainable water supply for projected urban growth.

Demand for groundwater is increasing as surface water supplies are fully allocated in many regions. Groundwater Supply Protection Areas have been established and Groundwater Management Plans are being developed under the Water Act 1989 to provide for sustainable use.

In regulated systems, under the Water Act, Bulk Entitlements clearly define existing rights to water and Streamflow Management Plans are being developed to define rights on unregulated streams. Recent amendments to the Water Act provide for control of harvesting in the upper catchments. Overall, the management tools are in place to ensure sustainable use of the State's water resources but continued support for water use efficiency measures will be required. Return of flow to the Snowy River signals the need for similar actions elsewhere in the State to ensure sustainable water resources management.



### Theme - Managing Land

Dryland salinity continues to pose a real threat to agricultural land. Between 8 and 18 per cent of agricultural land is considered at high risk and 47 per cent is in the moderate risk category. Land management practices, including cropping and grazing, are accelerating salinity processes on agricultural land. The State's *Salinity Management Strategy, 2000* proposes actions that require a quantum change in land use. The National Action Plan for Salinity and Water Quality will strategically address salinity where major economic, social and environmental assets are threatened.

Increasing soil acidity is affecting the productivity of 23 per cent of agricultural land and, with current land management practices and rates of acidification, the area is expected to double within the next 50 years. Although lime application has increased it is still only 12 per cent per annum of that required.

Water erosion threatens susceptible soils and current land management practices are accelerating processes on 21 per cent of agricultural land. Soil structure decline and decreasing soil health are also evident but insufficient data has been collected to make any assessment on a Statewide basis. There is a clear need for an integrated and comprehensive soil management program.

### Theme - Managing Pest Plants and Animals

The impact of rabbits has decreased markedly, with 55 per cent of the State showing no signs of rabbit activity and only 3 per cent with population levels that pose an immediate threat. Although there has been a 100 per cent increase in infestations of State Prohibited weeds since 1997, these incursions are currently under control. In the future, more comprehensive data is required on other declared noxious weeds to make an informed assessment of weed condition and management responses across the State.

### Theme - Greenhouse Gas Emissions and Climate Change

Victoria generated 21.3 per cent of Australia's emissions in 1999, growing 15.9 per cent in the previous decade. Climate change models project temperature increases of between 0.3°C and 1.6°C by 2030, with more hot summer days and less rainfall across the State. Extreme rainfall events will become more intense and frequent and seasonal changes may impact on runoff and the sustainable yield of water catchments.

### Theme - Community attitudes and participation in natural resource management

Little comparative data has been collected to estimate trends but a 2001 survey across CMA regions indicated that water quality was considered to be the leading NRM issue, followed by salinity management, protecting waterways, wetlands and environmental flows. Unprompted awareness of the Catchment Management Authorities was about the same as the local water board with prompted awareness at 54 per cent. Those more likely to be aware of CMAs are farmers or people living in rural areas and between 30–69 years old.

Preliminary data from the ABS 2000-01 Agricultural Commodity Census shows that 36.2 per cent of respondents answering the question "Are you or a representative of your holding a member of a Landcare group?" consider themselves to be members of a Landcare group.

## 4.2 Overview of the statewide management responses

The continued evolution in available information and methods for managing environmental systems has led to a series of very positive initiatives at a State and regional level.

The scale of environmental issues, coupled with clearly finite community and financial resources to address issues, has resulted in the development of a number of strategies and frameworks to support decision making, priority setting and efficient, effective investment.

The State Government, through NRE and the EPA, has focused significant effort over the last five years to develop a range of strategies that set priorities and strategic direction for natural resource management activities at a State and regional level.

More recently completed initiatives include:

- > the *State Biodiversity Strategy* 1997
- > the draft *SEPP Waters of Victoria* 2002
- > the *Victorian River Health Strategy* 2002
- > the *Victorian Pest Management Framework* 2002
- > the *Victorian Landcare Action Plan* 2002
- > the *Victorian Coastal Strategy* 2002
- > the *Victorian Vegetation Management Framework* 2002
- > the *Victorian Irrigation Farm Dams Legislation* 2002.

In all cases documents have been developed to help guide regional programs and activities. Monitoring, evaluation and reporting programs are included, providing a broad framework for linking regional condition reporting processes to State reporting processes.

Reporting the outcomes of these initiatives requires further coordination and a clear commitment to monitoring, evaluation and reporting. This will position Victoria as a leader nationally in environmental accountability.

The State will be well placed to employ successful management programs that adapt and change as knowledge increases, providing unambiguous information to individual land managers and the broader community.

The State, with impetus from the National Action Plan for Salinity and Water Quality, is developing evaluation and monitoring strategies, research and development strategies and importantly is also looking at social and community capacity issues.

There remain gaps in strategic planning at a State level. From the indicators we can ascertain a weakness in the area of soil and soil management. The future for our soils does not look optimistic and this needs to be addressed at a Statewide level. Over half the world's biomass is found underground. From a biodiversity and agricultural production perspective soil health is fundamental.

The plethora of information regarding management of resources that will be available over the next five years provides reason for optimism. There remains a need for an overarching management strategy for the State that sets clear management and investment priorities over the long-term.

#### **4.3 Overview of the regional management responses**

Underpinning resource management decisions at the regional level are the Regional Catchment Strategies (RCS). These documents, compiled and coordinated by the CMAs, based on community input, set the strategic directions and priorities for natural resource management at the local level.

The RCS documents are generally strategic, but are

underpinned by 'Action' or 'Implementation' plans with clear on ground programs and activities. These supporting plans provide the implementation detail for the efficient and cost effective investment in resource management at the local level.

The RCS are currently under review with all of the ten CMA regions to have completed their new documents by June 2003. The documents are expected to make clear provisions for on-going investment in environmental monitoring, evaluation and reporting with clear targets and performance measures. There are opportunities to strengthen links between regional and State evaluation and reporting processes.

The RCS development process represents an extraordinary collaborative effort between community representatives, government, community groups and other key stakeholders to forge a preferred future for each region. These are local strategies for local futures.

Increasingly, developing these strategies requires sophisticated processes for consultation, data collection, analysis and priority setting. The final RCS documents of 2003 will overshadow previous efforts to produce a comprehensive blueprint for the sustainable management of resources at the regional level.

One clear area of significant future risk across all regions is soil management. The indicators outline only two regions with a soil management strategy and program. At a local level some good information on soils and soil processes exists. While some regions will pick up elements of soil management in other programs the lack of emphasis generally across Victoria is of concern.

Across all regions there are knowledge management issues that need to be addressed. These occur at an information needs, information use and information dissemination level. These are important issues. Regional communities will require access to the best available information to work through future priority setting, resource use planning and management trade-offs.





#### 4.4 Are we making a difference?

The simple answer is - Yes, but not enough!

Victoria is the most densely settled State in Australia; a result of geography, climate and soldier settlement programs after two world wars. As a consequence, our natural resources are under pressure and, in many cases, will not be passed on to the next generation in good condition. As outlined earlier in this chapter, the Government has in place many strategies, plans and programs to encourage sustainable use of resources. Most of these, if given adequate resources, will make a significant impact on the health of our catchments.

Under current resourcing and management paradigms our efforts to protect and sustainably manage natural capital are not keeping pace with the breadth of degradation symptoms depreciating the natural capital base. One of the key hindrances to community and government efforts in this area is knowledge. In compiling this report we have found it difficult to answer questions on the condition of the State's resource base. We have a general picture of decline at projected massive scale but can make few uncontestable quantifiable statements about condition. This situation must improve.

New knowledge is helping and we have made great strides in the last five years. This knowledge coupled with experience and efforts over the past two decades tell us much about what we need to do. It is clear that best management practices will not be enough to ensure sustainable use of the land and water in many parts of the State. Major change will need to be made in the management of many areas to ensure ecosystem function continues and offset to the impact of degradation symptoms such as dryland salinity and soil acidity.

#### 4.5 Looking ahead to an uncertain 2050

The primary goal of catchment management is:

To ensure ecologically sustainable development of our natural resource based industries, the protection of land and water resources and the conservation of natural and cultural heritage.<sup>1</sup>

The National Strategy for Ecologically Sustainable Development, signed by the Commonwealth, States and Territories, articulates the goal of ecologically sustainable development as:

**"Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends."**<sup>44</sup>

The core principles underpinning this definition are:

- > To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations
- > To provide for equity within and between generations
- > To protect biological diversity and maintain essential ecological processes and life support systems.<sup>44</sup>

The remainder of this chapter is dedicated to discussion on issues and trends to the year 2050. Based in part on information provided by the indicator reports in Chapter 3, the following discussion looks at some likely key threats and impacts that will undermine our ability to service the above definition of ecologically sustainable development in Victoria.

#### Some long-term social / demographic trends

The impact of social, economic and environmental pressures and opportunities is being played out already, with significant restructuring occurring across Victoria.

The area of land used for agriculture in Victoria has declined from a peak in the 1940s when 16.7 million hectares was used for agriculture, to 14.2 million hectares (down 15 per cent) by 1986.<sup>45</sup>

Recent data suggests that the area of farmland in Victoria could now be down to 12.7 million hectares, a decline of 24 per cent since the 1940 high point.<sup>45</sup> As previously noted, over the last forty years, the number of farms in Australia has halved, with medium-sized enterprises recording the greatest decline. Currently farms in the State number around 37,000.<sup>45</sup>

The Victorian community is becoming increasingly urban. In 1920 there were 20 Victorians for every farm in the state. By 1970, the ratio had risen to over 50:1. Today, the ratio is 175:1 Victorians for every farm in the State.

Modelling suggests that over the next two decades, the number of Australian farmers will decline by somewhere between 40 and 60 per cent. The potential future adjustment suggests there will be 400 Victorians for every farm in the State by 2021.<sup>46</sup>

There will be accelerated depopulation of dryland farming areas over the next 20 years. Many mid-size broadacre farms will be amalgamated into larger enterprises. Technology and market forces will dictate how large properties can become.

The future landscape will see the further emergence of a small number of large farms responsible for the bulk of farm production, and a large number of small farms supported by off-farm income on the periphery of regional centres, Melbourne and along the coast.

Where returns from farming are greatest, such as intensive horticulture, dryland dairy, irrigation and some cropping areas, younger farmers will be attracted. Young farmers with new ideas and education will be important to future sustainable resource management. The ABS notes that concern for environmental issues increases with education.<sup>17</sup>

In less profitable dryland areas, the age profile is likely to remain at 50 or older. This is important as recent research suggests older farmers have difficulty pursuing the adoption of best management practices.<sup>47</sup>

The new generation of plans (salinity plans, nutrient plans, biodiversity action plans and vegetation plans) in preparation, are coming to grips with the scale of landscape and social change underway. In seeking to address complex interrelated degradation issues some plans have identified that the extent of protection and remediation activities required is beyond the scope of traditional, voluntary group activity.

In areas where depopulation continues, the removal of social infrastructure and economic viability will further undermine the ability to manage environmental issues through traditional local community efforts alone.

Moving against the above trends, are regional centres like Wodonga, Swan Hill, Shepparton and Mildura. These areas have experienced an increase in population due to improved production and related food processing.

Similarly, coastal and 'rural amenity' areas within commuting distance to Melbourne and major regional centres are experiencing population growth. Increasingly, these landowners are not agricultural producers in the traditional sense and have a high proportion of off-farm income. The influx of new people to such areas is raising land prices, reducing the ability of traditional farmers to expand enterprises and remain competitive.

Increasing urbanisation coupled with rural depopulation and declining social infrastructure will over time reduce the impact of the rural vote. Ultimately, if such trends continue, this will erode the democratic ability of rural communities to control their own futures.



### Sustainability – producers and consumers

Increasing urban economic prosperity and lifestyle opportunities provide opportunities and threats to the natural environment. On one hand these consumers have increasing capacity to pay the true cost of sustainable food production, whilst on the other hand they continue to place pressure on ecosystems and environmental assets across the State. Eighty per cent of Victorians live in or around major urban centres. The link between consumption and waste generated by urban areas and the impacts on surrounding ecosystems often remains unrecognised.

Humans have the capacity to transform and use materials at every level. The disturbance and waste flow from material extraction, transformation and use has a major environmental impact. The World Resources Institute suggests all material flows have environmental consequences and all environmental impacts are related to material flows.<sup>10</sup>

Material flow assessment (presented in tonnes per person per year) outlines how resource use (e.g energy, water, produce etc) affects the capacity of the environment to continue to provide materials and absorb waste from them.<sup>10</sup>

In 1991 Australians, at around 175 tonnes per person per year, had a material intensity flow 90 tonnes more than the United States, 115 tonnes more than Germany and around 140 tonnes more than Japan and the Netherlands.<sup>10</sup>

In the mid 1990s Australia was the second largest producer of waste amongst OECD countries. In 1996-97, 212 million tonnes of solid waste was buried in landfill.<sup>17</sup>

There will be increasing population and (relative) economic growth in major urban centres, with increasing consumption and waste (material flow) pressures distributed to rural communities and regional ecosystems.

Another measure of environmental impact is 'Ecological or Eco-footprint'. Eco-footprint describes the impact of a country's consumption on the environment by showing the area of land required to sustain that lifestyle. The tool has been applied to countries, corporations and individuals. Generally, the more elaborate the lifestyle the larger the footprint.<sup>17</sup>

One estimate suggest Australians, at 7.4 hectares per person, rank fifth highest in the world for area required to support the lifestyle of each person; USA is highest at 9.8 hectares, while the world average is 2.4 hectares.<sup>17</sup> Australians seem to consume far beyond their earth share.

There are 4.6 million people living in Victoria. If each individual requires 7.4 hectares, in total we require 34,040,000 hectares of productive land to support our current lifestyle. The actual size of the State is only 22,755,000 hectares.

The above extrapolation, although laced with contestable assumptions, does however provide a context for considering how sustainable our current practices are and the future impact on our natural capital. We are already consuming more than is sustainably available and our current trajectory reinforces this trend.

### Some key environmental pressures and trends

The VCMC overview of Chapter 3 outlines that if we continue as we are the future scale of environmental degradation in Victoria is likely to be enormous and increasingly irreversible.

The following discussion offers projections on the future impact across the State of four current topical issues: salinity, soil acidity, native biodiversity decline and water management.

#### > Biodiversity

Over 70 per cent of Victoria's native vegetation has been cleared and 46 species of plants and animals are presumed extinct. Despite being the cornerstone of our natural capital, biodiversity and ecosystem function, fail to be valued by both the general community and some individual land managers.

There is considerable work to be done to communicate the value of biodiversity and ecosystems to society.

Removal of biodiversity and subsequent reduced ecosystem function, results in a range of systemic degradation symptoms.

Complex interrelated systems seem more difficult to communicate than segmented simplistic analysis of degradation symptoms. Problems such as weeds, water quality decline, soil fertility decline and dryland salinity are all symptoms resulting from biodiversity decline and ecosystem failure.

Continuing reduction in the size, quality and diversity of remaining habitats and increased habitat fragmentation will further reduce ecosystem function.

The future impacts are difficult to model, but a continuing reduction in the diversity of large fauna we currently know and recognise will be one of the more overt symptoms. The ongoing decline in species will be extreme. It has been predicted that

Australia will lose half its terrestrial bird species in the next century if the status quo continues. Similar projections are possible for other fauna.<sup>48</sup>

Under current management regimes, and in their present extent and condition, all CMA regions, with the exception of East Gippsland will suffer further significant losses by 2050.

**In the extensively cleared wheat-sheep zone which covers nearly 20 per cent of Australia about 50 per cent of the bird species will have disappeared by 2050.**<sup>49</sup>

**Dr. Denis Saunders, CSIRO on Radio National Background Briefing 2002**

Conversely, as ecosystem processes and landscapes are further simplified and become more homogeneous, there will be continuing population explosions. The most adaptable indigenous fauna species, such as kangaroos, will continue to extend their range and impact.

The impact of declining diversity and ecosystem function on commonly overlooked insect fauna, non-flowering plants and microorganisms is also difficult to predict. It is recognised that this 'unseen' flora and fauna play a fundamental role in ecosystems. For example pollination of crops by insects has been valued at \$1.2 billion per year.<sup>49</sup>

**Ironically, it is not the big and beautiful creatures but the ugly and less dramatic ones we need the most.**<sup>4</sup>

Important attempts to protect and enhance ecosystems on public land, will limit the utilisation of public resources for individual benefits. The broader community benefits of protecting services provided by threatened ecosystems on public land often outweigh rudimentary returns provided through individual utilisation.

Such efforts to protect public land may result in extra pressure on remaining under-protected areas and /or forests on private land. Alternative resource sources will be required, supported by proper planning, investment and community education.

More than 60 per cent of native vegetation remaining on private land is considered to support threatened ecological communities. Additionally, around 30 per cent of threatened native species populations occur on private land. Such remaining ecological communities and systems are currently not economically valued, in a market sense, by the broader community.

With market failure some landholders neglect to exercise appropriate duty of care, as there is little recognised value in remnant biodiversity and ecosystem services. The resulting management regime continues to threaten remnant ecological communities, biodiversity and ecosystem services.





### > Dryland Salinity

A National Land and Water Audit projection estimates that the area at risk of becoming severely salt affected in 2050 is around 3 million hectares (or 13 per cent of the State).<sup>35</sup> Currently around 260,000 hectares are affected.<sup>32</sup> The best estimate of damage to infrastructure in non-metropolitan Victoria from salinity and rising water tables is \$12.2 million per year. Across Australia it is estimated at around \$100 million.<sup>35</sup> Up to 800 species of threatened native biodiversity may be affected by salinity.

The State Government's *Salinity Management Framework* suggests "research indicates that many best practice agricultural systems in the grazing and cropping industries can not reduce the amount of water leaking into the groundwater system in comparison to native vegetation."<sup>32</sup>

The efforts of government and communities has resulted in around 86,000 hectares of native vegetation being re-established in the last ten years (this figure does not include private forestry efforts).<sup>50</sup> Therefore, excluding water bodies, urban areas and public land, as a community we have in ten years revegetated 0.6 percent of the state at an annual rate of 0.06 per cent per year.

Re-establishment of indigenous vegetation remains a key management tool for dryland salinity. NRE suggests that agricultural land use will need to change on a massive scale, with revegetation of over 60 per cent of the landscape in some catchments.<sup>51</sup> The 86,000 hectares currently established service a range of environmental protection needs, including salinity but are not dedicated to salinity control alone.

At the re-establishment rate of 0.06 per cent per year, by 2050, 2.9 per cent of private land in the State would be re-established with vegetation. As noted the area suffering from severe salinity could well extend across 13 per cent of Victoria (this does not include moderately affected areas).

### > Soil Acidity

Currently up to three million hectares of Victoria's agricultural land is estimated to be suffering losses in productivity due to soil acidity. Without additional intervention by 2050, the problem is estimated to extend to six million hectares severely limiting traditional agricultural production activities.<sup>36</sup>

### > Water

Increasingly, access to water will be identified by individual land managers as the major resource management issue of the next 50 years. Already many river reaches across the State are considered to be stressed by inadequate environmental flows.

The dominant driver of water demand nationally is irrigated agriculture. A 1999 study by the Australian Academy of Technology Science and Engineering and the Institute of Engineers, indicated that in the absence of resource constraints the water needs of industry nationally, will outstrip water availability by 2020-21.<sup>52</sup>

Urban and industrial uses account for 17 per cent of the State's water use.<sup>53</sup> Under current trends, maximum utilisation of the existing annual water volume available to Melbourne will be reached in 2012. Other options, involving more conservative water use and increasing capacity from the current urban system, will accommodate utilisation needs until 2060.<sup>53</sup>

Melbourne sources its water from the Yarra catchment, the Thompson catchment (Gippsland) and the Goulburn catchment (north central Victoria). Increases in the urban population will place further pressure on access to water resources.

In September 2002, the State Government announced a dry seasons assistance package of \$2.6 million dollars for parts of the Mallee and northern Victoria. At the same time in Melbourne, daily water consumption was the highest since 1995, despite urban storages only being 2.6 per cent above the trigger level for water restrictions.<sup>54</sup>

Although only accounting for a small percentage of the State's water use, in the coming decades the consumptive and recreational needs and aspirations of the city will clash with the needs of regional Victoria and the environment.



The urban price for water is based upon a fixed service charge and a volumetric charge.<sup>53</sup> In December 2000, the representative charge for consumption of a megalitre of water in Melbourne was \$690.<sup>55</sup>

Seventy-seven per cent of the State's water is used by the agricultural sector. The price of this water varies considerably from one irrigation region to the next, due in part to different scales and sophistication of delivery infrastructure. At the higher end of the spectrum for cost was the Werribee Irrigation District at \$111.60 per megalitre (December 2000).<sup>55</sup>

Discussion regarding urban and rural water prices must take into account that urban infrastructure is significantly more sophisticated (with much higher maintenance and replacement costs) and the quality of water delivered for use is much higher. The comparison above reflects the purchasing power of higher value water users.

Increasingly, water will be distributed through the market to serve 'higher value' uses. The environment and environmental flows will be included as a higher value use along with high value agriculture, recreation and human consumption. Management of the water resource will further correlate surface and groundwater as elements of the same hydrologic system.

Scarcity and supply costs will continue to increase prices for water, further squeezing less profitable sectors and smaller irrigation enterprises. The true value of water will be appropriately reflected by price. Some in the agriculture and water industry expect the average price of water per megalitre to triple by 2020. In this future scenario, returns from irrigating broadacre pasture are unlikely to be competitive.

In the search for efficiencies and more water there will be a general move to bigger, more efficient irrigation enterprises. In some cases this will involve an amalgamation of smaller properties.

Alternatively, due to investment in previously costly irrigation infrastructure, the inflated price of smaller properties may limit buy-up by bigger corporations. This will create pressure for the development of new irrigation schemes and areas.

As water availability decreases, there will be increasing pressure from regional producers to use lower quality water. While offering some short-term relief, there will be significant risks. For example, pumping saline water onto already sodic soils would quickly accelerate salinity and soil fertility problems.

The availability of water will also be compounded by climate change. The possibilities of reduced rainfall could significantly reduce water flow in hydrologic systems, with an increase in drought patterns. A recent report from CSIRO states:

**Increased drought occurrence across the State was also simulated by most of the climate models. However, there are strong variations across the models in terms of seasonal dependency. Seven of the nine climate models show increases in drought through the spring-summer period. The drought frequency more than doubles in some simulations.<sup>56</sup>**

#### Some key economic pressures and trends to 2020

Victoria covers 22,755,000 hectares. Agriculture, at 56 per cent, is the major land use across the State. For this reason those with an eye on resource management often focus on rural landscapes.

In recent years elements of the agricultural sector have continued to grow strongly, making a significant economic contribution to Victoria.

- > In 2002, the agricultural sector is responsible for 11 per cent of Victoria's gross State product, and 33 per cent of all State exports.<sup>12</sup>
- > The production, processing and marketing of food employs 205,000 people, or 9.7 per cent of total Victorian employment. In rural and regional Victoria, the sector accounts for 21 per cent of all jobs.<sup>12</sup>
- > Over the last ten years the value of agriculture production has increased from \$5.2 billion in 1990 to \$6.8 billion in 2000.<sup>12</sup>
- > Over the same period, exports have risen from \$3 billion to \$7.6 billion at an average growth rate of 9.9 per cent.<sup>12</sup>

Despite these important positive agricultural results there are two points worth highlighting. Firstly, over the long-term the sectors generally benefiting are those that have the financial ability to adapt and readily access global markets. The benefits are therefore not spread evenly across agricultural industries and Victorian farms.

Secondly, the economic returns outlined above make no provision for the accumulating costs associated with the degradation of natural capital.

In large areas of the State, land use and management does not match land capability. Although returns from these areas contribute to positive economic figures, there is an on-going detrimental environmental impact. Ultimately, this is depreciating the natural capital base, limiting opportunities for current and future generations.

**The environmental repair bill Australia faces is enormous. The Prime Minister has been told it's \$65 billion and that's just to try to fix salinity.<sup>49</sup>**

Radio National Background Briefing, Sept 2002.

As an example of environmental pressures likely to undermine the economic potential of traditional agriculture, we offer the following discussion on the projected extent of dryland salinity and soil acidity.

100

The current land use map of Victoria (see Figure 68) shows that around 64 per cent of the State is freehold land with agriculture occupying about 56 per cent of the total area of the State (or 86 per cent of freehold land).

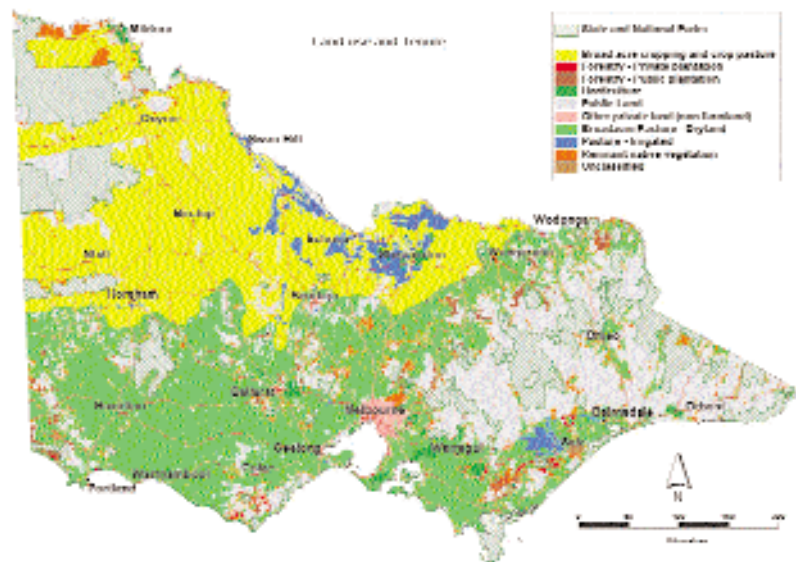


Figure 68. Victorian land use and tenure.

Source: NRE

The map provided in Figure 69 is drawn from the National Land and Water Resources Audit<sup>35</sup> 'worst case' scenario of future salinity risk in Victoria. The land shown in black on the map is where the watertable is forecast to be 0-2 metres below surface level (areas deemed to be at severe salinity risk).

Analysis of this area indicates that just under 3.1 million hectares of land would be affected.

Under this scenario the area available for agricultural use is reduced by around 21 per cent, to a total area of 11 million hectares.

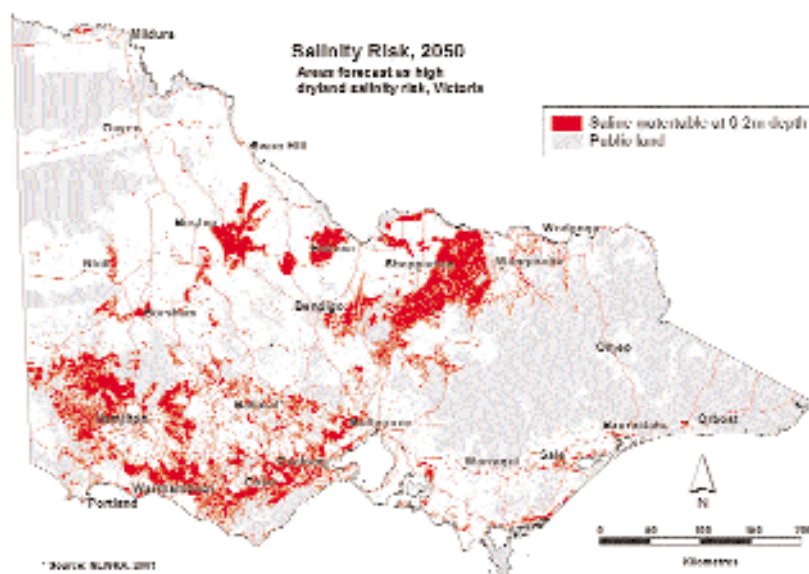


Figure 69. Salinity risk in Victoria 2050.

Source: NLWRA, 2000.<sup>35</sup>

In addition to salinity, acidification is an emerging problem in the Victorian landscape. The map below (Figure 70) displays a projection of the area at risk of severe acidification to 2050.<sup>36</sup>

101

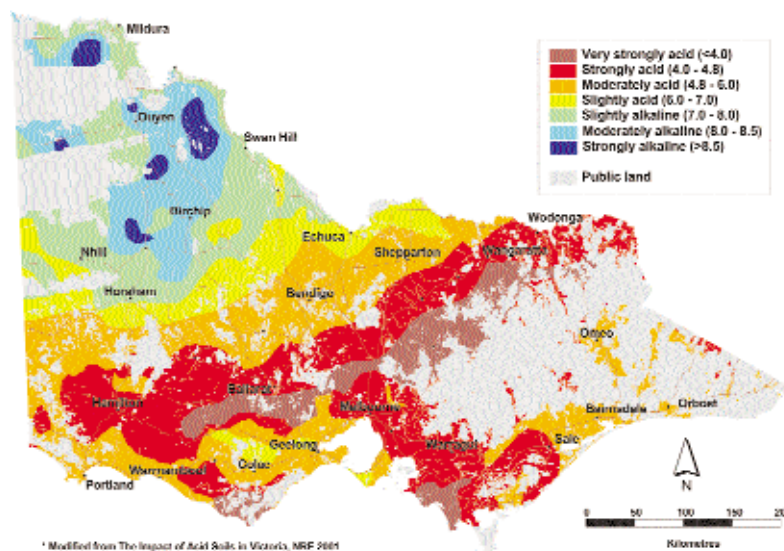


Figure 70. Soil pH risk 2050.

Source: NRE.<sup>36</sup>

This projection suggests that as much as 5.3 million hectares of private land would be severely acidified by 2050. This would affect 37 per cent of the area available for agriculture in the State.

In considering these worst case scenarios together, with salinity affecting 21 per cent of the State and acidification affecting 37 per cent, the land affected by either or both these degradation issues is estimated to be at least 40 per cent (5,646,000 hectares) of the area available for agriculture in Victoria.

Without remediation the most severely saline or acidic landscapes will stop production altogether. In other affected areas, these issues will limit production resulting in significant and ongoing remediation costs.

To provide a context for the impact of degradation problems like these on the broader population we return again to the ecological footprint model.

Applying the national population growth rate for 2000 of 1.3 per cent per annum (59,800 pa), by 2050, the State will be home to around 7,590,000 people. If each individual still requires 7.4 hectares to support a lifestyle, we will require 56,166,000 hectares.

Overlaying a worst case scenario for extent of acidity and salinity over this period, the area of the agricultural landscape uninhibited by these degradation issues and available to produce food, fibre and ecosystem services will have decreased to 8,469,000 hectares.

Although the above example is a simple extrapolation and unlikely to unfold in this nature, future implications for both urban and rural communities of employing an unsustainable management paradigm will nevertheless be profound.

Agriculture in the future will provide enormous opportunities for some. Restructuring will continue for others. In addition to pressure from depreciating natural capital, three key forces shaping the future of Victorian agriculture have been identified. These include globalisation, consumer expectations and community concern for the environment.<sup>12</sup>

Globalisation and international competition have driven a long-term decline in the terms of trade for Australian farm businesses. As noted in Chapter 3, the ratio of prices paid to produce goods compared with prices received for goods, by Australian farmers, has fallen by seventy per cent over the past 50 years.

The Rural Research Industry and Development Corporation also notes that quality assurance and environmental management issues loom large. It maintains that agriculture in Australia will be under further pressure to: give credence to its clean and green image; maintain food safety standards; demonstrate compliance with accredited environmental management systems; and service the environmental requirements of supermarkets and other retailers.<sup>57</sup>



At the 2002 World Sustainability Conference in Johannesburg, and in discussion with the World Trade Organisation, some European Union countries are arguing that environmental degradation is a hidden subsidy on exports. Environmental trade embargos, although unlikely, have been discussed.<sup>49</sup>

**I think it's much closer than a lot of people think. It's something that's more likely to arise out of the market than international trade rules. All it would need is a company of large size somewhere in the world to say - I'm sorry we won't buy from Australia anymore, simply because we do not like the environmental standards you're setting.<sup>49</sup>**

**Dr. Mike Young, CSIRO on Radio National Background Briefing, Sept. 2002.**

Analysis undertaken for the National Land and Water Resources Audit reveals that 80 per cent of profits at full equity comes from only four million hectares - less than one per cent of the area of land used for agricultural in Australia.<sup>58</sup>

In Victoria, the main area to fall within this relatively small window of high returns is the Northern Irrigation Region. The irrigation region only covers around four per cent of the State's agricultural land, but is responsible for nearly 30 per cent of the State's gross value of agricultural production.<sup>58</sup>

Opportunities for growth will remain in those agricultural sectors that are adaptable, efficient, clean and sustainable, that can increase production on a reduced area, using less water.

Other current profitable agricultural enterprises occur in the dairy regions of Gippsland, the Western Districts and parts of the cropping area of the Wimmera.<sup>58</sup>

Analysis of profits generated per hectare of Australian agricultural land per year, reveals that areas of central Victoria, the Mallee and western Wimmera made an annual loss for the five years up to 1996-97.<sup>58</sup>

It has been estimated that 50 per cent of the economically smallest farms could disappear with a minimal impact on Victoria's net production.

Economic viability and reduced access to funds limits the ability of many land managers to change management. A reduced

ability to access funding is likely to intensify. Some of Australia's major banks are now seeking clear processes to assess environmental risk associated with investment in traditional agriculture.

In areas currently or projected to suffer from degradation issues such as salinity and soil degradation, the bank sector may be increasingly cautious to lend money.

There is a significant and increasing prosperity gap between many rural and urban Victorians. Despite economic success in some key agricultural industries, the majority of benefits from recent national economic growth has manifest itself through increasing prosperity of major cities.<sup>27</sup>

**We Australians enjoy tremendous natural advantages. Our country is among the most beautiful and resource rich on the globe. Currently we are experiencing sustained economic growth. Yet the divisions among us – between the haves and the have nots and the city and the country – give cause for concern.**

**Sir William Deane, Governor of Australia, Australia Day Address 2000.<sup>27</sup>**

The gap in understanding between urban and rural areas will widen due to differing values, aspirations and an imbalance in economic and social opportunities.



## A 2020 VISION FOR CONDITION AND MANAGEMENT

The current and projected scale of environmental degradation issues requires a new Statewide response. While resourcing current strategies and implementation of best management practice may make some gains, over the long-term, this is unlikely to result in a sustainable outcome for Victoria. Large-scale changes in land use are vital to the future of rural landscapes.

As discussed in Chapter 4, change will continue. Pursuing the status quo will not prepare communities to minimise negative impacts, nor grasp fully the positive opportunities provided by change. The 'continue as we are' scenario will not ensure a long-term economic and sustainable future for agriculture in Victoria. Important decisions about the future condition and management of the State's natural resources are required. A new approach must be developed and strategically implemented over the coming decades.

### 5.1 A VCMC vision

The VCMC offers the following preferred scenario for 2020.

It begins with a 20-year integrated vision and strategy for natural resource management across the State.

The strategy provides a clear process of community engagement, education and decision-making. Communication of best available scientific information and research underpins collective decision-making. Change has not resulted in reactive decisions made under pressure, but instead resulted in personal, community and landscape-scale strategies to grasp opportunities.

In 2020 the State is covered with a mosaic of land uses that match capability. The mosaic includes a mix of intensive agriculture and land now used for farming ecosystem services, supporting rural lifestyles and nature conservation.

Intensive agriculture is thriving in efficient closed systems at targeted, specially planned sites around the State. Agriculture is sustainably servicing local and national needs and demands for produce in international markets, particularly Asia. There is little notion of waste in industry, with the waste from one industry feeding the resource needs of another.

The continued urbanisation of the State has led to an increasing recognition that there is a credible threat to ecosystems and the services they supply. Urban communities recognise the impact of consumer preferences and are paying to protect identified environmental assets. This manifests itself in payment to rural Victorians for supplying life-sustaining ecosystem services.<sup>19</sup>

The provision of ecosystem services by rural landholders is now a major land use across the State. It is the newest form of primary production, underpinning the social and economic health of the State.

By 2020 the mosaic landscape accommodates a 40 per cent coverage of native vegetation. The 20-year strategy has targeted ecosystem and native biodiversity asset protection and restoration works across all asset types, such as waterways, floodplains, grasslands and woodlands, and in key areas that presented the best opportunity to rebuild our rural landscapes. At first, the focus was to protect the best remaining ecosystems. Over the last decade we have been able to broaden rehabilitation efforts to other areas of the landscape.



Research and new technologies have evolved new agricultural industries based on natural systems that complement more traditional, high value environmentally and economically sustainable agricultural pursuits.

The mosaic also includes large amenity and lifestyle areas. Typified by commuters with off-farm income, these new landscapes also incorporate ecosystem service provision and nature conservation at a smaller scale. The quest for knowledge and technical innovation has driven many to provide technology-related services and information to surrounding regional centres and communities.

The growth in ecosystem services is a boon for those with a traditional agricultural history in land management. On-going rehabilitation and management services are in high demand, providing a range of employment and service opportunities.

Similarly, the amenity and ecosystem services dominated landscapes are attracting a variety of interstate, international and (importantly) intrastate urban people for relaxation and recreation. There is a proliferation of farm stay businesses, bed and breakfast and ecotourism providers across the State.

Key sections of the State are presented as 'wild' landscapes for tourism. Victoria, with its smaller size, diversity of climate and topography, offers tourists an enormous range of ecosystems in a relatively compact area.

Landscape management decisions are supported by a vast and improved knowledge base. Consequently our approach is more balanced with more intelligent emphasis on information.

Land and water managers have a high level of appreciation for the values of aquatic ecosystems and there has been a real reduction in the extent and severity of our soil health issues due to effective land management programs.

By 2020 there exists actual climate data to validate 30 years of climate projections. We are in a position to be significantly more confident about future projections. The community ability to understand and plan for future climate change is greatly enhanced by regionally specific and multi-sectoral projections. Funding to plan for and invest in adaptation strategies is significantly enhanced as a result of greater awareness across government and the community.

## 5.2 The case for supporting the vision with ecosystem services

A range of approaches have been employed to engender change in land management practices. Overall, the results have not kept pace with continuing systemic degradation. Past and current measures involve policy, regulations, education, volunteerism, prosecution and incentives.

The advent of the community participation model through Landcare and subsequently the Catchment Management Authorities has been one of the most positive moves to tackle environmental degradation and sustainable resource use over the last two decades.

The VCMC is keen to see this Landcare and community involvement and cost-sharing ethic further infiltrate the urban community and industry sectors. This can be achieved by developing markets for trading in ecosystem services.

Some suggest that government should take the lead through strengthening legislation and enforcement efforts to protect the environment. Enforcement and compliance work as tools in a package. They rarely work as a general mechanism for changing behaviour.

In most cases, the time, cost, legislative complexity and limited impact associated with enforcing regulations is easily outweighed by an approach that builds upon the collective goodwill activity of the community.

Our community cohesion is based on goodwill. The most cost-efficient and most effective paradigm should be to support this goodwill, rather than focus attention on regulation and enforcement.

Environmental, economic and social pressures are occurring over large areas of the landscape, forcing reappraisal by landowners of what they do and how they do it.

Experience in the water sector indicates that one of the best ways to encourage innovation and moves toward sustainable resource use is to send powerful signals to the community that the environment matters. There appears to be few more powerful signals than price.<sup>19</sup>



The VCMC advocates an extension of market activity to better reflect the role that ecosystems play and the benefits provided to all Victorians. Services provided by biodiversity and ecosystems are not consumer optional extras. We all need air, water, pollution mitigation, filtration, biomass production and genetic diversity to sustain our health, wealth and wellbeing.

The concept of 'ecosystem services' provides a complete change in the way we view and manage the landscape. In addition to sustainable agriculture it provides another option to match the capability of land with a sustainable and benign use.

**We need to become rampant ecological nationalists.<sup>59</sup>**

**Andrew Campbell, Executive Director Land and Water Australia, 2002**

Will it work? There are existing examples at a State and national level of resource management programs using market trading, auctions, taxes and subsidies. In the Bush Tender Auction Trial in Victoria landowners have entered into contracts (at their own tendered price) with the Government to protect remnant biodiversity on private land. The landowner gets paid for providing this service and the public get the broader benefits associated with protection and enhancement of ecosystem services.

The North East, Wimmera and the Goulburn Broken CMAs have initiated programs to review opportunities for trading ecosystems and biodiversity services on private land. Other CMAs are looking at placing themselves to benefit from future carbon trading. Other recognised schemes include salt disposal credits and council rate rebates.

Internationally, the topic is more advanced. Water consumers in New York City are paying people upstream to manage their forests and agricultural land better. Paying for better management upstream turns out to be cheaper than cleaning up water downstream after it has been fouled.<sup>19</sup>

It has been estimated that there is an US\$8 billion dollar saving to the city of New York every year by sourcing water cleaned and purified through natural ecosystems.

New York, Washington DC and Florida have all found it cheaper to pay for natural filter beds and wetlands to manage contaminated water, rather than create artificial treatment plants. This recognition of value has helped lead to a trade in wetland credits in the US.<sup>60</sup>

The credits are issued by Wetland Mitigation Banks to companies who restore wetlands. The credits are then sold on to third parties who wish to modify a wetland somewhere. To date, credits have been sold for as much as US\$250,000 per acre.<sup>60</sup>

International research conducted by Robert Costanza from the University of Vermont's Gund Institute for Ecological Economics has suggested there is a 100-1 return on investment in protecting 'wild' nature. For an annual investment of US\$45 billion in nature, society would yield a return of between US\$4.4 and US\$5.2 trillion in ecosystem services.<sup>61</sup>

Trends indicate that a declining number of farmers will find themselves responsible for the majority of the State's biodiversity. Urban aspirations continue to place pressure on resources but, ironically, are increasingly dictating that protecting the environment is important. Rural land managers can provide this service if the markets exist and the cost-sharing arrangements recognise the public good being provided by private land managers.

Future investment in ecosystem services must involve participation across urban and rural communities and the public and private sectors. The scale of ecosystem degradation and biodiversity decline is well beyond the capacity and resources of government alone to tackle.

### 5.3 Are there activities upon which we can build?

There are existing activities that provide opportunities to build a positive future for the condition and management of natural resources.

- > We now have a reasonably good understanding of the broad biophysical processes taking place across the landscape. Importantly there is increasing awareness by the community of the need to address degradation issues. There is also an awakening interest within industry and business regarding sustainable development.
- > Elements of the agriculture sector are quickly changing. The most adaptable are moving to position themselves for a future in sustainable production, using fewer resources and operating with a reduced environmental impact.

There is a very strong history of community activity and management of natural resources in Victoria. The Landcare program, and other community programs such as Waterwatch, and Land for Wildlife have proliferated and prospered. There are enormous opportunities to build on the activities and strong ethic of the Landcare movement.

The community engagement structure of the Catchment Management Authorities derives from Landcare. This basis for local decision-making will be fundamental to regional participation in determining local futures.

- > The tourism sector makes a large contribution to Australia's economy. In 1998, spending by domestic tourists totalled \$43 billion with international tourist spending \$17.3 billion. In Victoria, figures for 1996/97 show tourism generated \$9.4 billion. Over 85 per cent of Japanese and 70 per cent of European and American travellers identified the natural environment as a key element in their travel decisions.<sup>32</sup>

Despite the importance of tourism, there are few private landscape areas in Victoria dedicated to servicing this potential land use.

- > Many traditional farmers hold an attachment to the lifestyle of farming that is tangible and intangible. There is a desire in many instances to pass on these lifestyle opportunities to following generations. The 37,000 remaining farm holdings are responsible for managing 57 per cent of the State.

If a new management scenario can accommodate and strengthen this intrinsic farmer attachment to the land, a new management paradigm for our landscapes may evolve.

- > Similarly, intensification of agricultural systems and retreat of agriculture in some areas will leave significant areas of current agricultural land producing a small and decreasing proportion of the agricultural output of Victoria.

This may also provide opportunities for policies and investment to encourage the production of increased non-agricultural services from this land if these services are compatible with the basic amenity objectives of the landowners. There is a role for government and industry in providing research outcomes that enhance the trend towards intensification and result in tools that encourage the transfer of land from the provision of agricultural to environmental services. In doing so accelerating a transition towards greater environmental protection that generally accompanies economic growth.<sup>62, 63, 64</sup>

- > Increasing awareness by the urban population of the finite nature of our natural resources is developing a stronger ethic to protect and enhance natural ecosystems for recreation, tourism and health reasons.
- > Work is being done at a State and national level to redress market failures and properly value the services provided by nature.
- > In business, depreciation is planned for by putting aside profit to replace assets at a future time. This 'depreciation allowance' permits maintenance and replacement of assets. Such careful and planned asset management drives future benefits and income.<sup>7</sup>

Victorians will need to consider developing an ecosystem depreciation allowance to enable investment in maintaining the health of natural assets and ecosystems.<sup>7</sup>





- > The work conducted by the Bush Tender program in Victoria is groundbreaking and is addressing market failure by helping facilitate a defined value for biodiversity. NRE has done a quick assessment of extending the Bush Tender Program in its current form across the entire State. In the initial stages the cost of such activity could be as little as \$25-30 million over five years. In comparison to this sum Victorian's spend around \$4 billion on gambling every year.

Markets for environmental goods are not new and Victoria has a range of examples upon which to draw. Victoria has a well-developed and sophisticated market for water and water trading. In scarcity, the price messages associated with purchase is seeing water move to higher value uses.

Similarly, user-pays pricing of water has seen Melbourne's annual growth in demand for water use drop from around three per cent in the 1980s to under one per cent now. Across the State the future will involve the managed and equitable increase in the price of water over the next 20 years.

- > Under the new \$8 million private plantations blueprint, Victoria's private forestry estate is projected to treble in size to 750,000 hectares by 2020. Appropriately planned growth in private forestry activity provides opportunities for other ecosystem services to help address many environmental issues facing Victoria.
- > Finally, planning activities are becoming increasingly sophisticated. As noted, all the CMA regions across the State are redeveloping their Regional Catchment Strategies - the blueprints for resource management in each region.

Victoria has also developed a range of management strategies and programs. There is scope to build on both the above initiatives at a State level.

The scale of degradation we face in Victoria is large, but so are the opportunities. Sustainability reform – a package combining social, economic and environmental reform – should be the growth industry sector for the 21st century.<sup>27</sup>

## REACHING THE 2020 VISION ~ NEXT STEPS

### 6.1 Some key considerations for sustainable resource management

The VCMC overview of condition and management has demonstrated that to protect and enhance the natural capital of the State, revolutionary change is required in the way we manage much of the Victorian landscape.

Current trends for resource condition across Victoria do not reflect the definition of sustainability offered in Chapter 4. To reach a level of sustainability a comprehensive new approach is required. Increasingly, it is clear that sustainable resource management relies on a range of interrelated elements.

The State Government of Victoria's key policy framework *Growing Victoria Together*<sup>2</sup> recognises this. *Growing Victoria Together* outlines the need for economic, social and environmental goals to be equally addressed through government decisions and directions for the future.

Brunckhorst's conceptual framework of a range of capital asset classes underpinning environmentally sustainable and prosperous communities provides a structure to realise these goals. These asset classes include:

- > Natural capital – e.g. nature's goods and services
- > Social capital – social infrastructure e.g. cohesiveness, trust, reciprocity and cooperation of communities
- > Human capital – the status of individuals e.g. health, education, skills, knowledge and access to services that foster this capital
- > Physical capital – e.g. local infrastructure, buildings, roads etc
- > Financial capital – money, savings and affordable accessible credit.<sup>26</sup>

The future condition of Victoria's environment and its natural capital is closely linked to the future management decisions, aspirations and trends for social, financial, human, and built capital.

**People can't change the way they use resources without changing their relations with one another.<sup>4</sup>**

Declines in one area will have flow-on effects to other areas, ultimately undermining community health. One example often used is the increasing difficulties farmers face reconciling short-term economic imperatives with long-term environmental aspirations.

Planning and reporting in the future should address all segments of social, human, built, natural and financial capital in the same framework. There is a need to develop a vision for the future of rural and regional Victoria. This should encompass a whole-of-government approach to ensure consistent policy messages and broader understanding of the issues across all government, community and industry sectors.

## 6.2 Next steps

*Growing Victoria Together*, recognises that Victoria's system of water catchment management is a model being replicated around the world.<sup>2</sup>

The Victorian Government is a leader in natural resource management, particularly in the devolved responsibility and partnership approach of the Catchment Management Authorities. Internationally, the CMA approach taken by Victoria is recognised as a key element in fostering integrated natural resource management.

The Australian Federal Government has recognised the value and strengths of Victoria's progressive management approach. Through the NHT II and NAP programs, it is actively encouraging other Australian States to implement similar regional community-based integrated catchment management systems.

Through *Growing Victoria Together*, the Victorian Government has made a commitment to build on the strong foundation of the CMA system. Since 1996, CMA regions have developed priorities to implement transparent, efficient and effective natural resource management programs.

Victoria needs a vision for its rural landscape underpinned by a strategy, investment plan and whole-of-government implementation plan. This could be considered aspirational but there are international examples of more complex and larger scale planning and implementation activities.

For instance, Sweden has set itself the goal of becoming sustainable within one generation (by 2025-30). It has approached this goal through legislating 15 environmental quality objectives that the whole-of-government is working to achieve.

Similarly, the Netherlands have implemented a number of policy tools to achieve sustainable development, taken a whole-of-government approach, and worked with industry for sustainable development beyond government. It has set itself the goal of becoming sustainable and in 2001 produced a fourth National Environmental Policy Plan (NEPP 4). The NEPP 4 clearly sets the agenda for environmental management to 2030.

In Victoria the government has released a Metropolitan Strategy. Given the impact of urban areas on surrounding ecosystems there are clear opportunities to link the implementation of the urban strategy with the development of a rural strategy.

Environmental degradation, economic restructuring and social changes are rapidly underway in regional Victoria. This is occurring without an articulated clear direction for the future or for the communities which will be affected.

The State's first generation management plans were about engaging people; the second generation plans need to assist in making some really tough decisions. Key decisions will be required on trade-offs between individual benefits and community benefits.

The government is meeting this challenge and has pushed through some important changes that will help equitably share and protect resources for current and future generations. The Irrigation Farm Dams Legislation is a clear example.

Victoria needs a fundamental shift toward technologies that emphasise sustainable use of natural resources, avoid environmental degradation and commit to rehabilitation of past damages.<sup>25</sup>

### A State integrated natural resource management strategy

In future, the focus must be to design catchments and landscapes for sustainability. The planning timeframe for such activities will need to be long-term, probably 20 or even 50 years, to allow the community to adapt and adopt new ideas and management paradigms.

Currently NRE Catchment and Water division is undertaking the first steps in developing a Statewide integrated natural resource management investment framework. The scope of the framework is still being finalised.

This Project will develop in four stages over the coming twelve months. A Review Paper will form the first output of this Project, and will focus on documenting how such a framework is being implemented elsewhere, identifying world best practice, and documenting how Victoria is performing in relation to world best practice.

The VCMC supports the State Government in this important initiative. Ultimately, a Statewide natural resources management strategy and its investment plan must be developed on an adaptive management basis and would contain the following elements:

- > A vision for the Victorian landscape in 2050
- > A vision for the future of agriculture within that landscape
- > Identification of opportunities for the State
- > An outline of innovative public/private partnerships to achieve the strategy
- > A knowledge management plan, to include research and development and monitoring, evaluation and performance review
- > Adequate resources from the public and private sector.

### 6.3 Conclusion

In the long run it is clear that Victoria's natural resource base will significantly degrade if we continue to impart the same management paradigm across the landscape. It is cheaper to adjust and manage our natural resources properly rather than pay the exorbitant repair bill we are accumulating.

Victoria is committed to sustainable development, ensuring that economic, environmental and social resources are managed in such a way that they are available equitably for the well-being of the next generation. Sustainable management of our catchments will require some major changes to ensure that the resources that underpin our successful agriculture sector are protected for future use.



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