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Corangamite Catchment
Management Authority

**Inventory of Information and
Databases Relating to Land
Degradation Processes in the
CCMA Region.**

Report No: 311/01/06

Date: 30th June 2006

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1. Introduction

The Corangamite Catchment Management Authority (CCMA) is currently finalising a Soil Health Strategy (CSHS) as a sub-strategy of the Corangamite Regional Catchment Strategy. The development of the CSHS is being managed by the Department of Primary Industries (DPI) and will provide the basis for investment in regional soil health over the next decade. The CSHS addresses a number of land degradation and soil issues of which landslides and erosion are of particular interest to the CCMA.

A preliminary draft of the CSHS identified the need for suitable regulatory control of erosion and landslides throughout the CCMA region as a key element of the strategy. As a result, the development and implementation of Erosion Management Overlays (EMO) within a number of key regional municipal planning schemes was identified as a key implementation outcome to be conducted in parallel with the finalisation of the CSHS.

A pilot study aimed at the development and implementation of an EMO in the City of Greater Geelong (CoGG) was commenced in 2004. Key elements of this study, which is due to be completed in June 2006, included:

- The development of a GIS based data management system.
- Suitable land degradation susceptibility maps for erosion and landslide.
- Development of EMO boundaries suitable for inclusion in the Victorian Planning Scheme (VPS).
- Development of planning schedules for inclusion in the VPS.
- Development of a series of referred documents aimed at supporting and explaining the EMO.
- Establishment of data management systems aimed at providing greater access to all stakeholders of key information require din completing and evaluating assessments.

The CoGG pilot study provided the opportunity to develop a consistent approach to planning scheme amendments throughout the CCMA region. As a result, a number of key process elements and documents are expected to be readily transferred and adopted in other municipalities.

A recent project commenced with Colac Otway Shire (COS) similarly aims to update susceptibility mapping within the COS local government area and to incorporate the standard schedule developed as part of the CoGG study into the COS planning scheme.

As part of the recognition of the need for better access to relevant information across the CCMA region, a key initiative commissioned by DPI was to produce a series of associated reference documents aimed at assisting the implementation of EMO's throughout the region. This report details the compilation of available information including data inventories, bibliographies and databases relating to erosion and landslide throughout the CCMA region.

The report combines both specific and broader based information from across the region and is intended for use in all municipalities within the CCMA region.

2. Information Resources for the CCMA Region

2.1 Background

Erosion can be found throughout the entire Corangamite Catchment Management Authority (CCMA) region. The processes of land degradation have been persistent throughout geological time and continue to be active although they are generally episodic in nature.

A diverse range of landscapes and soil units exist within the CCMA region and when combined with highly variable climatic conditions across the region, resulting in annual rainfall ranging from 430 mm to in excess of 1250 mm, almost all types and forms of erosion are possible.

The main processes of land degradation within the CCMA include:

- Landslides (or mass wasting).
- Sheet and rill erosion.
- Gully and tunnel erosion.
- Wind erosion.
- Streambank and waterway erosion.
- Coastal erosion processes.

Susceptibility to land degradation and the rate at which it occurs depends on many factors including geology, geomorphology, climate, soil texture, soil structure, nature and density of vegetation and land management practices.

Information of these processes can be obtained from a diverse list of data sources which might include previous studies, university research projects, conference proceedings, journals and consultant's reports just to name a few.

The following sections provide some guidance on known sources of information. The information provided and the lists compiled must not be viewed as a complete or fully comprehensive compendium of the available resource material. It is however intended to serve as a useful starting point in identifying key information sources and relevant knowledge of the processes of land degradation within the CCMA region.

2.2 General Information

General information on land degradation including erosion and landslides can be found in any number of text books. Appendix A provides a listing of a number of useful books containing broad technical information on land degradation processes.

General information on erosion types can also be obtained from the following:

- Landcare Notes - State of Victoria, Department of Sustainability and Environment
- Agricultural Notes – State of Victoria, Department of Primary Industries.

2.3 Databases and Web-Based Information Sources

The following sections contain extracts and information from the various websites and data repositories and where possible, provide details as provided by the custodian on the type and level of services available.

2.3.1 AANRO

The Australian Agricultural and Natural Resources Online (AANRO) database represents an integrated knowledge discovery tool for agriculture and natural resources funded by Australian Commonwealth and State Governments. Information relates to a diverse range of agriculture and natural resource management data across the entire country. The database has contributions and links to over 80 different organisations throughout Australia. Website details are as follows:

<http://www.aanro.net/page/home.html>

AANRO have assisted in the development of the new CCMA research and development database (see below).

2.3.2 CCMA Research and Development Database (CCMA R & D)

The Corangamite Catchment Management Authority's Research and Development Database (CCMA R & D) is an extensive collection of research project descriptions, research publications and technical reports on all aspects of the catchment including Atmosphere and Climate, Biodiversity and Ecology, Land and Landscapes, Social, Cultural and Economic, and Water and Aquatic Systems. The database has been indexed by subject and locality for information retrieval and analysis. The information has been assembled from a series of geo- and environmental bibliographies provided by key regional stakeholders and contributors such as the University of Ballarat.

Currently in its final stages of development, the R & D database is accessed at present form the AANRO website as follows:

<http://www.ccma.vic.gov.au/>

It is envisaged that the CCMA R & D database will be fully commissioned and operational by March 2006 and will be accessed directly via the CCMA homepage.

2.3.3 Victorian Resources Online (VRO)

The Victorian State Government Department of Primary Industries' (DPI) Victorian Resources Online (VRO) website. provides access to a wide range of natural resource maps and associated information. In particular, it serves as a useful information source on land degradation including all forms of erosion and landslides in the CCMA region. Information is available at both State-wide and Regional levels across Victoria. The website for the VRO home page is as follows:

<http://www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/vrohome>

2.3.4 ELIXIR On-line Library Service (DPI)

Library and information services are also delivered by DPI through an integrated library network, with most of the library collection housed at the Knowledge Resource Centre at Werribee. The centre is a state-of-the-art facility designed for the long term preservation of library materials.

The library service holds a broad range of information resources relating to agriculture, conservation, land management and resources. Library resources include:

- A comprehensive collection of publications produced by the Department of Primary Industries (DPI) and the Department of Sustainability (DSE) and their former agencies.
- Extensive scientific journal and book collections
- Collections of maps, photographs, videos and CD-ROMs
- Unpublished reports

The information is accessed via the ELIXIR on-line library catalogue and can be accessed via the following link:

<http://webcat.nre.vic.gov.au/uhtbin/cgisirsi/Mon+Mar+20+13:53:07+EST+2006/SIRSI/0/49>

2.3.5 Geoscience Australia (GA)

Geoscience Australia maintains an extensive series of online mapping programs and databases. Most of the information is at a regional scale and is listed under key themes.

Databases of interest to the CCMA region include:

- The LANDSLIDES database which contains limited information on landslides that have been recorded in Australia since 1842.
- The OZESTUARIES database includes conceptual models of the biophysical processes that operate in a wide range of estuaries and coastal waterways found around Australia.
- The 1:250,000 scale scanned GEOLOGICAL MAPS provide a map enabled index to access 1:250 000 scale Geology Maps, scanned from paper versions.
- The NATIONAL GEOSCIENCE GIS which includes themes such as geology, geochemistry, geophysics, geohazards, petroleum and mineral resource
- The AUS GEOREF database provides an index to Australian geoscience journals, books, maps, conference proceedings and reports and includes references to the Australian literature published since 1933.

The website for the Geoscience Australia homepage is as follows:

<http://www.ga.gov.au/>

2.3.6 Explore Victoria Online – GeoVIC (M & P)

Minerals and Petroleum Division's (M&P) operate an online resource known as Explore Victoria online – GeoVIC. The web mapping application allows users to search M&P's geospatial databases and display the results as maps or tables. Datasets that can be viewed and interrogated include mineral, petroleum and extractive industries tenements, land-use and airborne geophysical survey boundaries, gravity, magnetic and radiometric images, borehole & well data, surface geochemistry results, mines and mineral occurrences, and geological maps and interpretations at various scales.

The website for M & P's GeoVIC website is as follows:

<http://www.dpi.vic.gov.au/minpet/geovic>

2.3.7 The University of Ballarat Research Databases (McVeigh and Feltham).

The University of Ballarat has been involved in landslide research for many years and numerous student projects have been undertaken within the region (see Bibliography). A landslide inventory and database was first established through the work of John McVeigh (2001) and later expanded to include both erosion and landslide by Feltham (2004, 2005 and 2005a) (See Appendix C for references).

The latest database included previous data and new photo interpretation from 1:50,000 aerial photographs with limited field checking for the entire CCMA region. Over 4600 incidences of erosion and landslides have been mapped within the CCMA region. The database was most recently presented as an appended CD in the following report:

- Feltham W 2005. *"CCMA Landslide and Erosion Database". Version 2. Report to the CCMA. Ballarat University Department of Geology July 2005.*

Further updates will occur as more information is received from other stakeholders and contributors and it is envisaged that a live version of the erosion and landslide database will be available on either the CCMA website or a sponsored site in the near future.

2.3.8 Aerial Photography from Land.Vic

The State of Victoria has been regularly photographed from the air since the 1940's. The majority of images are black and white, with colour starting around the 1970's. There are two types of aerial photography available - the traditional vertical photography flown at high level for mapping, and low level obliques (side views) of metropolitan landmarks and events. The photography scales range from 1:10000 to 1:40000.

Images for mapping are held in two forms: Aerial Photography Prints - known as field or office sets used to compile maps, often involving ground or field checks by surveyors and Glass Diapositives - used in the drawing of maps and identification of features on or near the ground. The images are used in a variety of applications - Mapping, Planning, Real Estate, Tourism, Recreation, Landcare and as court evidence in disputes.

A library of images is available for viewing at the Land Information Centre at 57 Cherry Lane, Laverton North 3826. Phone (+61 3) 8368 5432. Prints are available for viewing and photocopies of prints can be obtained. A computerised index of the aerial photographs enables easy searching to identify the required prints.

3. Bibliography for the CCMA Region

3.1 Introduction

A bibliography of information relating to erosion and landslides was assembled in 2004 from the available studies, reports, research thesis, consultants reports (where available), conference proceedings, journal papers and newspaper articles by Peter Dahlhaus at the University of Ballarat. This bibliography has been reproduced either fully or partially in a number of the online databases previously referred to and is provided here in its original format in Appendix B.

It is very important to note that the list should not be viewed as the complete set of all available knowledge. Other relevant information and data invariably exists and may not have been included into the bibliography.

The information in the presented bibliography is that as supplied by Peter Dahlhaus in 2004. At present there is no mechanism for regular updating of the information presented in this bibliography although this process would be greatly assisted if the information was transferred to a database with single custodianship.

The generosity of Peter Dahlhaus in making this bibliography available to online databases and the author is fully acknowledged and greatly appreciated.

3.2 Studies and Research Reports

A number of previous studies have been conducted within the CCMA region that address issues of erosion susceptibility and land capability on a regional scale. They provide valuable insight and understanding into the potential occurrence of erosion in landscapes, landform units or soil units.

A list of useful studies and research reports relating specifically to erosion and landslide processes applicable to the CCMA region is detailed in Appendix C. Again, this list should not be viewed as either a complete or comprehensive compendium of the available resource material but is intended to serve as a useful starting point in understanding the current spatial extent and severity of erosion within the CCMA region

4. Comments

The information and data contained in this report represents some of the available information on land degradation processes within the CCMA region. The inventory has been compiled using known data sources but it must be noted that it does not represent a full or complete compendium of all available knowledge.

It is intended that this document and referred databases will be used as a key element for the understanding and assessment of risks associated with land degradation processes in the CCMA region. Risk assessment of processes such as erosion and landslide is expected to be regulated through the implementation of an Erosion Management Overlay(s) within the municipal planning schemes.

The ready access to available knowledge on land degradation processes is seen as a key way of ensuring future assessments take into account available knowledge and data. It is hoped that better access to this information will result in better quality reports and assessments. This would then result in greater confidence during the evaluation phases of the planning process and lead to more appropriate and sustainable development.

It must be noted however that the state of knowledge and information is a dynamic process and it is not the purpose of this document to serve as the only information which needs to be accessed and assimilated. Instead this document represents a minimum benchmark which both regulators and practitioners should apply to the assessment and evaluation process.

The current inventory and bibliography should be continually updated as further studies are completed and/or new sources of information are accessed. Much of the bibliography prepared by Peter Dahlhaus at the University of Ballarat has been incorporated into the CCMA R & D database and it is recommended that ongoing protocols are established for the updating of information.

It is also recommended that industry be encouraged to contribute to the CCMA R & D database as this can only benefit all stake holders. In time it may be possible to combine information from a number of sources to establish an overall knowledge database for the CCMA region similar to the broader based VRO web site.

Appendix A

List of Useful General Texts on Erosion and Landslides

Date of Publication	Publisher	Author	Title	Comments
1971	Soil Conservation Authority Government Printer Melbourne	L.E.Milton	A review of Gully erosion and its control	Internal report on gully erosion in Victoria
1979	Soil Conservation Authority Government Printer Melbourne	R.J. Gavin	Guidelines for minimising soil erosion and sedimentation from construction sites in Victoria	Practical information to reduce erosion and sedimentation for developers contained in a detailed handbook
1980	Soil Conservation Authority Government Printer Melbourne	S.A. Zallar	Soil Stabilisation and Revegetation Manual	
1982	Elsevier Scientific	D. Zachar	Soil Erosion. Developments in Soil Science 10	
1986	Longman Scientific	R.P.C. Morgan	Soil Erosion and Conservation	
1987	Balkema	B.F. Walker and R. Fell	Soil slope instability and stabilisation	Excellent reference text with detailed case studies
1991	Elsevier Applied Science and IMM	E Hoek and J.W. Bray	Rock slope Engineering	Classic handbook dealing with the geotechnical problems of rock slope design
1991	EPA Victoria	EPA Victoria	Construction Techniques for Sediment Pollution Control	Comprehensive handbook and guidelines for managing and controlling sediment pollution
1996	National Academy Press Washington D.C.	A.K. Turner and R.L. Schuster	Landslides. Investigation and Mitigation. Special Report 247. Transport Research Board. National Research Council	Comprehensive text containing technical information on all aspects of landslide investigation and remediation.

1990	Monash University Press	S.C. Boucher	Field tunnel Erosion: Its Characteristics and Amelioration.	
1993	Longman Cheshire	G.H. McTanish and W.C. Boughton (eds)	Land degradation processes in Australia	
1995	B.T.Batsford	N. Hudson	Soil Conservation (3 rd Ed)	
1998	Goanna Print	R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker, M.S. Hopkins	Australian Soil and Land Survey Field Handbook (2 nd ed)	This detailed handbook provides a systematic and standardised program for recording of field observations in soil and land survey.
2001	Thomas Telford	N Simons, B Menzies and M. Matthews	A short course in slope and rock slope engineering	A basic text focused on essentials with quick reference charts and tables
2004	Thomas Telford	E. M. Lee and D. K. C Jones	Landslide Risk Assessment	Excellent state of the art text currently well regarded among the geotechnical community
2005	Taylor and Francis	R.E. Hunt	Geotechnical Engineering Investigation Handbook	Comprehensive guide to geotechnical and geological engineering with an extensive section on geohazards
2005	A.A. Balkema	O. Hungr, R. Fell, R. Couture and E. Eberhardt (eds)	Landslide Risk Management. Proceedings of the international Conference on Landslide Risk Management, Vancouver, Canada, 31 may- 3 June 2005.	State of the art publication with 7 key papers on critical aspects of risk management.

Table 1 List of some useful general texts on erosion and landslide processes.

Appendix B
Bibliography for the CCMA Region

(Courtesy of Peter Dahlhaus at the University of Ballarat)

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LANDSLIDES REFERENCES IN THE CCMA REGION.

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ANON. 2-26-1982. Experts look at Otway landslide problems. Colac Herald 2-26-1982 Colac

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Appendix C

List of Some Previous Land and Soil Information in the CCMA Region

Date of Publication	Organisation	Author	Title	Type of Study
1973	CSIRO Division of Applied Geomechanics	K Grant	Terrain Classification For Engineering Purposes of The Queenscliff Area. Victoria (Technical Paper No 12)	PUCE -
1977	Soil Conservation Authority	A.J.Pitt, A.W.Jakimoff and B.J.Evans	An interim report on land in the Heytesbury Settlement	
1979	Soil Conservation Authority Kew	J.P.Jeffrey and R.T.Costello	A study of land capability in the Shire of Ballan	Land capability
1979	Soil Conservation Authority Kew	J.P.Jeffrey, R.T.Costello and P.King	A study of land capability in the Shire of Bungaree	Land capability
1980	Soil Conservation Authority Kew	J.P.Jeffrey	A study of land capability in the Shire of Buninyong	Land capability
1981	Soil Conservation Authority Kew	J.P.Jeffrey and R.T.Costello	A study of land capability in the Shire of Bannockburn	Land capability
1981	Soil Conservation Authority	A.J.Pitt	A study of the Land in the Catchment of the Otway Ranges and Adjacent Plains (TC-14)	Land systems
May 1986	Ministry for Planning and Environment		The Rural Land mapping Project- Shire of Otway	Land capability
1987	State Chemistry Laboratory	J.M. Maher and J.J. Martin	Soil and landforms of south-western Victoria Part 1. Inventory of soils and their associated landscapes	Soil unit and Land system
2001	University of Ballarat	J.A. McVeigh	A Landslide Database for Southwest Victoria. Bachelor of Applied Science (Honours) Thesis	Landslide database
2003	Department of Primary Industries (PIRVIC)	Robinson et al	A land Resource assessment of the Corangamite Region	Soil-landform units

Aug 2004	GHD	AS Miner	Erosion Management Overlay for the City of Greater Geelong	Historical instances (Erosion and Landslide) database
2004	University of Ballarat	W. Feltham	CCMA Landslide and erosion database. Major Project Bachelor of Applied Science (Geology)	Historical instances (Erosion and Landslide) database
2005	University of Ballarat	W. Feltham	Corangamite Catchment Management Authority Landslide and Erosion Database. Version 2.	Historical instances (Erosion and Landslide) database
2005a	University of Ballarat	W. Feltham	Erosion in the Corangamite Region. Bachelor of Applied Science (Honours) Thesis	Historical instances and Assessment (Erosion and Landslide) database

Table 2. List of Some Previous Land and Soil Information for Erosion and Landslide processes in the CCMA Region