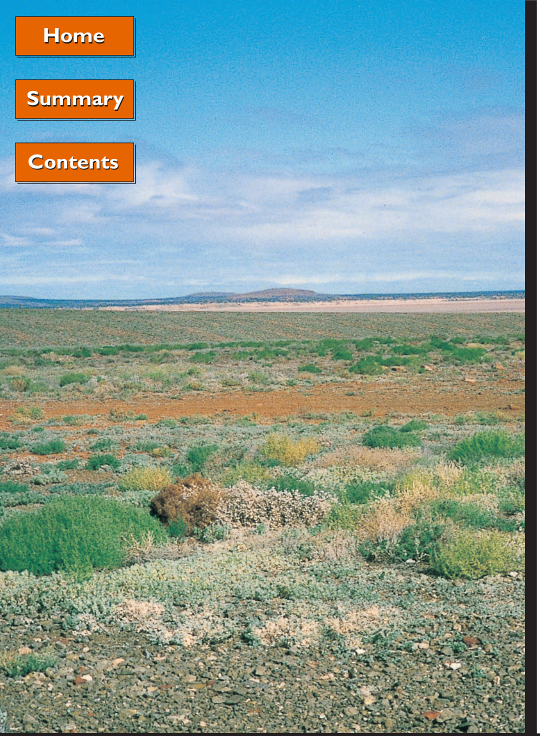

Natural Heritage Trust
Helping Communities Helping Australia
A Commonwealth Government Initiative

AUSTRALIAN NATIVE VEGETATION ASSESSMENT 2001

National Land and Water Resources Audit
A program of the Natural Heritage Trust

Melaleuca woodland, Kakadu National Park, Northern Territory

NATIONAL LAND AND WATER RESOURCES AUDIT

Providing nationwide assessments

The National Land and Water Resources Audit (Audit) is facilitating improved natural resource management decision making by:

Providing a clear understanding of the status of, and changes in, the nation's land, vegetation and water resources and implications for their sustainable use.

Providing an interpretation of the costs and benefits (economic, environmental and social) of land and water resource change and any remedial actions.

Developing a national information system of compatible and readily accessible land and water data.

Producing national land and water (surface and groundwater) **assessments** as integrated components of the Audit.

Ensuring integration with, **and collaboration** between, other relevant initiatives.

Providing a framework for monitoring Australia's land and water resources in an ongoing and structured way.

In partnership with Commonwealth, and State and Territory agencies, and through its theme activities—Water Availability, Dryland Salinity, Vegetation, Rangelands Monitoring, Agricultural Productivity and Sustainability, Australians and Natural Resource Management, Catchment, Rivers and Estuaries Condition and Information Management—the Audit has prepared:

Assessments of the status of and, where possible, recent changes in Australia's land, vegetation and water resources to assist decision makers achieve ecological sustainability. These assessments set a baseline or benchmark for monitoring change.

Integrated reports on the economic, environmental and social dimensions of land and water resource management, including recommendations for management activities.

Australian Natural Resources Atlas to provide internet-based access to integrated national, State and regional data and information on key natural resource issues and underpinned by the **Australian Natural Resources Data Library**.

Guidelines and protocols for assessing and monitoring the condition and management of Australia's land, vegetation and water resources to meet the information needs of decision makers at regional to Australia wide scales.

The **Australian Native Vegetation Assessment 2001** details Australia-wide activities undertaken to implement a national vegetation data management and information provision system. Using the data compiled in this system, this report assesses the status of Australia's native vegetation and makes suggestions for continued development of the information system and its application in supporting natural resource management decisions.

AUSTRALIAN NATIVE VEGETATION ASSESSMENT 2001

National Land & Water Resources Audit
A program of the Natural Heritage Trust

Published by:

National Land and Water Resources Audit
C/- Land & Water Australia
On behalf of the Commonwealth of Australia

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Disclaimer

We invite all interested people, both within and outside Government, to make use of the Audit's reports, information, its Atlas and products in whatever way meets their needs. We encourage you to discuss Audit findings with the various partners and contributors who have prepared this information. Partners and contributors are referenced in this report.

The Commonwealth accepts no responsibility for the accuracy or completeness of any material contained in this report and recommends that users exercise their own skill and care with respect to its use.

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National Land & Water Resources Audit
A program of the Natural Heritage Trust

Minister for Agriculture, Fisheries and Forestry
Parliament House
Canberra, ACT 2600

Minister for Environment and Heritage
Parliament House
Canberra, ACT 2600

Dear Ministers

I have pleasure in presenting to you *Australian Native Vegetation Assessment 2001* – a report of the National Land and Water Resources Audit (Audit).

This report details major advances made by the Audit and its partners to implement an information system for Australia's vegetation. This system has required the development and agreement to guidelines, data protocols, access arrangements and procedures to compile and keep up to date consistent data about Australia's vegetation.

Both pre-European and present native vegetation information is summarised in this report. The vegetation information is at the best available scales and is based on over 100 data sets mapped by agencies over the last 15 years. Importantly, through the Australian Natural Resources Atlas, this information is now publicly available, providing support to a broad range of activities from regional planning to Australia wide policy making.

The report demonstrates some of the applications of the National Vegetation Information System. These include providing information for setting priorities for nature conservation, catchment management initiatives and regional vegetation management planning.

The National Vegetation Information System is already being used by the Australian Greenhouse Office to add further precision in the National Carbon Accounting System. As part of the National Action Plan for Salinity and Water Quality, the native vegetation information system is being used to help identify vegetation types at risk from increases in the extent of dryland salinity. Environment Australia is using the information to assist with implementing the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) and guiding funding priorities for the Bushcare program.

Much remains to be done in Australia as we address priority native vegetation management challenges and provide information to underpin natural resources decisions. Key priorities from an information perspective include:

- continued and targeted mapping and collection of key additional native vegetation information to complement that already compiled;
- implementation of a more distributed data management system so that data custodians can continually update, make accessible and provide interpretations of their part of the massive data set compiled by this initiative; and
- development of additional components, including readily accessible information in all States and Territories on native vegetation clearing and native vegetation condition.

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A consistent and continued effort to improve native vegetation information and make it available to the community is needed. This will be best achieved through partnership with States and Territories.

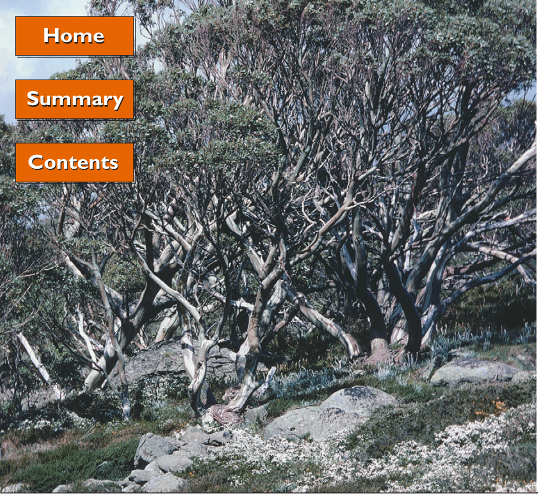
The Audit is pleased to report that Environment Australia has volunteered to undertake the ongoing role of national coordinator for the native vegetation data and products. Transition arrangements from the Audit to Environment Australia and continued coordination activity with Agriculture, Fisheries and Forestry – Australia provide an excellent foundation for continued progress. This will ensure that the Audit's sixth objective as set by the Natural Heritage Trust Ministerial Board—*providing a framework for monitoring Australia's land, vegetation and water resources in an ongoing and structured way*—is achieved for native vegetation.

I have pleasure in presenting you with this report on Australia's native vegetation.

Yours sincerely,

Roy Green

Chair
National Land and Water Resources Audit Advisory Council
November 2001



SUMMARY

About the Australian Native Vegetation Assessment 2001

Australian Native Vegetation Assessment 2001 is the first regional scale and collaborative Australia-wide assessment of the type and extent of Australia's native vegetation.

Consistent and comparable information on native vegetation has been called for by many for some time—including Commonwealth, State and regional natural resource management policy and decision makers. The history of vegetation data management in Australia up till now has been for State and Territory and Commonwealth agencies to map vegetation as a one off project or program without underlying standard guidelines. Some States had standardised mapping within their boundaries and now, as a result of the Audit's investment, all are developing comparable systems Australia-wide.

The National Vegetation Information System was developed in response to this need for a consistent approach to native vegetation and standardises vegetation data Australia wide, delivering efficiencies in storing, analysing and reporting on vegetation data and underpinning and making possible the Australian assessment of native vegetation.

Data management – defining the National Vegetation Information System

The National Vegetation Information System was developed to ensure that native vegetation data is consistent, comparable and useful for a range of users. It provides guidelines and defines the minimum requirements for the compilation of vegetation data across Australia and was designed to be compliant with the Australian Spatial Data Infrastructure.

The National Vegetation Information System information hierarchy defines a classification for describing the structural and floristic patterns of Australia's vegetation and reporting on vegetation types for a range of users at a range of scales. The hierarchy consists of six levels from a broad classification of trees and shrubs to detailed structural and floristic information on all layers in a vegetation type.

Once agreement on the National Vegetation Information System was reached, State and Territory agencies compiled pre-European and present native vegetation data from their existing data holdings. This involved over 100 data sets covering about two-thirds of Australia. From the National Vegetation Information System data 23 major vegetation groups were agreed as the basis to report on Australia's native vegetation. These groups summarise the broad structural and floristic groupings of Australia's native vegetation from which more detailed information at lower levels in the hierarchy can be obtained.

Australia's native vegetation at a glance

Following compilation of vegetation data, assessment reveals:

Type and extent of present native vegetation

- Australia is dominated by a few plant genera ranging across the broad range of structural vegetation types. Eucalypts and acacia species are widespread and occur as forests, woodlands and shrublands. The hummock grasslands cover vast areas of the arid interior.
- Hummock grasslands cover 23% of Australia followed by the eucalypt woodlands with 17% extent, acacia forests, woodlands and shrublands with 17% extent, chenopod/samphire shrublands, other shrubs and forblands at 10% and tussock grasslands another 7% of the continent.
- Smaller areas are dominated by eucalypt forests (4%), mallee woodlands and shrublands (3%), callitris, casuarina and melaleuca forests and woodlands (2%), rainforests and vine thickets (0.4%), heaths (0.3%), other grasslands, herblands, sedgelands and rushlands with approximately 1% extent.
- About 33% of Australia's native vegetation in the intensively used areas (primarily the agricultural and urban zones) have been cleared or substantially modified.
- Information is analysed by basin and subregions on percent of remaining vegetation. Twenty-five out of 245 basins and 42 out of 354 subregions have less than 30% remaining native vegetation.

Cleared vegetation types

Clearing of native vegetation has occurred for human settlement and agriculture in the higher rainfall regions and where there are more fertile soils, generally excluding the arid interior and tropical far north.

Major vegetation groups most affected by clearing include:

Eucalypt woodlands and eucalypt open woodlands: approximately 31% and 25% of pre-European extent has been cleared, accounting for 32% and 13% respectively of all clearing—Eucalypt woodlands and eucalypt open woodlands are an important component of cereal cropping and pastoral zones. Cleared areas are very extensive, with the broad fabric of the landscape from a native vegetation perspective lost.

Inland acacia forests and woodlands: approximately 15% of pre-European extent cleared, accounting for 10% of all clearing. Agricultural and pastoral development has led to major changes in extent and condition of these landscapes, especially in brigalow (*Acacia harpophylla*) and mulga (*A. aneura*) communities.

Mallee woodlands and shrublands: approximately 35% of pre-European extent has been cleared, accounting for 14% of all clearing. As with the Brigalow Belt, encouragement for clearing was provided by government in the temperate mallee woodlands areas. Clearing was encouraged for cereal cropping and pastoralism and was often a condition of leases.

Rainforest communities: most lowland occurrences have been cleared, approximately 30% of pre-European extent has been cleared, accounting for 1% of all clearing. The broad range of rainforest and vine thicket communities across Australia found within this major vegetation group masks the level of regional depletion of some rainforest and vine thicket types.

Heath communities: approximately 45% of pre-European extent has been cleared, accounting for 2% of all clearing. Heathlands have been heavily impacted by clearing for sand mining, agriculture, grazing or development mainly in southern coastal areas. Mallee communities, which occur in association with some heath communities, have similarly had extensive areas cleared, mainly for pastoral development in Victoria and South Australia.

Tussock grasslands: approximately 10% of pre-European extent has been cleared, accounting for 6% of all clearing. Many of the tussock grasslands of eastern Australia have been either substantially cleared or heavily modified by grazing. The mapping of this type in the National Vegetation Information System reflects where there is good information on native grasslands. There are known to be many other areas either not mapped or subject to change through grazing and introduced pasture grasses.

Informing vegetation management

Two Australia-wide applications demonstrate the use of well compiled vegetation data.

Nature conservation

- The protection status of the major vegetation groups in bioregions with less than 30% native vegetation remaining is relatively low. Many of the vegetation groups in each region fall below reservation class 3 with less than 10% of the pre-European extent of the vegetation group in a protected area.

Regions with relatively small areas of vegetation remaining pose many challenges in achieving a comprehensive, adequate and representative system of protected areas.

Fragmentation of native vegetation

- Out of 42 subregions with less than 30% native vegetation remaining, 22 are highly fragmented. These have greater than 30% of their remaining vegetation in fragments smaller than 1000 hectares, demonstrating the challenges ahead if we are to repair native vegetation connectivity in these landscapes.

Sprengelia incarnata, Gymnoschoenus spaerocephalus, Melaleuca squamea, near Scotts Peak Dam, Tasmania

Continuing to consolidate management relevant data on Australia's vegetation

The Audit focused on the collation of the best available existing information on the type and extent of pre-European and present native vegetation. Not all areas of Australia have been mapped and much of the data available is far from complete.

An assessment of the gaps in our knowledge reveals:

- thematic (information and knowledge) gaps (e.g. limited mapping of grasslands and shrublands, lack of comprehensive and comparable information on the condition of the native vegetation);
- spatial (scale and geographic coverage) gaps (e.g. many areas of South Australia and the Gulf country in Queensland);
- currency (date) of mapping (e.g. Western Australian present vegetation mapping ranges from the 1970s to the 1990s);
- vegetation classification level gaps (e.g. large areas of New South Wales mapped to Level III); and
- variable reliability of survey and mapping methods.

Much remains to be done, but with the framework provided by the National Vegetation Information System and setting of priorities, we can start to cost-effectively invest in further data collection activities.

The way forward: an Australia-wide data management initiative to underpin native vegetation management

Promoting the Native Vegetation Assessment 2001 outcomes. Applications of the information system and the assessment will inform governments and the community about the role of native vegetation in natural resource management and biodiversity planning. The information compiled will contribute to initiatives such as the National Action Plan for Salinity and Water Quality and Natural Heritage Trust.

Keeping guidelines and information relevant. Environment Australia will act as the national coordinator supported by a partnership with Agriculture, Fisheries and Forestry – Australia and the States and Territories to continue the work of providing comparable and consistent data sets Australia wide.

Ensuring continued information and updating through cooperative arrangements. A continued Australia-wide approach underpinned by a distributed information system—all States and Territories have agreed to continue working in partnership with Commonwealth agencies towards this goal.

Strategic investment. Collecting and collating data and information on key gaps and to meet natural resources management priorities.

Landscape scale information. Linking the National Vegetation Information System to other natural resource information including land use mapping and developing an improved understanding of the role of vegetation in landscape function, assisting natural resource and biodiversity planning and management.

Vegetation change and condition. Information on changes in vegetation type and extent can be used as a basis for condition monitoring. Australian Native Vegetation Assessment 2001 provides a framework for assessments, monitoring and reporting of the status of native vegetation.

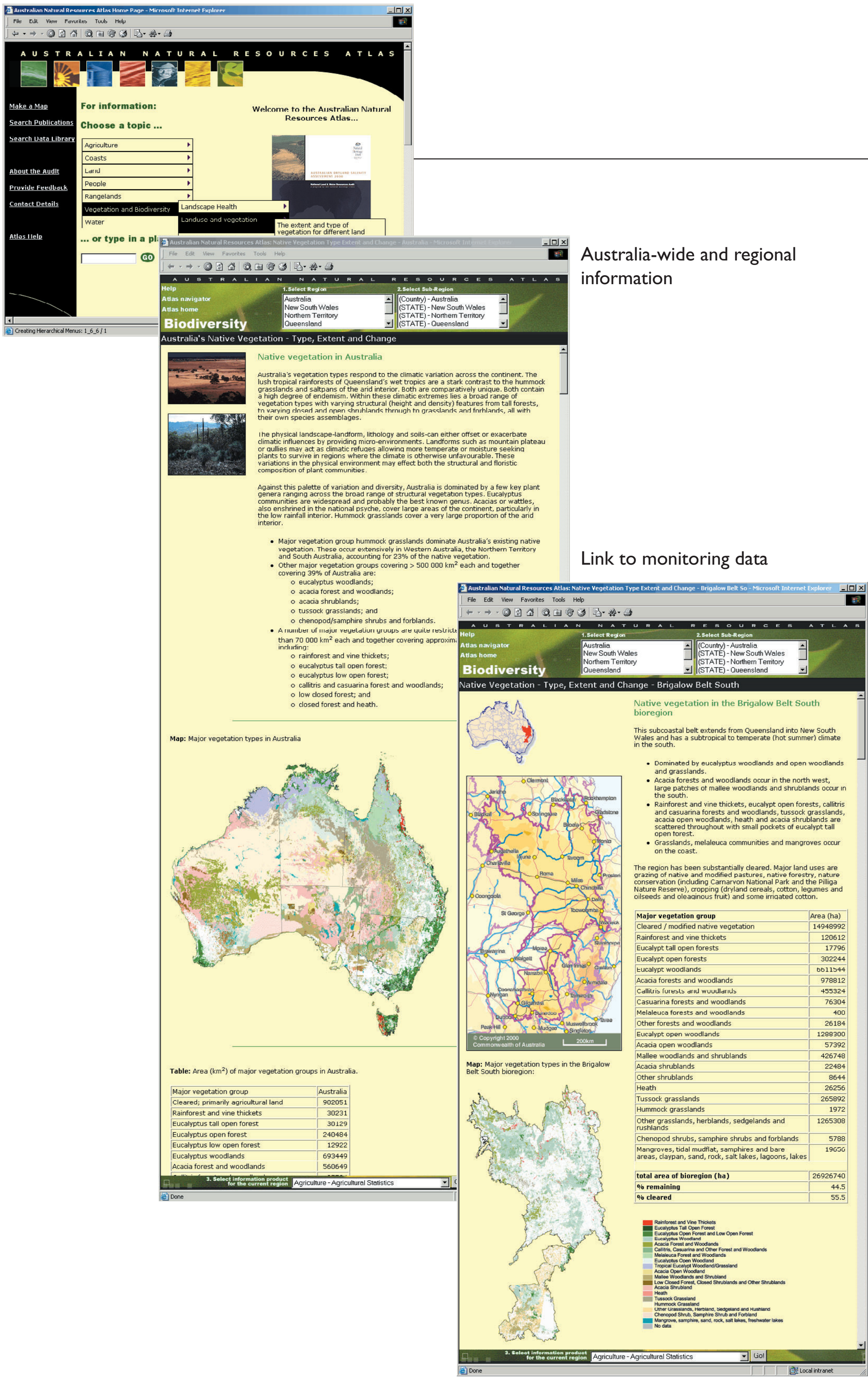
Stocktake and evaluation. Evaluating progress, incorporating new methods of vegetation mapping and data analysis, undertaking future assessments at a maximum of five-yearly intervals based on the National Vegetation Information System 2000 baseline and ensuring relevance to broader natural resource management activities.

Management relevance. Based on good information, we can develop targets for native vegetation management and its application to salinity management, erosion control and biodiversity conservation across all regions of Australia.

Making information available

It is essential that Australia capitalises and builds on the data collection investment of this initiative and puts in place long term Australia-wide assessment and reporting systems with the ability to produce information products at a variety of scales suitable for national, State/Territory and regional assessments.

The Australian Natural Resources Atlas starts this process and provides access to the wealth of information compiled on Australia's native vegetation by the Audit and its partners.



Australia-wide and regional information

Link to monitoring data

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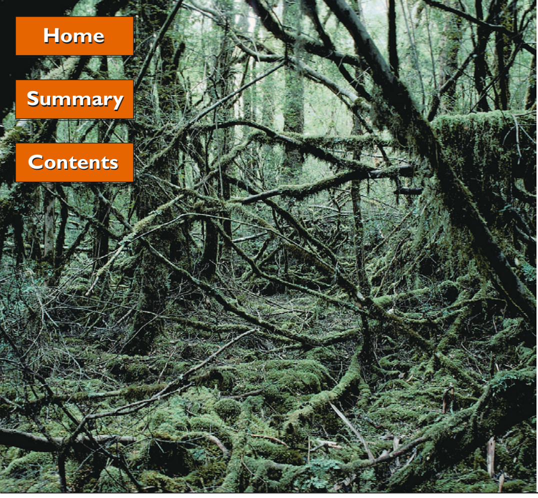

Pedder Impoundment Road, Tasmania

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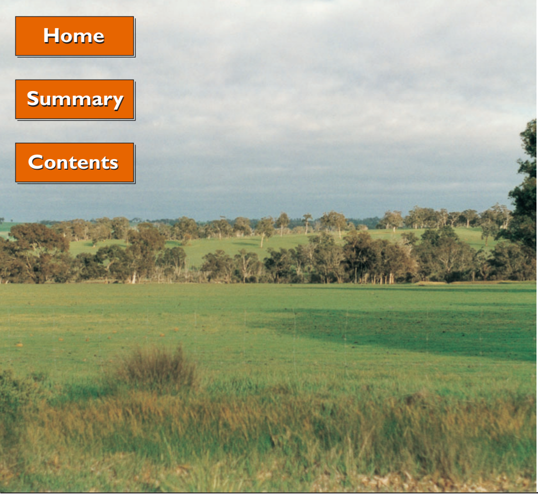

Eucalypts in riparian zone affected by salt,
South of Kojonup, Western Australia

PREFACE

Natural resource management requires integrated solutions and assessments across the landscape. *Australian Native Vegetation Assessment 2001* serves as an input to the broader natural resource management issues assessed by the Audit and other natural resource management activities at all scales of government and community activity.

The Natural Heritage Trust is focusing on protecting and enhancing native vegetation cover across Australia to reverse the long-term decline in the quality and extent of Australia's native vegetation cover. Parallel to the Bushcare initiative under the Natural Heritage Trust, all States and Territories have active programs in vegetation management, usually based on regional vegetation management planning.

- *Australian Native Vegetation Assessment 2001* provides a key information input to planning and vegetation management activities from Australia-wide through to regional scales by making information available on the extent and type of native vegetation present.

The National Framework for the Management and Monitoring of Australia's Vegetation (ANZECC 2000) builds on existing inter-governmental agreements and unifies and complements these processes for native vegetation management. The framework is intended to have a broad scope and to apply across the landscape (inclusive of all processes) and to encompass the environmental, social and economic values of native vegetation. It notes that a system of compatible vegetation information across Australia is one of the key inputs into best practice arrangements for vegetation management and monitoring.

- The National Vegetation Information System underpins and significantly contributes to the Australian New Zealand Environment and Conservation Council National Framework for the Management and Monitoring of Australia's Vegetation.

Native vegetation has a range of productive as well as conservation values. Australia has a long history of forest management and continues to seek a balance between their productive and conservative use.

- *Australian Native Vegetation Assessment 2000* provides context information for forest planning, providing an Australia-wide overview of our forest and woodland types and their extent. The National Vegetation Information System, when linked to the National Forest Inventory data sets will provide an important information source for planning and management activities.

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The National Action Plan on Salinity and Water Quality is a significant advance for natural resource management. It calls for concerted effort of governments and community through regional planning approaches to address the issues of dryland salinity and water quality within 20 priority catchments. Dryland salinity control is chiefly concerned with re-establishing the water balance that occurred with pre-European native vegetation. Native vegetation management plays a key role in protection from and mitigation against dryland salinity.

- Information on the pre-European and present native vegetation contained within the National Vegetation Information System are key inputs to understanding changes in water balance that have caused increase in groundwater levels. Native vegetation information also provides input to determining the most appropriate strategies to re-establishing water balance.

As part of the international commitment to mitigating against climate change, the Australian Greenhouse Office has established a National Carbon Accounting System that requires information on carbon sequestration and release from both soils and vegetation. The National Vegetation Information System provides the best available Australia-wide vegetation extent and type information, fundamental to and underpinning the National Carbon Accounting System.

- The data sets contained within the National Vegetation Information System are key inputs to understanding changes to Australia's carbon accounts, particularly the role of native vegetation.

Wilpena Pound, South Australia

AUSTRALIAN NATIVE VEGETATION ASSESSMENT 2001

Information on Australia's native vegetation

Australian Native Vegetation Assessment 2001 is the first Australia-wide, regional level, collaborative assessment of the type, extent and change in Australia's native vegetation cover. It reports on the status of Australia's native vegetation using the National Vegetation Information System and other sources of mapped vegetation information.

The National Vegetation Information System was developed using State and Territory mapped vegetation data in collaboration with Commonwealth, State and Territory agencies and provides a national framework for inventory and monitoring of vegetation types and extent.

It is available to the community on the Australian Natural Resources Atlas (Atlas). The Australian Natural Resources Data Library underpins the Atlas.

The National Vegetation Information System framework allows for additional data collection and interpretation building an Australia-wide consistent approach to native vegetation information—a key basis for improved vegetation management.

Australian Native Vegetation Assessment 2001

- Reports on the type and distribution of Australia's native vegetation
- Presents a range of information products about Australia's native vegetation
- Describes the development of the National Vegetation Information System
- Provides access through the Atlas (**www.nlwra.gov.au/atlas**) to summary data and information in a hierarchy of scales from national to State/Territory, to bioregion and catchment
- Identifies key knowledge and information gaps about Australia's native vegetation
- Details national coordinator and data custodian relationships for the ongoing maintenance and updating of the National Vegetation Information System to ensure currency and relevance of Australia's information on native vegetation

National Vegetation Information System

- Specifies an agreed technical framework and guidelines allowing for the collection, compilation and monitoring of Australia's vegetation
- Stores data on type and extent of native vegetation in Australia
- Provides an Australia-wide geographic and attribute information system for vegetation data that facilitates analysis and reporting
- Provides access to a range of detailed and compatible mapped data sets about Australia's native vegetation

IN PARTNERSHIP

Australian Native Vegetation Assessment 2001 was facilitated and coordinated by the National Land and Water Resources Audit and prepared in partnership with State, Territory and Commonwealth agencies:

Australian Capital Territory

Department of Urban Services
www.urbanservices.act.gov.au

New South Wales

Department of Land and Water Conservation
www.dlwc.nsw.gov.au

NSW National Parks and Wildlife Service
www.npws.nsw.gov.au

NSW Botanic Gardens
www.rbgsyd.gov.au

Northern Territory

Department of Lands, Planning and Environment
www.lpe.nt.gov.au

Queensland

Environment Protection Agency
www.env.qld.gov.au

South Australia

Planning SA
www.planning.sa.gov.au

Tasmania

Department of Primary Industries, Water and Environment
www.dpiwe.tas.gov.au

Victoria

Department of Natural Resources and Environment
www.nre.gov.au

Western Australia

Department of Conservation and Land Management
www.calm.wa.gov.au

Agriculture WA
www.agric.wa.gov.au

Commonwealth

Agriculture, Fisheries and Forestry – Australia
www.affa.gov.au

Australian Greenhouse Office
www.greenhouse.gov.au

Environment Australia
www.ea.gov.au

NATIVE VEGETATION MANAGEMENT AND THE AUDIT

Natural resource managers are dealing with increasingly complex and interrelated natural resource issues including greenhouse gas emissions, biodiversity conservation, land degradation control (especially dryland salinity and erosion), riparian revegetation and sustainable forest development. Land managers need access to accurate, consistent and preferably seamless Australia-wide data about the type, extent, change and condition of vegetation. The development of the National Vegetation Information System framework was designed to meet these objectives.

Other natural resource assessments addressed by the Audit—dryland salinity, sustainable agriculture and production, ecosystem health (particularly catchment and river assessment), and social and economic wellbeing (from an amenity or nature conservation value perspective) and rangeland monitoring—have relevance to or reliance on vegetation assessment and monitoring.

Information on vegetation cover and type provides much of the framework for the catchment and river condition assessments.

- The status of river, estuary and catchment condition is presented in the Audit's *Australian Catchment, River and Estuary Assessment 2001* report (NLWRA in prep.).

Information on vegetation cover and extent is needed to assess Australia's biodiversity. Arguably native vegetation and its change in extent and condition is a key surrogate for biodiversity. Information compiled as part of the National Vegetation Information System is being built on through further data collection and assessment to complete the Audit's biodiversity assessment.

- Assessment of Australia's biodiversity at the subregional scale uses an assessment of native vegetation with the National Vegetation Information System underpinning this Audit initiative.

Information requirements for better reporting and managing Australia's rangelands include assessments of productivity and indicators for biodiversity monitoring, ecosystem function, extreme climatic events and fire. These require information on vegetation type and extent.

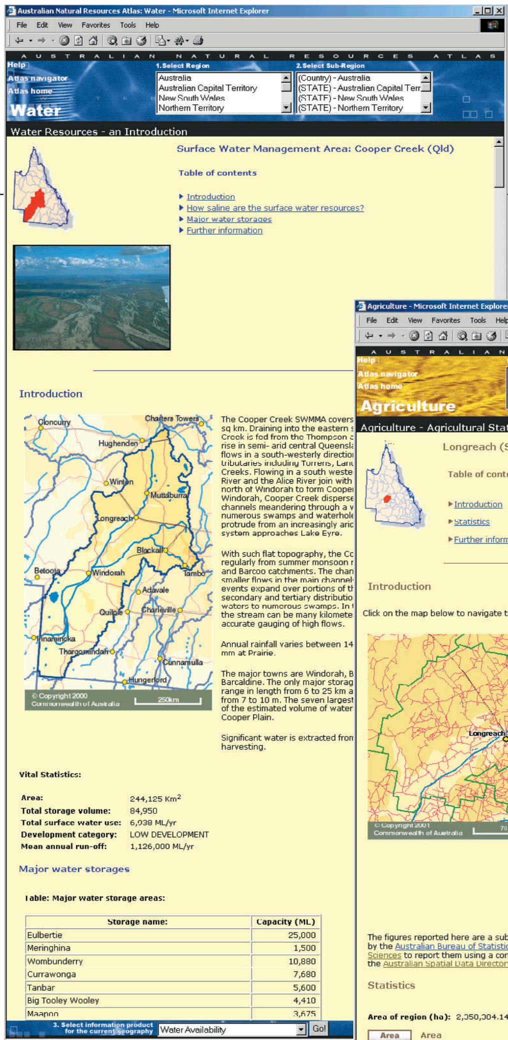
- Many of the components of the Australian rangelands monitoring and reporting program, presented as part of the *Rangelands – Tracking Changes – The Australian Collaborative Rangeland Information System* report (NLWRA 2001d), rely on information on Australia's native vegetation, facilitated now through the National Vegetation Information System.

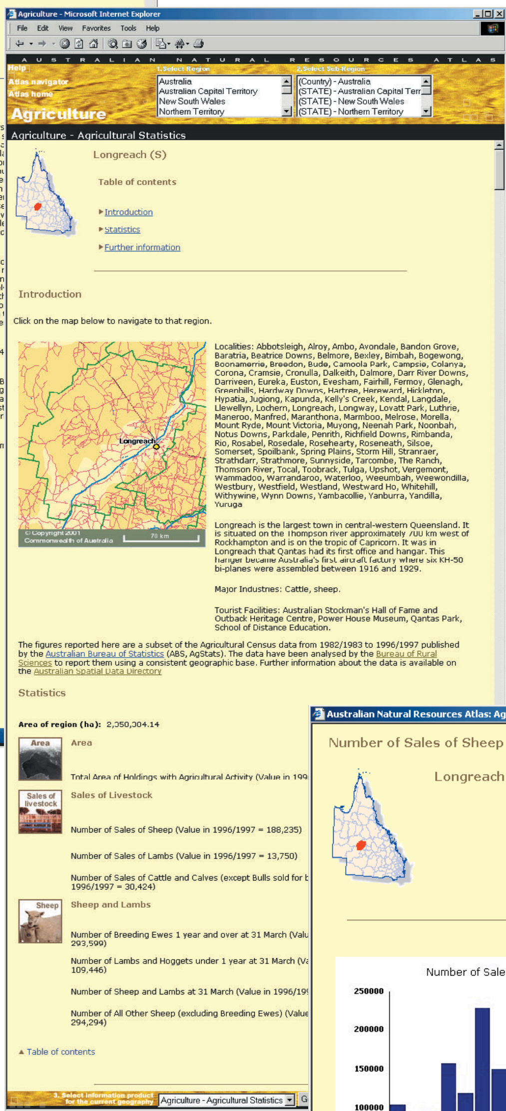
Red gums on the Murray River

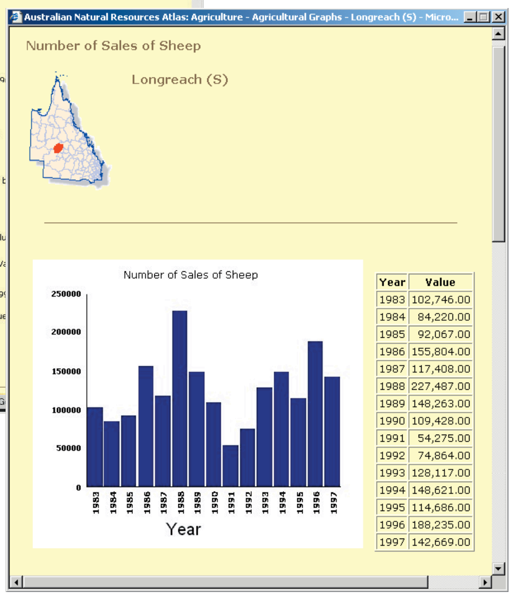
Information on Australia's native vegetation underpins natural resource management. Australia needs to build and capitalise on the Audit's native vegetation initiative by:

- continuing development of the National Vegetation Information System, adopting Australia-wide consistent and comparable approaches to native vegetation resources assessment, updating of data sets and monitoring; and
- linking native vegetation type and extent with land use mapping and land management practices, native production forests and plantations, riparian vegetation condition and the assessment of weed invasions providing an integrated and sustainable natural resource information set on which to base recommendations and management.

Access to Australia's natural resource information, including native vegetation information is available through the Audit's Australian Natural Resources Atlas (**www.nlwra.gov.au/atlas**).







Australian Natural Resources Atlas: www.nlwra.gov.au/atlas

Upper slopes Mount Bellenden Ker, Queensland

AUSTRALIAN VEGETATION INFORMATION FRAMEWORK: the need

Australian Native Vegetation Assessment 2001 presents the first regional level, comprehensive guidelines for assessing and reporting Australia's native vegetation resources, their extent and change since European settlement.

It highlights examples and applications of the native vegetation information at scales appropriate for Australia-wide policy development and program evaluation, and reports on the application of the information framework for:

- mapping Australia's vegetation (including structural and floristic characteristics and quality of the mapping); and
- documenting sources of vegetation information.

Lessons of the past: prior to *Australian Native Vegetation Assessment 2001* a number of attempts were made to develop a consistent, comparable and Australia-wide approach to native vegetation mapping and compilation through forums such as Australian Biological Resources Study. Some major compilation activities focused on describing or delineating the occurrence of vegetation associations found in Australia (i.e. Specht et al. 1974, Beadle 1981, AUSLIG 1990, Specht & Specht 1999) or a summary overview of Australia's vegetation (e.g. Read 1994). While there have been significant contributions to this goal the impetus for a national system was generally limited, due to:

- a lack of comprehensive agreement and commitment to a national framework for describing Australia's vegetation;
- a limited commitment of resources across Australia;
- the availability of efficient information technologies to store and process the information; and
- a lack of national leadership and short-term recognition of the benefits, the efficiencies and effectiveness of such an Australia-wide system and its application to the broader discipline of natural resources management.

Other impediments to developing a consistent, comparable and Australia-wide approach to vegetation information included:

- no sustainable long term vision or dedicated resources facilitated through a national coordinator;
- protection of individual mapping standards and classification schemes;
- restricted or difficult access to information;
- patchy coverage of data suitable for region-scale decision making; and
- the diversity of differing requirements for vegetation information making the task complex and multi-client in nature.

Australia-wide vegetation information prior to the National Vegetation Information System

- **Limited information capacity** reflecting current status of native vegetation at a range of scales
- **Reporting mechanisms variable and poorly coordinated** at broader or finer scales
- **Data management capacity variable and generally poor** limiting capacity to access and use comparable vegetation data
- **Data content and quality extremely variable** and often not comparable across mapping areas or State/Territory boundaries
- **Limited use made of Australia's knowledge-base** including the wealth of scientific expertise, competence and technical capacity to quantify and describe Australia's vegetation and the substantial investment to date in collecting vegetation data

The *Environmental Indicators* report on biodiversity developed for Australian State of the Environment Reporting (Saunders et al. 1998) stated that:

> *... a priority for state of the environment reporting should be the production of a consistent vegetation classification system throughout Australia, which should include marine vegetation; mangroves, seagrasses and macroalgae. The classification should be hierarchical, with lower-level classes (local and subregional) nested within higher-level classes (regional and continental). If local-scale classifications, capable of being agglomerated hierarchically, existed across the continent, national reporting and monitoring could be made wholly compatible and consistent with reporting and monitoring at the local government scale. A national classification should incorporate both structure and floristics, with floristics as attributes at lower levels. Higher-level classes based on structural attributes could be mapped at the IBRA or IMCRA region, or even national, scale and lower level classes could be mapped at more local scales.*

They concluded that:

> *Many existing local and subregional scale classifications are likely to be amenable to agglomeration into higher-level classes such as structural types. The first step in producing a consistent national-level classification is a study to assess the feasibility of such a classification, including the compatibility of existing classifications and their suitability for higher-level agglomeration.*

The National Forest Inventory developed agreed standards and protocols for compiling, analysing and reporting forest types over the last decade. These standards and protocols formed one of the inputs in developing the guidelines for the National Vegetation Information System. The precedent set by the National Forest Inventory in developing an agreed set of 64 forest types has enabled forest vegetation across Australia to be compiled and reported for the last decade.

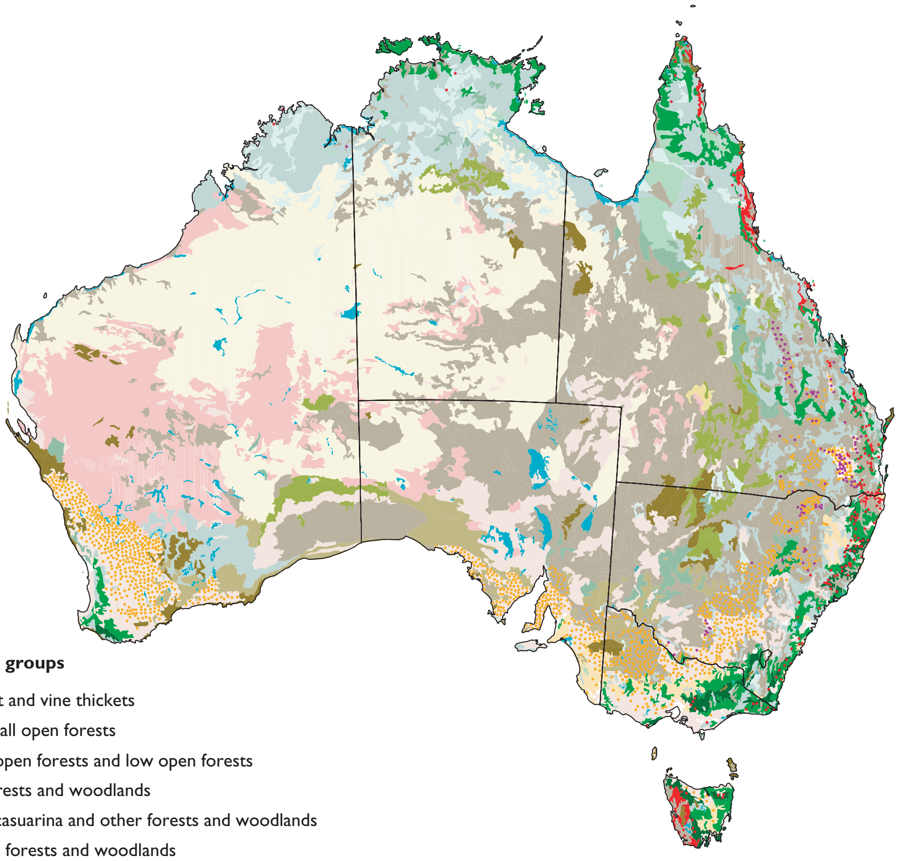
Information capacity limited: prior to Australian Native Vegetation Assessment 2001 the only available Australia-wide data of Australia's native vegetation was compiled by J.A. Carnahan and published in Volume 6 of the Atlas of Australian Resources (AUSLIG 1990). These maps are a snapshot of vegetation at a national scale based on interpreting patterns of vegetation observed in 1980s satellite imagery and are built on the considerable vegetation mapping activities available within the respective State or Territory. They are not suitable for regional level planning.

Mechanisms are now available to:

- maintain and update national and regional level data and information products;
- review user requirements for additional information;
- engage State and Territory vegetation practitioners; and
- ensure the information provided meets the needs of decision makers.

Because of the compatibility between the attribute frameworks that underpin the AUSLIG assessment and reporting of Australia's vegetation, the Audit has translated the mapping using the National Vegetation Information System hierarchy. Figure 1 shows the Australian Land Information Group mapping published at 1:5 000 000 scale, represented by the major vegetation groups classification.

Figure 1. Present vegetation (1988) mapped by J.A. Carnahan.



Major vegetation groups

- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forest, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes
- Summer cereals
- Winter cereals

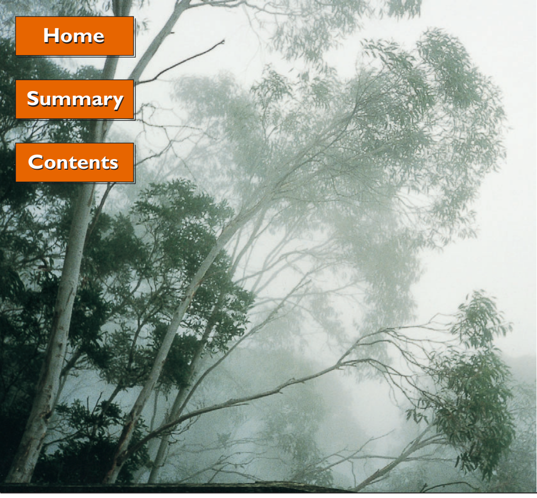
Major vegetation groups

Major vegetation groups are composed of a large number of vegetation types with similar structural and/or floristic characteristics.

Source: AUSLIG (1990)

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



NATIONAL VEGETATION INFORMATION SYSTEM

The framework supporting the Australian Native Vegetation Assessment 2001

The National Vegetation Information System framework (NLWRA 2000a) provides an easily accessible and nationally consistent framework for describing and compiling data and information all vegetation types in Australia. Its application and adoption means that Australia has a robust and flexible system for collecting, compiling, analysing and reporting on vegetation information from regional to national levels.

The framework specifies guidelines to describe:

- structural and floristic characteristics of the vegetation for mapped areas and individual sites;
- data quality;
- sources of vegetation information collected in Australia; and
- vegetation condition.

As the basis for collaborative and collective work across Australia, the National Vegetation Information System was designed to meet an agreed set of guiding principles. These principles were established as part of the initial scoping of the tasks and provide an excellent frame of reference for continued cooperative development.

National Vegetation Information System guiding principles

- resolving data and information differences across administrative and program boundaries to provide comparable and consistent information Australia wide
- collaborative work of mutual benefit
- recognising regional level environmental differences
- flexible and extendable
- fully documented quality and application of the component data sets
- delivering information to meet current needs, foreshadowing and anticipating long-term needs
- improving the knowledge and information base of Australia's vegetation (pre-European and present) and addressing data gaps
- ensuring use is commensurate with data
- providing information and assessments to support vegetation and other natural resource management decision making
- improving data access and dissemination
- recognising the jurisdictional role in meeting specific vegetation information requirements, management responsibilities and obligations

The hierarchical approach to classifying Australia's native vegetation

The National Vegetation Information System information framework defines a hierarchical classification system for describing the structural and floristic patterns of groups of plants in the landscape (NLWRA 2000a). Collectively, the different levels in the classification provide a description of vegetation that can be directly related to precise spatial areas as a vegetation map.

This system benefits data collection and use by:

- standardising the level of detail within a data set, and within and between jurisdictions;
- enabling existing and new vegetation data and information to be described;
- facilitating the addition of new levels of data for particular applications (e.g. forestry);
- providing a flexible framework for generating outputs such as map products at various levels; and
- providing users with a range of vegetation descriptions for various applications.

The hierarchy is based on six levels (Table 1, Figure 3), presenting broad vegetation classifications at national scales (Levels I–III) to a detailed level of information for users at regional scales (Levels IV–VI).

Supporting this hierarchy are a series of attributes (NLWRA 2000a) that can be summarised to report on the hierarchy or combined in other ways to develop user-based classifications of vegetation.

Table 1. National Vegetation Information System information hierarchy (NLWRA 2000a).

Hierarchical level	Description	National Vegetation Information System structural/floristic components required
I	**Class**	Dominant growth form of the ecologically dominant stratum.
II	**Structural formation**	Dominant growth form, cover and height of the ecologically dominant stratum.
III	**Broad floristic formation**	Dominant growth form, cover, height and broad floristic code usually dominant land cover genus of the uppermost or dominant stratum.
IV	**Sub-formation**	Dominant growth form, cover, height and broad floristic code usually dominant genus and family of the three traditional strata (i.e. upper, mid and ground).
V	**Association**	Dominant growth form, height, cover and species (three species) of the three traditional strata (i.e. upper, mid and ground).
VI	**Sub-association**	Dominant growth form, height, cover and species (five species) of all layers/strata.

National Vegetation Information System hierachy definitions

Dominant

A characteristic of a species that has the greatest possible influence in the vegetation type being described.

Ecologically dominant stratum

The stratum, which because of its physiognomy and relative continuity, dominates the rest of the vegetation type in the sense that it conditions the habitats of other strata (Beadle & Costin 1952).

A series of decision rules about the height and foliage cover of the vegetation can assist with assigning the ecologically dominant stratum in a vegetation type. The consistent assignment of this is important to ensure compatibility of vegetation information across data sets.

These decision rules become important when existing vegetation mapping standards have defined dominance in different ways (e.g. the Beard-Webb versus the Specht systems). Classifications begin to vary considerably (e.g. when considering vegetation types as shrublands and grasslands with very sparse emergent trees: by the Specht scheme these would be classed as open woodlands whereas by the Beard-Webb Scheme they are classed as shrublands or grasslands).

Growth form

Habit of a plant, identified most precisely by the position of its perennating buds (e.g. tree, mallee, shrub) (Beadle & Costin 1952).

Stratum

Layer in a vegetation type produced by the occurrence (at approximately the same level) of an aggregation of plants of the same habit (Beadle & Costin 1952).

Cover

Cover produced by the foliage of any vegetation within a defined area.

Height

Measurement from the base to the top. Can be calculated for a given vegetation type to derive the average height for a given stratum.

Broad floristic

Usually the genus of the dominant species in the dominant stratum.

A combination of growth form, height and cover is used to describe the vegetation structure for each stratum for levels II to VI. A description of the height class then allows for a more common structural description of the vegetation (e.g. low open woodland has a tree growth form with a height class of less than 10 m and less than 10% foliage cover). Appendix 7 includes the information used to derive this description.

The Australian Vegetation Attributes (NLWRA 2000a) provide consistent definitions and guidelines that were used by the lead agencies in each State and Territory to translate and compile a selection of existing native vegetation data sets. Using the attributes, information can be compiled on:

- the mapped data set (e.g. mapping methods and attribute accuracy) which may assist in an assessment of its reliability for a particular use;
- the dominant vegetation within a mapped unit and information on its strata, growth forms and species; and
- other co-dominant or subdominant vegetation types within a mapped unit and information on the strata, growth forms and species.

Appendix 5 lists all the vegetation attributes and the definition of each attribute is available in the Australian Vegetation Attributes (NLWRA 2000a).

Relationships between the attributes are complex and comprehensive and describe the range of vegetation layers (strata), growth forms and species descriptions required for a detailed vegetation description for all components of a mapped unit. They allow for multiple descriptions of vegetation types within a mapped unit, often referred to as mosaics of vegetation.

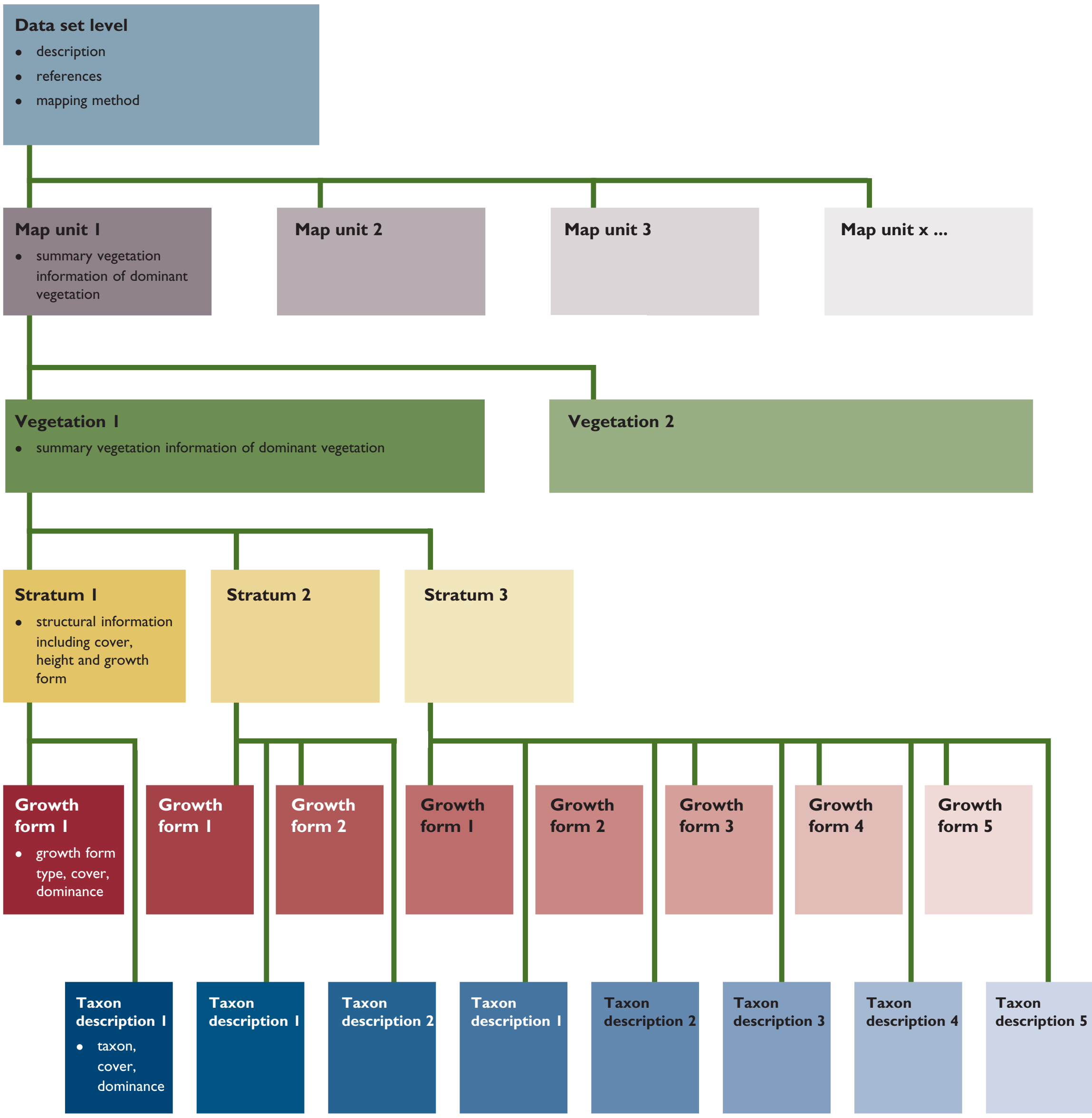
Figure 2 shows one map unit for a South Australian data set. This map unit is a vegetation mosaic with two vegetation descriptions. All available levels of information are presented for vegetation description 1.

Vegetation description 1 has three strata:

- Stratum 1 has one growth form and one taxon description
- Stratum 2 has two growth forms and two taxon descriptions
- Stratum 3 has five growth forms and five taxon descriptions

As an example, the data set description and all attributes related to vegetation description 1 as entered into the National Vegetation Information System database are found in Appendix 6. The Australian Vegetation Attributes (NLWRA 2000a) should be used in association with this table for a definition of these attributes and units of measurement.

Figure 2. Data set and vegetation data found in a map unit of a South Australian data set.



See Appendix 6 for a full description of vegetation description 1.

Figure 3. Hierarchy information as a map legend for a small number of polygons (Brigalow Belt North bioregion, Queensland).

Vegetation type 1

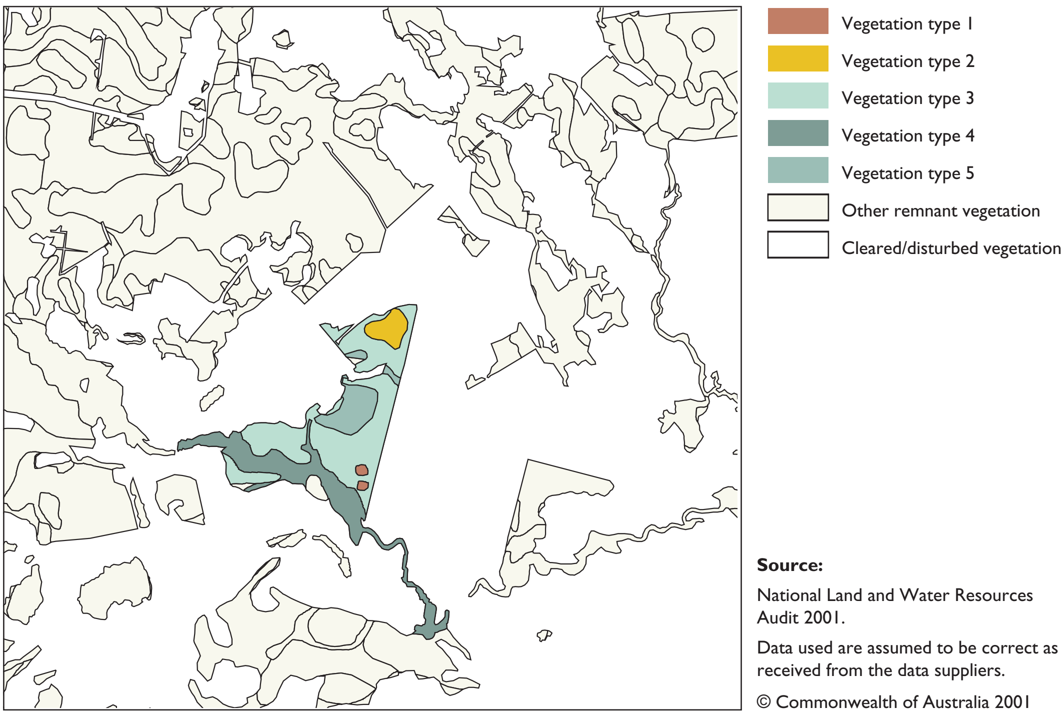
Entry level: Sub-association (Level VI)
Mix: Pure
Level I: Tree
Level II: Open forests
Level III: Acacia open forests
Level IV: Acacia open forests/mixed tall open shrubland/grassy sparse tussock grassland
Level V: ;U+ *Acacia harpophylla*, *Casuarina cristata*, *Eucalyptus orgadophila*/tree/7/c; M *Eremophila mitchellii*, *Geijera parviflora*, *Capparis lasiantha*/shrub/4/i; G *Ancistrachne uncinulata*, *Aristida ramosa*, *Paspalidium caespitosum*/tussock grass, forb/2/r
Level VI: ;U1+ *Acacia harpophylla*, *Casuarina cristata*, *Eucalyptus orgadophila*, *Eucalyptus populnea*, *Atalaya hemiglauca*/tree/7/c; M1 *Eremophila mitchellii*, *Geijera parviflora*, *Capparis lasiantha*, *Canthium oleifolium*, *Santalum lanceolatum*/shrub/4/i; G2 *Ancistrachne uncinulata*, *Aristida ramosa*, *Paspalidium caespitosum*, *Paspalidium criniforme*, *Sporobolus caroli*/tussock grass,forb/2/r; G1 *Carissa ovata*, *Enchylaena tomentosa*, *Myoporum deserti*/shrub, chenopod shrub/2/r
Environmental description:
Undulating lowlands and plains, predominantly on deep, alkaline, strongly gilgaied cracking clays with acidic mottled horizons

Vegetation type 2

Entry level: Association (Level V)
Mix: Pure
Level I: Tree
Level II: Open forests
Level III: Acacia open forests
Level IV: Acacia open forests/mixed open shrubland
Level V: ;U+ *Acacia harpophylla*, *Terminalia oblongata*, *Casuarina cristata*/tree/7/c; M *Lysiphyllum carronii*, *Geijera parviflora*, *Ventilago viminalis*, *Eremophila mitchellii*, *Terminalia oblongata*/tree,shrub/6/i; G *Carissa ovata*, *Alectryon diversifolius*, *Croton insularis*/shrub,tussock grass/3/i
Level VI: ;U1+ *Acacia harpophylla*, *Terminalia oblongata*, *Casuarina cristata*/tree/7/c; M1 *Lysiphyllum carronii*, *Geijera parviflora*, *Ventilago viminalis*, *Eremophila mitchellii*, *Terminalia oblongata*/tree,shrub/6/i; G1 *Carissa ovata*, *Alectryon diversifolius*, *Croton insularis*, *Citrus glauca*/shrub /3/i; G2 -9999/tussock grass, forb, fern, sedge/1/r
Environmental description:
Plains, clay; and lowlands

Vegetation type 3

Entry level: Sub-association (Level VI)
Mix: Pure
Level I: Tree
Level II: Open woodlands
Level III: Eucalypt open woodlands



Source:
National Land and Water Resources Audit 2001.
Data used are assumed to be correct as received from the data suppliers.

Level IV: Eucalypt open woodlands/mixed sparse shrubland/ spinifex sparse tussock grassland

Level V: ;U+ *Eucalyptus melanophloia*, *Eucalyptus crebra*, *Acacia longispicata*/tree/7/r; M *Acacia macradenia*, *Alphitonia excelsa*, *Capparis lasiantha*/shrub/3/r; G *Aristida jerichoensis*, *Eragrostis elongata*, *Eragrostis lacunaria*/ tussock grass,chenopod shrubs/2/r

Level VI: ;U1+ *Eucalyptus melanophloia*, *Eucalyptus crebra*, *Acacia longispicata*, *Corymbia terminalis*, *Eremophila mitchellii*/ tree/7/r; M1 *Acacia macradenia*, *Alphitonia excelsa*, *Capparis lasiantha*, *Carissa ovata*, *Santalum lanceolatum*/ shrub/3/r; G1 *Aristida jerichoensis* var. *subspinulifera*, *Eragrostis elongata*, *Eragrostis lacunaria*, *Eragrostis speciosa*, *Sclerolaena birchii*/tussock grass,chenopod shrub/2/r

Environmental description:
Hills on quartz sandstone

Vegetation type 4

Entry level: Association (Level V)

Mix: Mosaic

Number of vegetation descriptions:
4

Level I: Tree

Level II: Woodland

Level III: Eucalypt woodlands

Level IV: Eucalypt woodlands/mixed low tussock grassland

Level V: ;U+ *Eucalyptus populnea*/tree/7/i; M *Eremophila mitchellii*, *Geijera parviflora*/tree/4/bi; G *Aristida ramosa*, *Dichanthium sericeum*, *Themeda triandra*/tussock grass, forb/1/c

Level VI: ;U1+ *Eucalyptus populnea*/tree/7/i; M1 *Eremophila mitchellii*, *Geijera parviflora*/tree/4/bi; G1 *Aristida ramosa*, *Dichanthium sericeum*, *Themeda triandra*, *Bothriochloa ewartiana*/tussock grass, forb/1/c

Environmental description:
Mainly alluvial soils, sometimes basalt or shales

Vegetation type 5

Entry level: Sub-association (Level VI)

Mix: Dominant mosaic

Number of vegetation descriptions:
2

Level I: Tree

Level II: Woodland

Level III: Eucalypt woodlands

Level IV: Eucalypt woodlands/mixed isolated shrubs/grassy open tussock grassland

Level V: ;U+ *Eucalyptus thozetiana*, *Acacia harpophylla*, *Eremophila mitchellii*/tree/7/i; M *Capparis lasiantha*, *Carissa ovata*, *Eremophila oppositifolia*/shrub/3/bi; G *Enteropogon acicularis*, *Eragrostis lacunaria*, *Paspalidium caespitosum*/tussock grass/2/i

Level VI: ;U1+ *Eucalyptus thozetiana*, *Acacia harpophylla*, *Eremophila mitchellii*, *Geijera parviflora*, *Capparis loranthifolia*/tree/7/i; M1 *Capparis lasiantha*, *Carissa ovata*, *Eremophila oppositifolia* subsp. *rubra*, *Myoporum deserti*/shrub/3/bi; G1 *Enteropogon acicularis*, *Eragrostis lacunaria*, *Paspalidium caespitosum*, *Paspalidium constrictum*, Sporobolus actinocladus/tussock grass/2/i

Environmental description:
Scarps, residuals and tops on exposed shales under eroding Tertiary sediments

Explanation of codes in map legend

U	upper stratum
M	mid-stratum
G	lower, ground stratum
+	indicates the dominant stratum
-9999	unknown

Growth forms

Code	Description	Code	Description
T	Tree	R	Rush
M	Tree mallee	F	Forb
S	Shrub	E	Fern
Y	Mallee shrub	O	Moss
Z	Heath shrub	N	Lichen
C	Chenopod shrub	W	Liverwort
U	Samphire shrub	L	Vine
G	Tussock grass	P	Palm
H	Hummock grass	X	Xanthorrhea
D	Sod grass	A	Cycad
V	Sedge	J	Seagrass
		UNK	Unknown

Height classes

Code	Description
8	Height range > 30 m trees, vines, palms
7	Height range 10 – 30 m trees, vines, palms, mallee, mallee shrub
6	Height range < 10 m trees, vines, palms; height range 3 – 10 m mallee, mallee shrub
5	Height range < 3 m mallee, mallee shrub
4	Height range > 2 m cycads, xanthorrhoea, shrubs, heath shrub, chenopod shrub, ferns, samphire, tussock and hummock grasses, sedges, rushes, forbs
3	Height range 1 – 2 m cycads, xanthorrhoea, shrubs, heath shrub, chenopod shrub, ferns, samphire, tussock and hummock grasses, sedges, rushes, forbs
2	Height range 0.5 – 1 m cycads, xanthorrhoea, shrubs, heath shrub, chenopod shrub, ferns, samphire, tussock and hummock grasses, sedges, rushes, forbs, sod grass, liverwort, lichen, moss, seagrasses
1	Height range < 0.5 m cycads, xanthorrhoea, shrubs, heath shrub, chenopod shrub, ferns, samphire, Tussock and Hummock grasses, Sedges, Rushes, Forbs, Sod grass, Liverwort, Lichen, Moss, seagrasses
Unknown	Unknown

Cover code

Code	Description
d	Foliage cover 70–100%, crown cover 80–100%, ground cover 70–100%
c	Foliage cover 30–70%, crown cover 50–80%, ground cover 30–70%
i	Foliage cover 10–30%, crown cover 20–50%, ground cover 10–30%
r	Foliage cover < 10%, crown cover 0.25–20%, ground cover < 10%
bi	Foliage cover ~ 0% (scattered), crown cover 0–0.25%, ground cover ~ 0% (scattered)
bc	Foliage cover ~ 0% (clumped), crown cover 0–0.25%, ground cover ~ 0% (clumped)
UNK	Unknown

See *Glossary* for additional terms in legend

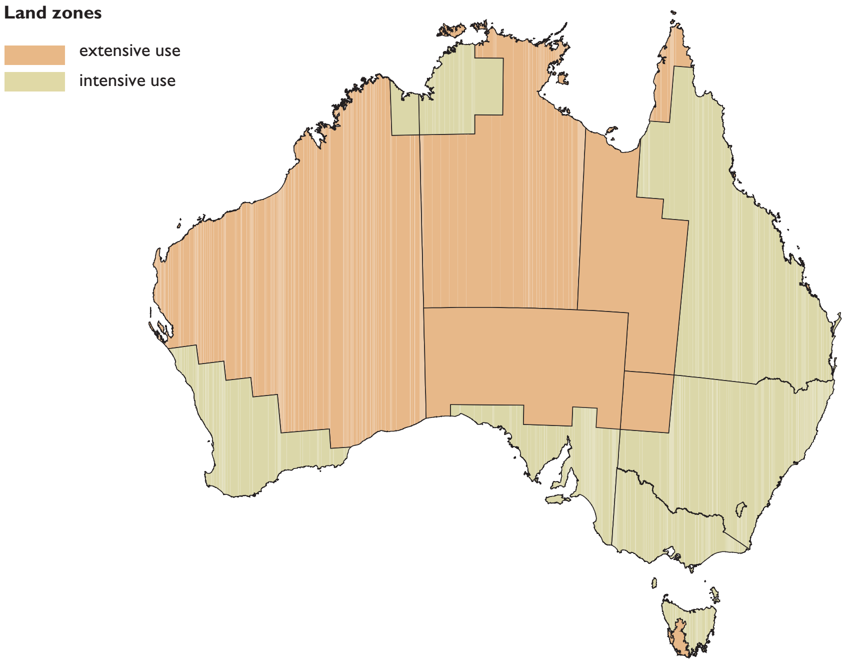
Ensuring quality in the National Vegetation Information System

Minimum requirements for the National Vegetation Information System were developed as part of the framework for data compilation. They were then implemented as part of data collation. Some key requirements include scale, currency of mapping and attribute detail.

Scale

Two scale thresholds are needed for current and future native vegetation mapping: 1:100 000 scale or finer mapping in the intensive land use zone, and 1:250 000 scale mapping or finer in the extensive land use zone (Figure 4).

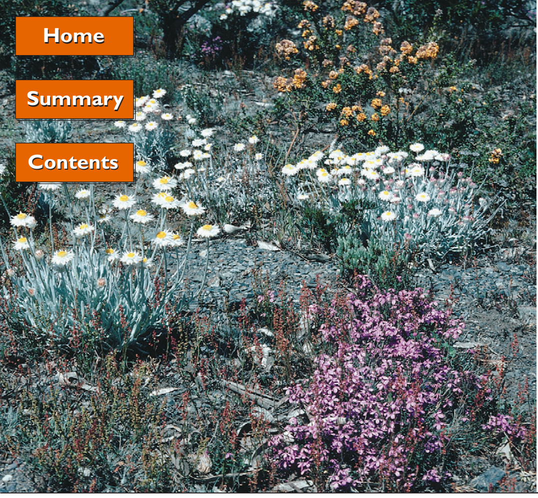
Figure 4. Intensive and extensive land use zones of Australia.



Source:

Graetz et al. 1995.

Data used are assumed to be correct as received from the data suppliers.



Helipterum albicans, Tetratheca spp., Brindabella Ranges, Australian Capital Territory

These thresholds also define the scale of data sets required for regional planning and management: greater detail is required in areas with intensive land use and clearing. Within these areas the majority of the decisions relating to natural resource and environmental management are made. They include key areas for biodiversity loss, dryland salinity, soil erosion, urban expansion and degradation to key ecosystems such as rivers and estuaries.

As a general rule, less detail and precision is required for vegetation information in the extensive land use zone either because there have been fewer human impacts or the areas are remote and not used. This extensive use zone broadly conforms with that part of Australia known as rangelands. Through the rangelands theme, the Audit has recommended a specific set of monitoring activities that build upon the scale of vegetation mapping, are compliant with National Vegetation Information System guidelines and will provide key information for the natural resource management for these lands.

For pre-European vegetation mapping 1:1 000 000 scale data was recommended as a suitable scale for broad assessments across Australia. This recognises that, compared with current vegetation mapping, relatively little spatial detail is available or possible for pre-European vegetation types.

Currency

Currency of present vegetation mapping compiled in the National Vegetation Information System was specified to a minimum of 1997 for undertaking a year 2000 data compilation exercise. This applies equally to maps (spatial units) and associated attributes. Application of this threshold is flexible and depends on rate of land use change for a region (e.g. preferably a region undergoing rapid changes to the native vegetation should have its vegetation information updated on an annual or biannual basis to ensure change is monitored and the community kept up-to-date with major issues such as the extent of clearing and location and size of areas of remnant vegetation).

Attributes

Level V (vegetation association) of the National Vegetation Information System hierarchy was specified as the target for incorporating native vegetation data into the National Vegetation Information System. The Level V target defines the detail required by decision makers such as those involved in regional planning and management.

The Australian Vegetation Attributes, Version 5.0 (NLWRA 2000a) identified 81 mandatory attributes to be compiled for each data set. Mandatory attributes were grouped into four categories:

- Ma: Mandatory required for National Vegetation Information System hierarchy
- Mb: Mandatory required for data quality
- Mc: Other essential information required to define a data set
- Md: National attributes (e.g. National Vegetation Information System identification)

Great Cumbung Swamp

Implementing the National Vegetation Information System

Data compilation

Guidelines for classifying Australia's vegetation were agreed and potential sources of vegetation mapping for inclusion in the data collation program were documented. Each State and Territory nominated vegetation maps to be used, preferably those that met minimum requirements of the National Vegetation Information System. Where mapping was unable to comply with standards but otherwise provided an important coverage of part of a State, the best available mapped information was provided as 'interim coverage'.

State and Territory compilation activities were supported by expert advice on translation and interpretation of vegetation mapping and on information products required by decision makers.

Activities were constrained by available financial resources and time frames. Time frames were extended by a year beyond that specified in the Audit strategic plan, doubling the actual resources dedicated to the initiative. Data sets incorporated into the National Vegetation Information System are summarised in Appendix 8; methods used to implement the various components of the framework are documented in Appendix 9.

Quality assurance

Activities in building, checking, editing, documenting and finalising the database (Version 1) for Levels I–III included:

- reviewing and resolving loading errors from the data compiler to the database;
- providing data custodians with detail of errors and requesting resupply of outstanding map units;
- preparing plots of Levels I–III to visualise the data and attempt to resolve spatial errors;
- checking database entries against known code sets; and
- incorporating changes into the database in consultation with data custodians.

The majority of inconsistencies in classification and mapping across jurisdictions were unable to be resolved with data custodians in the time frame for the project. This required an intensive process of consultation with vegetation experts across each jurisdiction resulting in a resolution to change vegetation descriptions and mapped boundaries.

Version 1 of the database was used in the development of products for the Australian National Vegetation Assessment 2001.

Information gaps

Detailed vegetation mapping available for the 2001 assessment was incomplete for the entire continent and a number of gaps occur in our knowledge and on the coverage at regional scales (see *Knowledge, data and information gaps* section). An analysis of these gaps by users provides a rigorous basis for setting priorities for further investment in native vegetation mapping.

Reporting on Australia's native vegetation

Additional, readily available information was compiled to develop the major vegetation groups to enable Australia-wide assessments.

The assessments of the status and extent of Australia's native vegetation detailed in this report have been based on information from the National Vegetation Information System as well as sourcing other information to complete the assessment of Australia's present and pre-European vegetation.

The level of detail that can be used to describe the vegetation at broad scales constrained the description of Australia's vegetation to:

- 23 major vegetation groups; and
- a further 42 major vegetation subgroups being developed.

These products are designed for broad use at national and State-wide scale and are very useful for simple vegetation descriptions at regional scales. Appendix 10 outlines the development of these groups.

Within these limitations these assessments have provided the first hierarchical classification of Australia's native vegetation at an Australia-wide scale with the ability to access comparable finer-scale regional information where it exists.

Version control

The long-term success of the National Vegetation Information System is based on continuing collaboration and partnership with all States and Territories. The first steps are complete and Australia has an agreed set of attributes and systems for transferring, storing, validation, analysing and reporting vegetation information.

A review of these guidelines and systems and incorporation of identified changes will ensure that the National Vegetation Information System is a success in the long term. As new information is collected and existing data is compiled, validated and updated, the National Vegetation Information System will continue to change and improve. Through the development process, it has become evident that a national coordinator is vital to support activities of data custodians and continue the coordination and facilitation role of the Audit. This coordinator would:

- continually improve and manage the National Vegetation Information System framework;
- evaluate and develop improved systems for storage and reporting of data and their progressive implementation by all data custodians;
- oversee and validate data and information as new versions and information products are developed; and
- coordinate and disseminate technical advances in vegetation mapping.

AUSTRALIA'S NATIVE VEGETATION: type, extent, change

Alpine community, summit of Mount Wellington, Tasmania

Assessing the status of native vegetation

This section provides an assessment of the status of our native vegetation. This assessment is now feasible because of the investment made in collating, in a relatively seamless fashion, a vast array of native vegetation mapping data collected in the proceeding 15 years by a number of initiatives across Australia. In total, the National Vegetation Information System has combined mapped information from over 100 projects, involving 25 agencies to make this assessment possible.

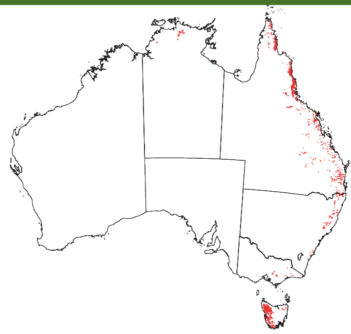
The first part of this assessment involves gaining an overall appreciation of Australia's native vegetation prior to European settlement. This is an inferred but necessary part of the landscape jigsaw if we are to understand changes brought about by our land use and management activities, and develop options and opportunities for managing remaining native vegetation.

The assessment then provides detail of Australia's remaining native vegetation—those native vegetation remnants left after 200 years of vegetation clearing and development of Australia's soil and water resources to support our industries and provide an economic return. As well as presenting the Australia-wide analysis, examples of change and native vegetation remaining are illustrated demonstrating the richness of the National Vegetation Information System and its applicability to regional scale issues.

The grouping of Australia's complex vegetation into 23 major vegetation groups details the vegetation types we have lost and in what amounts across the Australian landscape. Analysis is provided in this assessment both nationally and by State and Territory for all major vegetation groups.

This information provides the first Australia-wide understanding of some of the opportunities for native vegetation management. Two applications are demonstrated:

- native vegetation fragmentation and therefore, how to use the information base to assist in developing priorities for native vegetation landscape repair; and
- nature conservation—what and where are the major vegetation groups protected, again providing information to assist in setting priorities for further nature conservation activities, through protection of vegetation in reservations or through increased attention to native vegetation management.



MAJOR VEGETATION GROUPS

The large number of vegetation types and the complexity of considering co-dominant and subdominant vegetation, necessitated the development of a simpler classification for reporting on Australia's native vegetation at national and State/Territory scales. The major vegetation groups were derived by aggregating the vegetation information according to a grouping of major vegetation types from Levels I to VI and other mapped information.

The major vegetation groups classification contains different mixes of plant species within the canopy, shrub or ground layers, but are structurally similar and are often dominated by a single genus.

Each major vegetation group is presented as a fact sheet (see *vegetation profile fact sheets*) including general descriptions of each group plus information on:

- distribution;
- change since settlement by Europeans;
- key values; and
- management considerations.

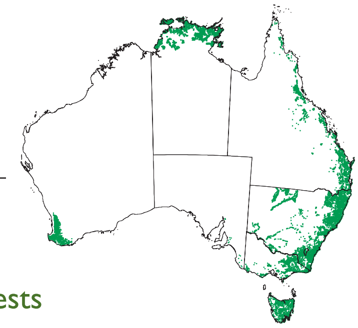
Rainforest and vine thickets

- Closed forests characterised by dense foliage and a large diversity of plant species
- Mostly confined to the wetter areas or climatic refuges in eastern Australia, with some in the semi-evergreen vine thickets of the Brigalow Belt and the monsoonal vine thickets of the seasonal tropics of northern Australia
- Extent varies from a few hectares in sheltered gullies to hundreds of square kilometres in a mosaic, often with wet sclerophyll forests
- Community types include cool temperate rainforest, subtropical rainforest, tropical rainforest, vine thickets, and semi-deciduous and deciduous vine thickets

Rainforests were cleared extensively in the late nineteenth and early twentieth centuries for high value timbers, dairying, tobacco/sugar cane or other agricultural production.

Upper slopes Mount Bellenden Ker, Queensland

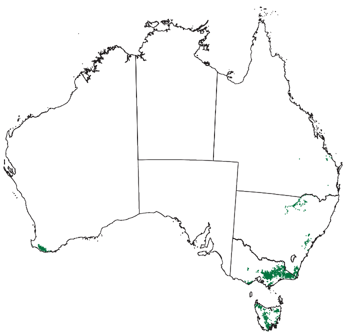

Karri tall forest, Pemberton, Western Australia



Eucalypt tall open forests

- Stand over 30 m tall and reach heights of 100 m
- Restricted to all but the wetter areas of eastern Australia from the margins of the wet tropical rainforests of north Queensland to Tasmania, and the south-west of Western Australia, often in rugged mountainous areas
- Typified by a well-developed, often broad-leaved shrubby understorey or sometimes tree ferns
- Mostly found adjacent to, or in association with, rainforest communities

Extensive areas of these communities were cleared for agriculture and grazing early in the twentieth century, particularly where they occurred on flatter topography in areas associated with better agricultural soils. Major areas remain today in crown reserves as state forests or national parks.



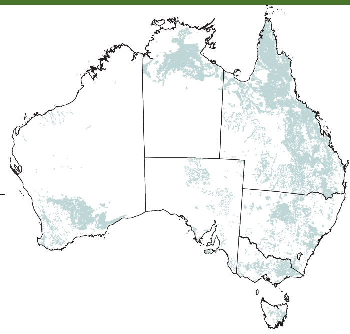
Eucalypt open forests

- Vary from 10 m to 30 m in height
- Widespread along the subcoastal plains and foothills and ranges of the Great Dividing Range in eastern Australia; and the subcoastal ranges of the south-west of Western Australia
- Generally have a shrubby understorey which is low to moderate in height, but in drier sites they may have a grassy understorey with scattered shrubs and/or cycads

Clearing of these communities for grazing and agriculture in the major agricultural zones of eastern Australia and the south-west of Western Australia has been widespread. The rate of clearing in these communities by the early twentieth century saw the development of crown reserves for the protection of forests, either as national parks or as production forests, and the establishment of forestry departments within several jurisdictions.


Mount Field National Park, Tasmania

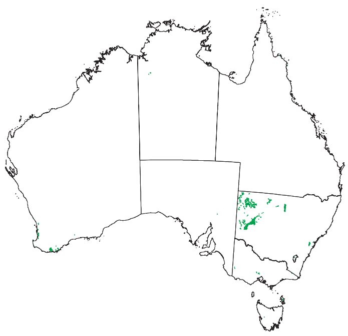
Low open eucalypt forest (*Eucalyptus maniffera*), Wee Jasper, New South Wales



Eucalypt low open forests

- Grow on less favourable sites (e.g. under extreme cold, such as in sub-alpine areas, dryness, heath and steep rocky slopes)
- Can vary from 5–10 m in height
- Eucalypt species may be the same as those occurring in the nearby more favourable sites, which support open forests. In other stands of low open forests the dominant species may include a gradation in species type with change in growing constraints (e.g. the snow gum (*Eucalyptus pauciflora*) in sub-alpine areas)
- Exhibit a variety of subforms, with understoreys ranging from low trees and shrubs to tussock grasses or, in some cases bare ground

Some of this vegetation has been cleared. The remaining restricted areas may be relatively intact as a result of the extremes in site conditions.



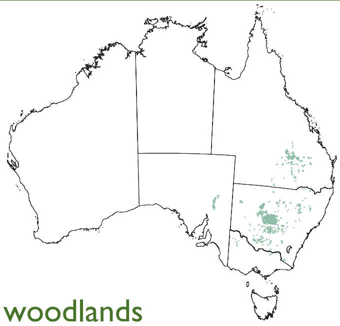
Eucalypt woodlands

- Form a transitional zone between the higher rainfall forested margins of the continent and the hummock grasslands and shrublands of the arid interior
- Widespread throughout the mountain ranges and plains west of the Great Dividing Range in eastern Australia and east of the subcoastal ranges of south-west Western Australia
- Includes a series of communities, which have come to typify inland Australia (e.g. the box and ironbark woodlands of eastern Australia)

The eucalypt woodlands have been the most extensively cleared and modified, particularly in the agricultural zones of eastern Australia and in south-west Western Australia. In many regions only small isolated fragments remain, in many instances found only along creeks and road verges.

Eucalypt grassy woodland, near Suggan Buggan, Victoria

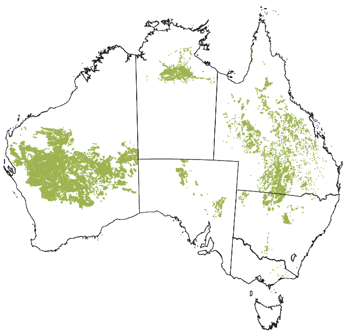
Acacia aneura woodland near Yenloora, Queensland



Acacia forests and woodlands

- Trees are stunted (often less than 10 m); in some areas they can grow to heights of 25 m
- Dominant species include lancewood (*Acacia shirleyi*), bendee (*A. catenulata*), mulga (*A. aneura*), gidgee (*A. cambagei*) and brigalow (*A. harpophylla*). The most widespread species are mulga and brigalow
- Climatic conditions are generally dry, hot summers, with cool to warm winters

The mulga and brigalow communities of eastern Australia have been extensively cleared for grazing and agriculture. Mulga communities in the arid interior have not been cleared to the same degree but many areas have been modified by the grazing of cattle/sheep and feral animals, and increased macropod populations supported by access to water from bores.



Callitris forests and woodlands

- Found mostly in a series of discrete regions, notably in the Brigalow Belt, but also in the arid areas in South Australia and in association with mallee communities near the South Australia – Victoria border
- Generally dominated by an herbaceous understorey with only a few shrubs
- Associated tree species include mulga (*Acacia aneura*), wilga (*Geijera* spp.), sugarwood (*Myoporum* spp.) and buloke or belah (*Casuarina* spp.). Associated shrub species include *Eremophila, Dodonaea*, chenopods such as *Atriplex, Maireana, Sclerolaena* and grasses such as *Triodia, Plectrachne, Aristida* and *Austrostipa*

Extensive areas have been cleared for grazing in the Brigalow Belt and in the Mallee bioregions in particular, but major areas are included in State Forests and other crown reserves in Queensland and New South Wales.

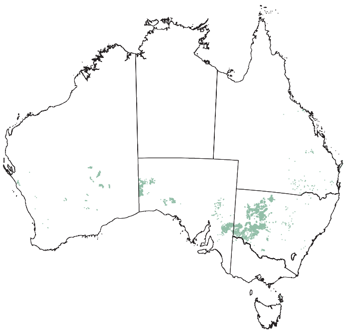
Callitris glaucophylla woodland, Snowy River National Park

Melaleuca quinquenervia, roadside swamp, Bellingen, New South Wales

Casuarina forests and woodlands

- Occur primarily on littoral and riverbank sites along the south-eastern, eastern and northern coast of Australia and on rocky sites throughout the continent
- In other inland areas casuarina occurs in association with acacia and eucalypts
- Containing both *Casuarina* and *Allocasuarina* genera, these occur in a series of quite distinct communities, notably foredune (*C. equisetifolia*) communities, swamp (*C. glauca*) communities, riverine (*C. cunninghamiana*) and desert (*C. cristata*) communities

These communities have been extensively cleared in many coastal areas for agriculture, or for industrial or urban developments. Areas in the arid zone are subject to modification by grazing of domestic stock and from feral herbivores.

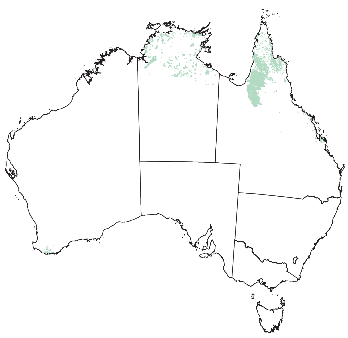


Casuarina cristata ssp. *pauper* woodland, Carrawinya National Park, Queensland

Melaleuca forests and woodlands

- Cover substantial areas in the tropical north but are also found in temperate climates most often in or adjoining coastal or montane wetlands. Monsoonal melaleuca woodlands are found in the Northern Territory and in far northern Queensland on the areas adjacent to the Gulf of Carpentaria and on the Cape York Peninsula
- Dominated by broad-leaved paperbark (*Melaleuca viridiflora*)
- In southern and eastern Australia the melaleucas are confined largely to the wetter watercourses and swamps with the paperbarked tea-tree (*M. quinquenervia*) the most widespread coastal species
- In Western Australia the melaleuca forests and woodlands are restricted to pockets in specific sites, such as the swamp paperbark (*M. preissiana)* on subcoastal swamp areas and *M. rhaphiophylla* on creeklines and watercourses

These communities have been extensively cleared on coastal floodplain areas for agriculture or housing near major cities. Extensive areas remain in the tropical north, in particular southern Cape York Peninsula.

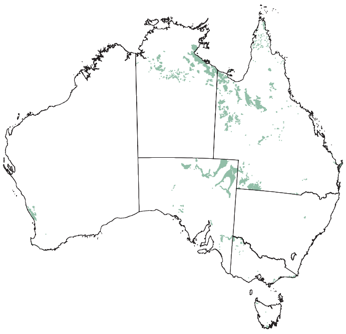


Open wandoo woodland, near Frankland, Western Australia

Other forests and woodlands

- Diverse group of communities, some of which (e.g. banksia woodland and *Leptospermum* forests) are comparatively restricted in their extent but may be locally abundant
- Includes a series of mixed communities of the arid zone which are not dominated by any particular species
- Exhibit a variety of subforms, with understoreys ranging from low trees and shrubs, to low shrubs and to tussock grasses

These communities have been extensively cleared in many coastal areas for agriculture or urban uses. Extensive areas remain in the arid zone but are subject to modification by grazing of domestic stock and from feral herbivores.



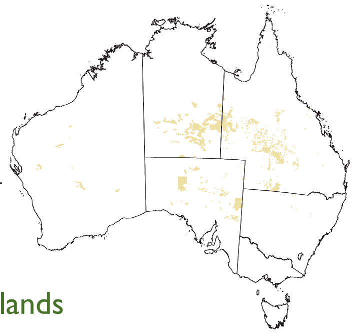
Terminalia fitzgeraldii, Kimberley, Western Australia

Eucalypt open woodlands

- Characterised by broad spacing between canopy trees so that in many areas the understorey appears more dominant in the landscape
- Very extensive, particularly in the semi-arid interior and the tropics, and cover many dry inland plains and downs and some rocky outcrops
- Contain many of the eucalypt species that occur in eucalypt woodlands
- *Acacia* and *Ventilago* are co-dominants in the northern areas; *Callitris* and *Casuarina* in the inland areas and *Banksia* in the rocky and sandstone areas
- Understorey varies from shrubs, heaths, tussock grasses and hummock grasses. Tussock grasses associated with the open woodlands include *Sorghum, Heteropogon, Chrysopogon, Bothriochloa, Aristida, Themeda, Heteropog*on and *Australiarostipa.* Variation in understorey reflects the variety of climatic zones and site conditions supporting these woodlands

Large areas have been cleared in the south east and far south west of Australia for cereal cropping and grazing. In the northern parts of Australia they have been modified by pastoral activities and changed fire regimes.

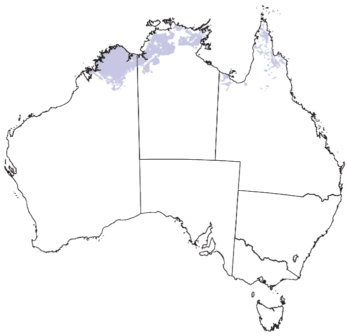

Eucalyptus tetrodonta woodland, annual *Sorghum* spp. grassland, Northern Territory



Tropical eucalypt woodlands/ grasslands

- Contains the tall bunch-grass savannas of north Western Australia and related eucalypt woodlands and eucalypt open woodlands communities in the Northern Territory and in far north Queensland, including Cape York Peninsula
- Woodlands include a mix of species—*Eucalyptus tectifica* (Darwin box), *E. tetrodonta* (Darwin stringybark), *E. miniata*, *Corymbia foelscheana*, *C. latifolia*, *C. flavescens*, *C. polycarpa*, *C. nesophila*, *C. clarksoniana*, *C. grandifolia*, *C. bleeseri*, *C. ferruginea*, *Erythrophleum chlorostachys*
- Savannas and understorey typified by a suite of tall annual grasses (notably *Sorghum* spp.) but does not include communities in more arid sites where *Triodia* spp. become more dominant

Much of the occurrence is within Indigenous-held lands and most of the vegetation type is in substantially natural condition except for some grazing pressure, changes in fire regime and weed infestation.



Acacia open woodlands

- Usually occur in low undulating inland areas, with mainly summer rainfall (northern) and winter rainfall (southern)
- Cover extensive areas of the arid zone or drier tropical north mostly with a shrubby or grassy ground layer
- Dominant acacias include mulga (*Acacia aneura*), Georgina gidgee (*A. georginae*), *A. tephrina*, *A. cambagei*, *A. harpophylla* (brigalow), *A. peuce* and *A. papyrocarpa*
- The most widespread species is mulga (*A. aneura*)
- The ground layers are generally herbaceous or chenopod shrubs such as *Atriplex, Maireana, Sclerolaena* and grasses such as *Triodia, Eragrostis, Plectrachne, Aristida* and *Austrostipa*

Little of this group has been cleared but many areas have been subject to modification by grazing of domestic stock and from feral herbivores.

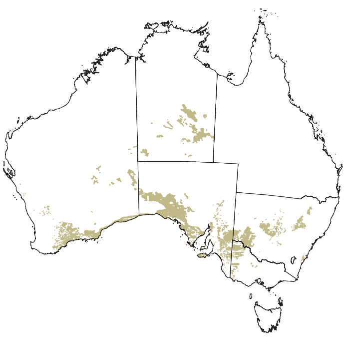

Acacia aneura, Eremophila bowmanii, near Yenloora, Queensland

Mallee (*Eucalyptus gracilis*, *Beyeria opaca*, *Triodia* sp.) Calperum, near Renmark, South Australia

Mallee woodlands and shrublands

- Grow from lignotubers and are multi-branched trees found in harsh site conditions usually with a flattened canopy which, in windswept coastal areas of Australia, can be stunted or angled
- Located in the winter rainfall belts of semi-arid areas of southern Australia, in south-western New South Wales, north-western Victoria, southern South Australia and south-western Western Australia
- Widespread mallee species include *Eucalyptus Dumosa* (white mallee), *E. socialis* (red mallee), *E. gracilis* (yorrell), *E. oleosa* (red mallee), *E. incrassata* (ridge-fruited mallee) and *E. diversifolia* (soap mallee)
- Eucalypt is the most widespread tree component. It rarely exceeds 6 m in height. Codominants can include species of *Melaleuca, Acacia* and *Hakea* in areas such as the Big Desert in Victoria, the Ninety Mile Desert, parts of Eyre Peninsula and in the wheatbelt and southern coastal areas of Western Australia

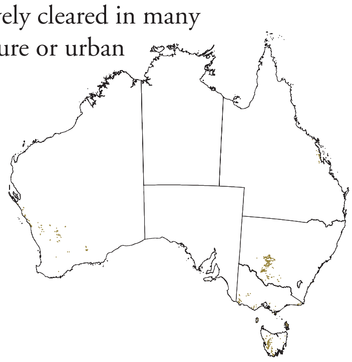
Mallee communities in Victoria and parts of South Australia have been extensively cleared, with only isolated remnants remaining in some areas. These communities are still widespread in the arid zone of South Australia and Western Australia but are subject to modification by grazing of domestic stock and from feral herbivores.



Low closed forests and closed shrublands

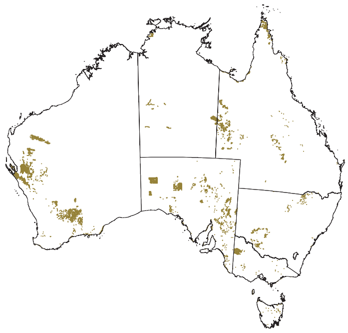
- Characterised by dense foliage in the upper layers and by low stunted species usually between 5 m to 10 m in height and are sometimes referred to as 'scrubs'
- Occur in a range of climatic zones, but many occur within coastal or subcoastal environments dominated by *Banksia*, *Leptospermum* and *Kunzea* species or *Melaleuca* with a mix of other species. A few occur in alpine environments in Tasmania
- Support a large range of species, partly as a result of their geographical range and partly from the variation in soils and site conditions

They have been extensively cleared in many coastal areas for agriculture or urban development.



Coastal melaleuca, Bournda National Park, New South Wales

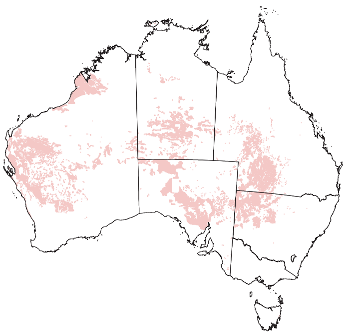
Acacia ligulata, South Australia



Acacia shrublands

- Typified by an overstorey dominated by multi-stemmed acacia shrubs
- Occur mainly in temperate semi-arid and arid regions of Australia, although they also extend into the tropical arid regions of north-west Queensland and eastern Northern Territory
- Occur mainly on extensive undulating plains and downs, low hills and valleys of range country
- Climatic conditions are generally dry, hot summers, with cool to warm winters
- Dominated by mulga (*A. aneura*), gidgee (*A. cambadgei*) and mixed species communities of the central Australian deserts, but it also includes a series of other desert acacia communities
- Associated species include grevilleas, emu bushes (*Eremophila* spp.) and a wide range of chenopod species from the *Atriplex, Maireana, Sclerolaena* genera and *Senna* spp.

Little of this group has been cleared outside the major agricultural zones, but they have been subject to modification by grazing from domestic stock and feral herbivores, introduction of exotic weeds (e.g. buffel grass) and from altered fire regimes.



Other shrublands

- Dominated by a broad range of shrub species that may include mixed species communities and mosaics of several communities. They do not fit well in other shrubland groups
- Dominated by a range of genera including *Allocasuarina* (in some States and Territories still *Casuarina), Banksia, Bursaria, Dodonaea, Eremophila, Grevillea, Kunzea, Leucopogon, Muehlenbeckia, Persoonia, Thryptomene, Neofabricia, Nitraria,* and *Melaleuca* spp.

This group has been extensively cleared in the agricultural regions and in coastal areas adjoining major cities. In the arid zone, little of this group has been cleared but many areas have been subject to modification by grazing by domestic stock and feral herbivores.

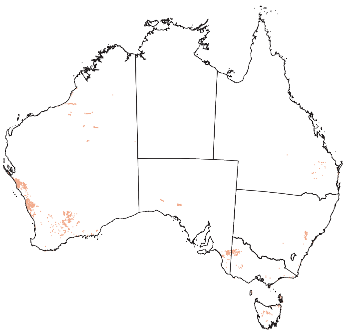
Lake Augusta, Central Plateau, Tasmania

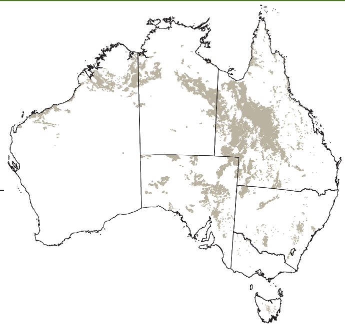
Banksia aemula, north of Coffs Harbour, New South Wales

Heath

- Open, closed or mixed shrublands dominated by plant genera typical of infertile or waterlogged sites, generally within the coastal, montane, sandy soils or laterite soils
- Includes stunted (< 1 m tall) vegetation, typified by the family *Epacridaceae* and also other dense low shrublands in subcoastal or inland environments
- Dominant genera include *Allocasuarina, Baekea, Banksia, Calytrix, Hakea, Epacris, Grevillea, Leptospermum, Melaleuca, Leucopogon, Prostanthera, Richea* and *Xanthorrhoea*

The communities have been cleared for sand mining, agriculture and urban development.





Tussock grasslands

- Contain a broad range of native grasslands from the blue grass and Mitchell grass communities in the far north to the temperate grasslands of southern New South Wales, Victoria and Tasmania
- Contain many widespread genera including *Aristida*, *Astrebla*, *Austrodanthonia*, *Austrostipa*, *Chrysopogon*, *Dichanthium*, *Enneapogon*, *Eragrostis*, *Eriachne*, *Heteropogon*, *Poa*, *Themeda*, *Sorghum* and *Zygochloa* and many mixed species communities

Extensive areas of this group have been cleared and replaced by exotic pasture species. Most other areas have been subject to modification by grazing, weed invasion and land management practices associated with grazing domestic stock (e.g. frequent fire and the application of fertilisers).

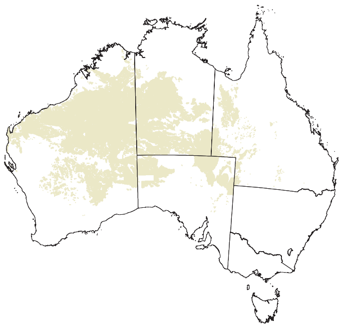
70 km south west of Blackall, Queensland

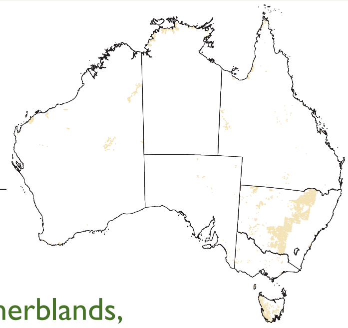
Eucalyptus terminalis, Triodia basedowii, Acacia ligulata, Cassia nemophila, north-west of Warri Gate, Queensland

Hummock grasslands

- Hummock forming evergreen perennials that appear as mounds up to 1 m in height. In between the mounds or hummocks the ground is usually bare or exposed
- Typified by spinifex (*Triodia* spp. and *Plechrachne* spp.) communities of the arid lands that are characteristic to the Australian outback
- Cover extensive areas either as the dominant growth form with the occasional emergent shrub or small tree (either acacia or eucalypt)
- Also a conspicuous element of other communities (e.g. open woodlands)

Little of this group has been cleared but many areas have been subject to modification by grazing by domestic stock and feral herbivores.





Other grasslands, herblands, sedgelands and rushlands

- Dominated by non-woody or herbal species (e.g. grasses, sedges, rushes, ferns or a mixture of these). The sedgelands and rushlands are often referred to as wetlands communities and support a large range of species, partly as a result of geographical range and partly as a result of the variation in soils and site conditions
- Occur on a range of sites from shallow soils to seasonally inundated areas both saline and freshwater (e.g. sedgelands are located on seasonally or periodically inundated waterlogged and wet areas). Ferns tend to dominate specific humid areas where the environment is less variable between seasons

Generally, many of these communities have persisted as they tend to occur on extreme sites. Changes that have occurred tend to be related to the effects on the flora and fauna species of different hydrological conditions, changes to fire regimes, impacts from feral animals and localised tourism.

Turtle Lagoon, Blue Lake National Park, North Stradbroke Island, Queensland

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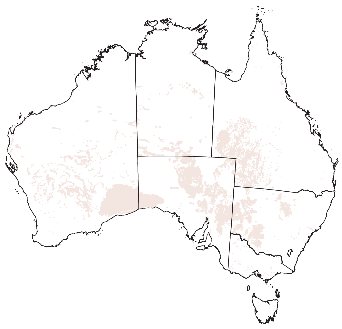
Chenopod shrubland, Western Australia,

Chenopod shrubs, samphire shrubs and forblands

- Overstorey is dominated by a range of hardy low shrub species
- Widespread in the near-estuarine, arid and semi-arid areas and occur generally as extensive flats
- Site conditions tend to affect the type of shrub species that occur within these communities
- In damp and waterlogged areas (e.g. on drainage areas and fringing salt lake areas) samphires dominate the overstorey
- Species in samphire communities include *Halosarcia*, *Salicornia*, *Sclerostegia* and *Sarcocornia* genera
- Species in chenopod communities are drought and salt tolerant and include the *Sclerolaena*, *Atriplex* (salt bush), *Maireana* (blue bushes, cotton bush), *Chenopodium* and *Rhagodia* genera

Generally these communities have remained intact since European settlement. In some cases the communities have increased in extent because of increased salinity and waterlogging. Foremost among threats for coastal occurrences are infilling for urban areas, changes to tidal regimes and isolation from the estuary by roads and infrastructure.



Chenopod shrubland

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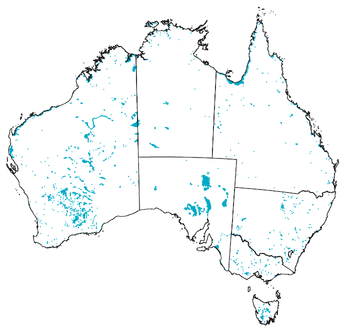
East of Lake King, Western Australia

Mangroves, tidal mudflats, samphires, claypans, salt lakes, bare areas, sand, rock, lagoons, freshwater lakes and reservoirs

- Occur over a wide range of site conditions, from near coastal and estuarine to salt lakes and freshwater lakes
- Mangroves vary from extensive tall closed forests communities on Cape York Peninsula to low closed forests or shrublands in southern regions
- Samphires are found in the coastal mudflats and marine plains, adjoining mangrove areas in many instances, but also cover extensive marine plains inland from the southern Gulf of Carpentaria and other parts of the tropical north
- Extensive areas devoid of vegetation can be found as bare ground, either sand dune, claypans or salt lakes in the harsh environments of the arid interior
- Coastal sand masses can often contain extensive areas of bare sands, mostly as active dunes

Widespread clearing or infilling of mangroves and tidal mudflats has occurred in coastal areas near urban major centres for industrial uses or urban developments.




Rhizophora stylosa, Cape Tribulation, Queensland

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Wetlands at Fogg Dam, Northern Territory

PRE-EUROPEAN VEGETATION IN AUSTRALIA

Key findings

Australia's vegetation has been in a state of dynamic change throughout geological history, responding to major shifts in environmental conditions associated with continental drift, periods of intense geological activity such as volcanism and climate change during the Quaternary. The dominance of certain morphological features of Australian plants such as sclerophylly, and the success of genera that have developed such water-saving features, underlines the adaption of the Australian flora to increasing aridity.

Structural vegetation types vary across the Australian continent, reflecting climatic and edaphic patterns, with rainfall a key factor limiting distribution (e.g. of certain closed forests or rainforest communities).

Australian vegetation has many unique features:

- many species are endemic to Australia; and
- two large tree and shrub groups—the eucalypts and acacias—dominate. These groups also contain a large number of species, an indication of their diversity and adaptation across the broad range of climatic and edaphic conditions.

The high numbers of vegetation types at the association and sub-association levels (Levels V and VI in the National Vegetation Information System information hierarchy) indicate a high level of diversity in Australia's vegetation. According to our current knowledge, there are more than 3000 vegetation types described across Australia and these have been summarised into 23 major vegetation groups for reporting (Figure 5, Table 2).

- Forests and woodlands covered approximately 50% of the continent across tropical northern Australia, down the higher rainfall eastern side of Australia, Tasmania, to southern South Australia and southern Western Australia. Eucalypt woodlands make up the largest proportion, approximately 13% of Australia.
- Shrubs and heaths covered approximately 11% of the continent. Key distributions of acacia shrublands were in south-western Queensland, central South Australia, southern Northern Territory and on the west coast of Western Australia up the central coast to Broome. The main distribution of heaths was in Western Australia in the Geraldton Hills region.
- Grasslands, chenopods and samphire shrubs covered approximately 40% of the continent across much of the mainland interior and western Tasmania. The hummock grasslands covered 23% of Australia, west of Queensland and New South Wales.
- There was little bare soil apart from the areas that were sparsely vegetated in the semi-arid and arid regions.
- Surface waters, including salt lakes, occupied less than 2% of the continent.

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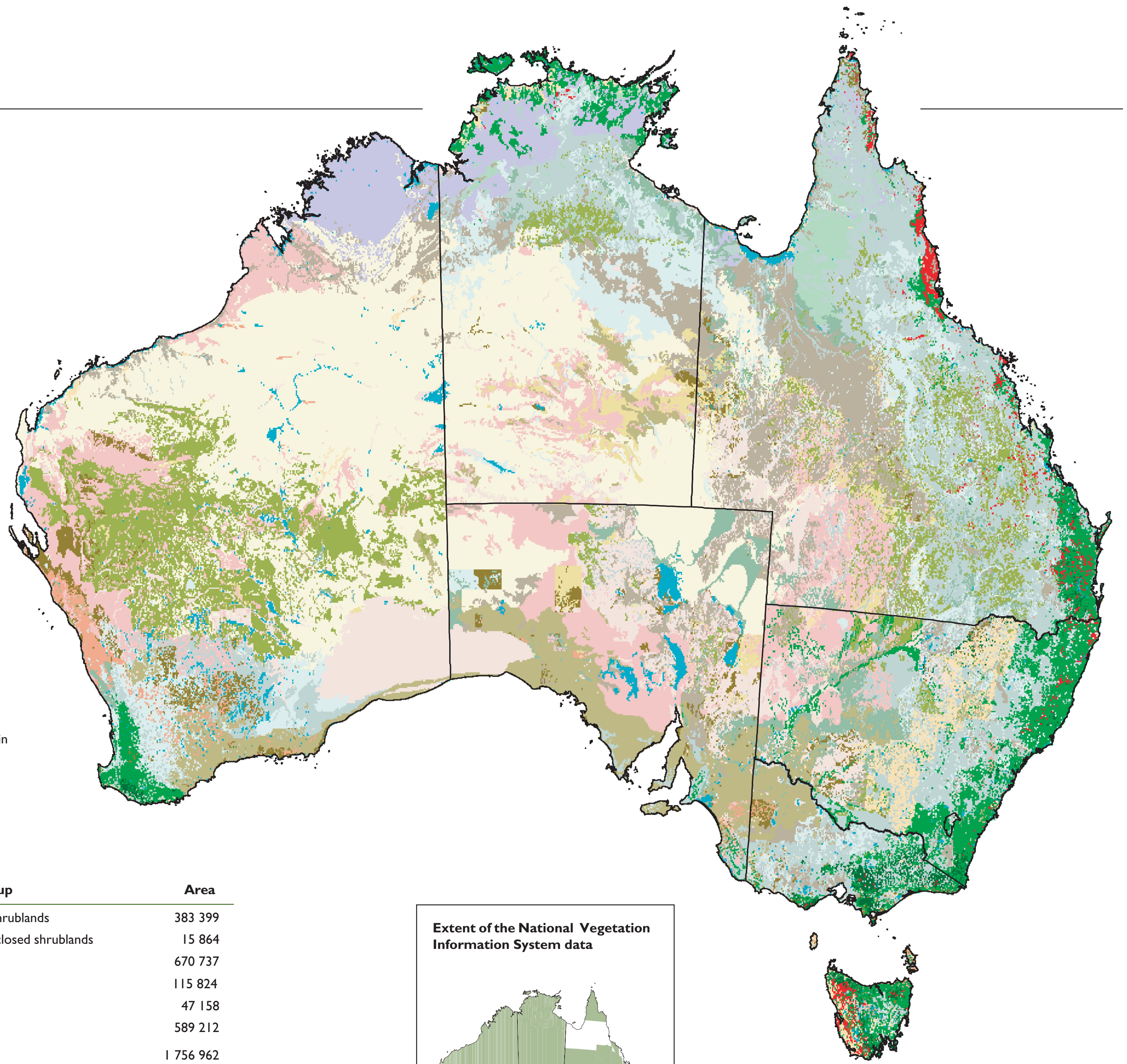
Figure 5. Pre-European major vegetation groups.

- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

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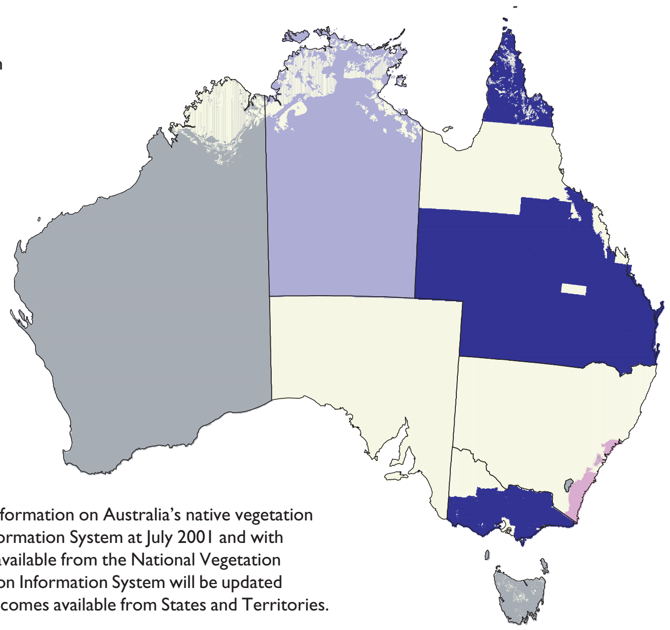
Extent of the National Vegetation Information System data

Table 2. Area (km^2) of pre-European major vegetation groups.

Major vegetation group	Area	Major vegetation group	Area
Rainforest and vine thickets	43 493	Mallee woodlands and shrublands	383 399
Eucalypt tall open forests	44 817	Low closed forests and closed shrublands	15 864
Eucalypt open forests	340 968	Acacia shrublands	670 737
Eucalypt low open forests	15 066	Other shrublands	115 824
Eucalypt woodlands	1 012 047	Heath	47 158
Acacia forests and woodlands	657 582	Tussock grasslands	589 212
Callitris forests and woodlands	30 963	Hummock grasslands	1 756 962
Casuarina forests and woodlands	73 356	Other grasslands, herblands, sedgelands and rushlands	100 504
Melaleuca forests and woodlands	93 501	Chenopod shrubs, samphire shrubs and forblands	563 389
Other forests and woodlands	125 328	Mangroves, tidal mudflats, samphires and bare areas, claypan, sand, rock, salt lakes, lagoons, lakes	112 063
Eucalypt open woodlands	513 943		
Tropical eucalypt woodlands/grasslands	256 434		
Acacia open woodlands	117 993		

Figure 6. Pre-European major vegetation groups data set classification detail.



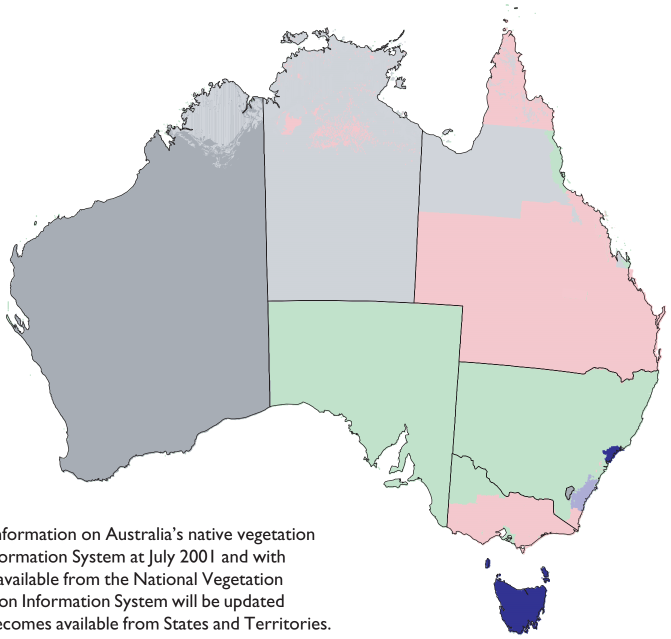
Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure 7. Pre-European major vegetation groups data set scale.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Methods

Pre-European vegetation of Australia has been reconstructed using a variety of interpolation and modeling techniques from mapping and information on the present types and extent, historical records and early aerial photographs. It is assumed that Australia had experienced no significant clearing other than changes due to fire regimes prior to European settlement.

The underlying data used to describe the pre-European vegetation is in many cases the same as that representing the present vegetation. Some States and Territories have assumed that vegetation types mapped as pre-European vegetation also approximate the present vegetation.

This presents varying problems in interpreting changes in vegetation. There are very few areas in Australia that have not undergone some modification in species or structure following European settlement (e.g. changes in fire regime). Australian scientists are still developing systems and techniques to assess the condition and changes to condition of native vegetation.

In South Australia, New South Wales and Tasmania the pre-European vegetation is presented as an interim product to be used at broad State and national scales. In South Australia and New South Wales, adding the present vegetation data from the National Vegetation Information System to the available pre-European mapping provided the source for the pre-European major vegetation groups. In Tasmania the data set was derived from modeling techniques and has yet to be finalised.

The major vegetation groups that are mapped, represent the dominant vegetation occurring in a particular area.

Applications

The inferred pre-European vegetation mapping can provide:

- a broad baseline to document change in the extent and type of native vegetation;
- information to assist in understanding the landscape for management and conservation of biodiversity;
- an understanding of native vegetation cover which, coupled with details on Australia's soils, topography and climate variability assists construction of a modelled; assessment of natural soil erosion. This then allows us to understand changes in soil erosion patterns that have accompanied land use and are now impacting on the condition of our rivers, estuaries and near shore zones (NLWRA in prep.);
- species and vegetation community information to assist in regional revegetation activities; and
- information to assist in understanding changes in water balance, the key driver of dryland salinity (NLWRA 2001a) and changes in catchment surface water hydrology (NLWRA 2001b).

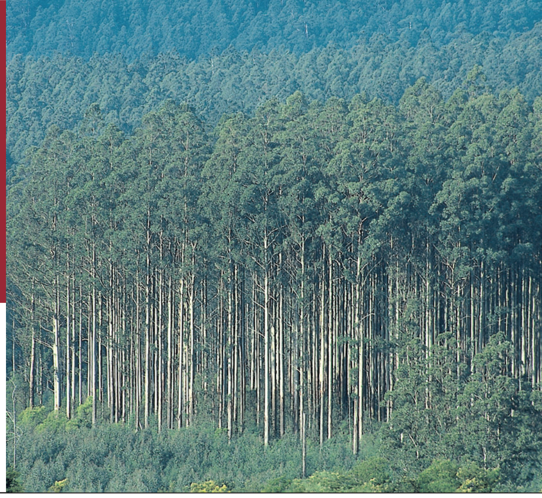
Limitations

The variety of methods used to map pre-European vegetation, the scale of some of the data and the difficulty of mapping in fragmented landscapes has resulted in an Australia-wide map which presents a combination of very broad and detailed mapping.

Queensland, Western Australia, Victoria and the Northern Territory National Vegetation Information System data have the greatest reliability. The New South Wales, South Australia and Tasmanian data are interim products and provide a broad scale view of Australia's pre-European vegetation.

The *Guidelines* section of this report provides guidelines on the use of the information and Appendix 8 presents information on the sources of data that have been collated into the National Vegetation Information System to represent Australia's pre-European vegetation including the extent, scale and date of collection.

Figures 6 and 7 provide information on the location and extent of data sets, their scale and level of classification used to develop the major vegetation groups.



NATIVE VEGETATION IN AUSTRALIA

Major vegetation groups and their representation in the Australian landscape

Mountain ash regrowth (*Eucalyptus regnans*) forest

Key findings

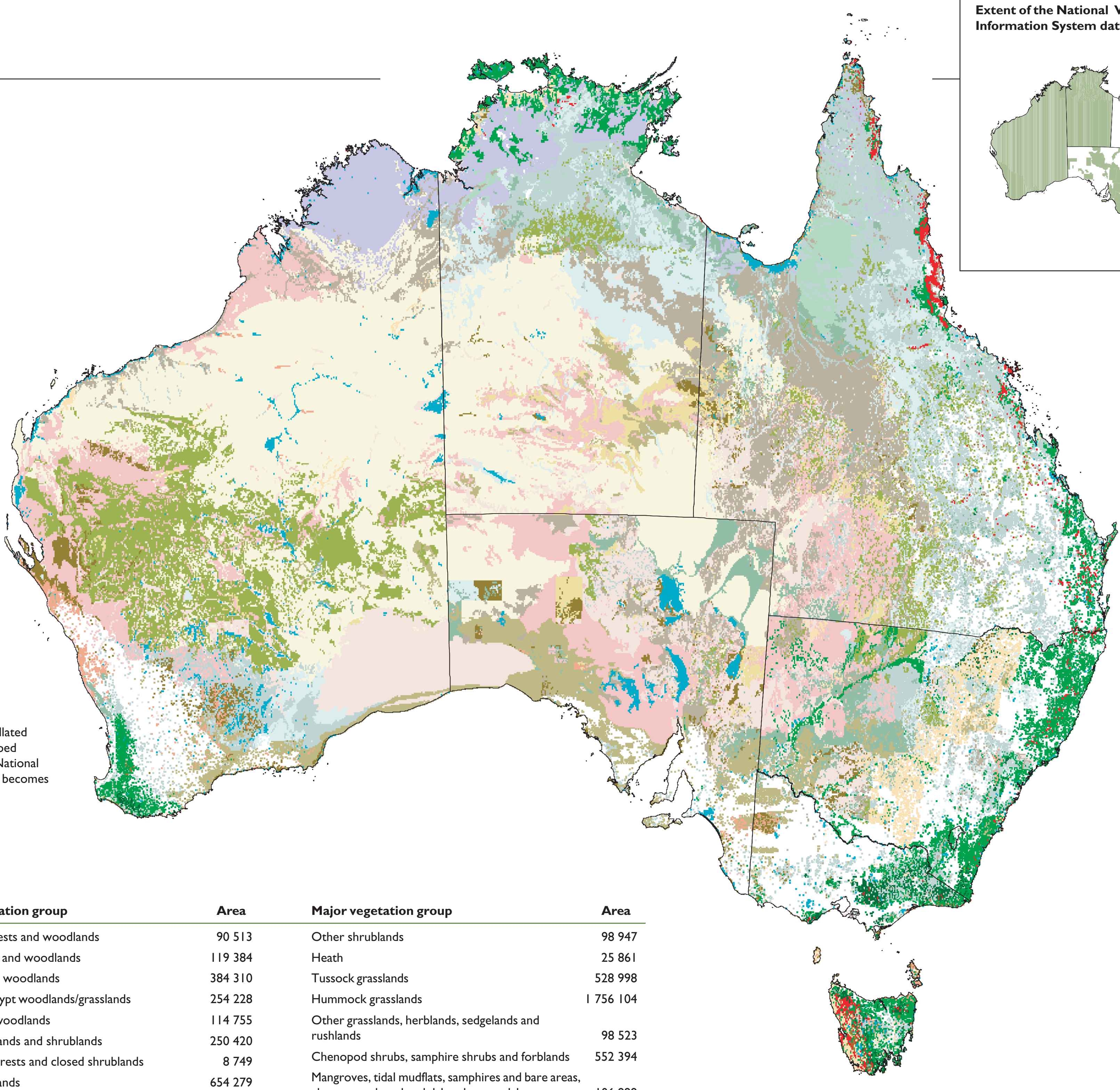
Australia's native vegetation types respond to the climatic variation across the continent. The lush tropical rainforests of Queensland's wet tropics are a stark contrast to the hummock grasslands and saltpans of the arid interior. Both are comparatively unique. Both contain a high degree of endemism. Within these climatic extremes lies a broad range of native vegetation types with varying structural (height and density) features from tall forests, to varying closed and open shrublands through to grasslands and forblands, all with their own species assemblages.

The physical landscape—landform, lithology and soils—can either offset or exacerbate climatic influences by providing microenvironments. Landforms such as mountain plateau or gullies may act as climatic refuges allowing more temperate or moisture seeking plants to survive in regions where the climate is otherwise unfavourable. These variations in the physical environment may effect both the structural and floristic composition of plant communities.

Against this palette of variation and diversity, Australia is dominated by a few key plant genera ranging across the broad range of structural vegetation types (Figure 8, Tables 3, 4). Eucalypt communities are widespread and probably the best known genus. Acacias, or wattles cover large areas of the continent, particularly in the low rainfall interior. Hummock grasslands cover a very large proportion of the arid interior.

- The hummock grasslands dominate Australia's native vegetation. These occur extensively in Western Australia, the Northern Territory and South Australia, accounting for 23% of the native vegetation.
- Other major vegetation groups covering greater than 500 000 km^2 each and together covering 39% of Australia are:
  - eucalypt woodlands;
  - acacia forests and woodlands;
  - acacia shrublands;
  - tussock grasslands; and
  - chenopod/samphire shrubs and forblands.
- A number of major vegetation groups that are quite restricted in area, covering less than 70 000 km^2 each and together covering approximately 2.6% of Australia, include:
  - rainforest and vine thickets;
  - eucalypt tall open forests;
  - eucalypt low open forests;
  - callitris and casuarina forests and woodlands;
  - low closed forests and closed shrublands; and
  - heath.

Figure 8. Major vegetation groups.



- Cleared/modified native vegetation
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

Extent of the National Vegetation Information System data

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

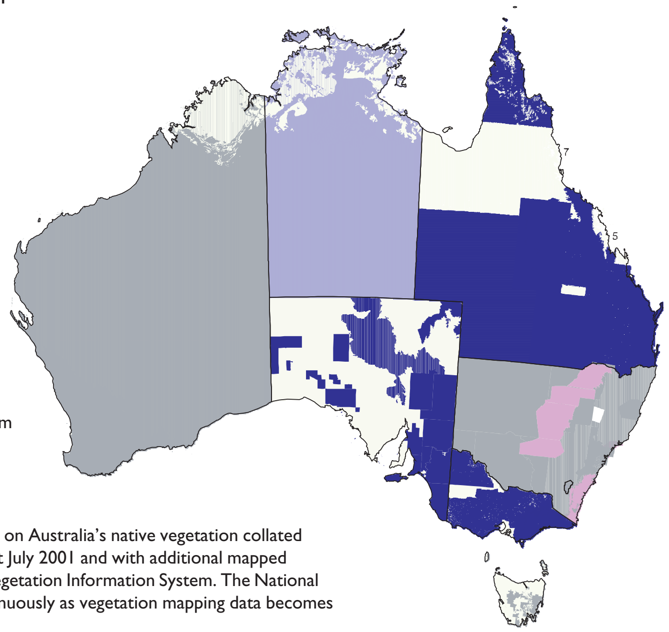
These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Table 3. Area (km^2) of major vegetation groups.

Major vegetation group	Area	Major vegetation group	Area	Major vegetation group	Area
Cleared/modified native vegetation	982 051	Melaleuca forests and woodlands	90 513	Other shrublands	98 947
Rainforest and vine thickets	30 231	Other forests and woodlands	119 384	Heath	25 861
Eucalypt tall open forests	30 129	Eucalypt open woodlands	384 310	Tussock grasslands	528 998
Eucalypt open forests	240 484	Tropical eucalypt woodlands/grasslands	254 228	Hummock grasslands	1 756 104
Eucalypt low open forests	12 922	Acacia open woodlands	114 755	Other grasslands, herblands, sedgelands and rushlands	98 523
Eucalypt woodlands	693 449	Mallee woodlands and shrublands	250 420	Chenopod shrubs, samphire shrubs and forblands	552 394
Acacia forests and woodlands	560 649	Low closed forests and closed shrublands	8 749	Mangroves, tidal mudflats, samphires and bare areas, claypan, sand, rock, salt lakes, lagoons, lakes	106 999
Callitris forests and woodlands	27 724	Acacia shrublands	654 279		
Casuarina forests and woodlands	60 848				

Figure 9. Present major vegetation groups data set classification detail.

Major vegetation groups
Level III, broad floristic formation
Level IV, sub-formation
Level V, association
Level VI, sub-association



Source:

National Land and Water Resources Audit 2001.

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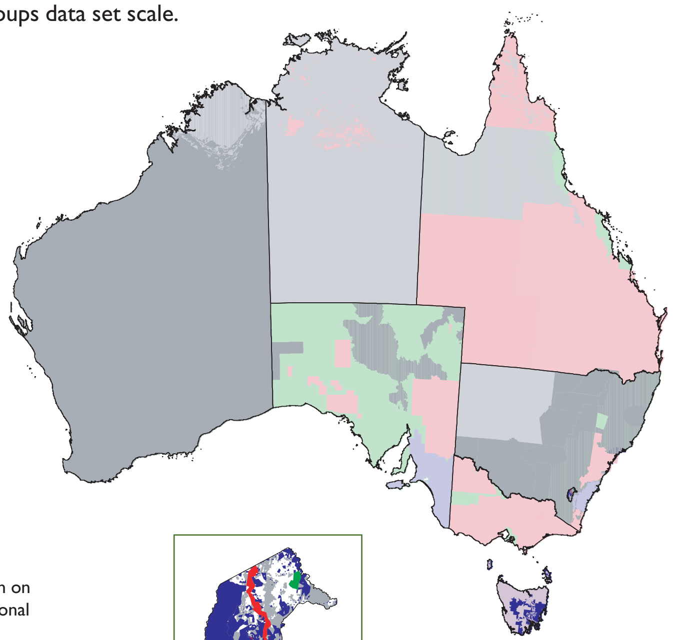
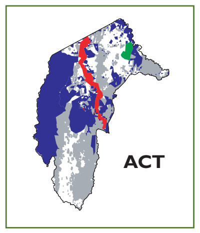
These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure 10. Present major vegetation groups data set scale.

5 000 000
1 000 000
500 000
250 000
100 000
50 000
25 000
10 000
5 000





Source:

National Land and Water Resources Audit 2001.

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Methods

The decision framework that underpinned compilation of the range of mapped present vegetation data sets into the National Vegetation Information System hierarchy is provided in Appendix 9.

Major vegetation groups that were mapped represent the dominant vegetation occurring in a particular area.

Applications

Appendix 1 presents the area and type of major vegetetation group in each IBRA bioregion. Information collated into a consistent framework can be used to report on Australia's native vegetation using any defined region selected by users.

Information about the extent and type of remaining native vegetation can be integrated with other key data sets to understand:

- landscape function;
- remaining habitats;
- opportunities for catchment rehabilitation, whether the issue is catchment hydrology or dryland salinity control;
- priorities for protection and rehabilitation, ensuring remaining native vegetation is representative of Australia's pre-European communities; and
- the contribution of native vegetation to land use planning and sustainable use of Australia's natural resources.

Limitations

Native regrowth and native plantings have not been specifically mapped or compiled into the National Vegetation Information System. Much of the mapping compiled in the National Vegetation Information System does not include small native vegetation remnants such as road reserves, travelling stock routes and undeveloped lands within farming landscapes.

The National Vegetation Information System data sets have the greatest reliability in mapping the type and extent of the native vegetation. Additional data used to compile an Australia-wide map of major vegetation groups should be considered an interim product and provides broad scale information on native vegetation.

The aggregation into major vegetation groups for summary analysis purposes simplifies the health of data provided for collation under the National Vegetation Information System, with the species and type detail behind all mapping programs provided in lower categories of the hierarchy.

The *Guidelines* section provides guidelines on the use of the information and Appendix 8 presents information on the sources of data that have been collated into the National Vegetation Information System to represent Australia's native vegetation including the extent, scale and date of collection. Figures 9 and 10 provide information on the location and extent of data sets, their scale and level of classification used to develop the major vegetation groups.

The State and Territory summaries of present vegetation also provide guidelines on the use of the information.

Table 4. Area (km²) of major vegetation groups in each State and Territory.

Major vegetation group	Australian Capital Territory	New South Wales	Northern Territory	Queensland	South Australia	Tasmania	Victoria	Western Australia
Cleared—modified native vegetation	738	234 527	6 055	304 043	99 473	10 695	142 633	183 887
Rainforest and vine thickets	–	2 218	977	19 558	–	7 055	407	16
Eucalypt tall open forests	4	4 405	–	429	–	6 193	16 755	2 343
Eucalypt open forests	937	90 979	58 471	35 150	396	19 212	15 018	20 321
Eucalypt low open forests	49	10 883	70	111	17	106	180	1 506
Eucalypt woodlands	223	68 306	123 078	367 293	16 459	4 609	25 051	88 430
Acacia forests and woodlands	–	21 184	29 866	91 534	15 414	28	400	402 223
Callitris forests and woodlands	5	22 132	–	4 134	1 023	1	429	–
Casuarina forests and woodlands	3	40 698	–	1 545	15 261	156	46	3 139
Melaleuca forests and woodlands	–	14	19 244	70 014	7	–	45	1 189
Other forests and woodlands	–	141	29 497	49 266	34 958	359	2 186	2 977
Eucalypt open woodlands	270	31 245	175 775	134 421	7 652	1 108	1 185	32 654
Tropical eucalypt woodlands/ grasslands	–	–	107 254	20 653	–	–	–	126 321
Acacia open woodlands	–	138	48 703	36 734	25 414	–	–	3 766
Mallee woodlands and shrublands	–	33 889	35 450	14	118 531	–	10 843	51 693
Low closed forests and closed shrublands	–	3 725	–	445	3	2 168	818	1 590
Acacia shrublands	–	77 017	86 035	100 660	151 769	13	14	238 771
Other shrublands	8	5 117	5 294	16 419	25 658	755	3 450	42 246
Heath	9	1 154	–	470	2 680	1 925	1 801	17 822
Tussock grasslands	91	19 318	83 613	282 547	81 187	1 090	614	60 538
Hummock grasslands	–	4	490 232	91 809	175 363	–	–	998 696
Other grasslands, herblands, sedgelands and rushlands	2	65 761	7 633	4 771	772	10 670	1 059	7 855
Chenopod shrubs, samphire shrubs and forblands	–	62 322	33 753	81 944	182 644	28	2 038	189 665
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	18	5 411	5 410	15 143	28 769	1 880	2 257	48 111

– Indicates that this major vegetation group does not exist in a particular jurisdiction or that the scale and type of mapping compiled has not captured this major vegetation group.

NATIVE VEGETATION IN AUSTRALIA

Change in the extent of native vegetation

Key findings

Thousands of years of traditional Aboriginal land use practices modified Australia's vegetation mainly through the impact of fire. Never has Australia's vegetation experienced such rapid change as since European settlement when large scale clearing and modification has occurred in a relatively short amount of time.

Agricultural, pastoral and urban development has significantly and rapidly changed Australian vegetation and landscapes in the 200 years since European settlement. Impacts have varied with land uses and include:

- broadacre clearing for cultivation and grazing on improved pastures;
- forest modification through logging practices, harvesting or disturbing selected species;
- rangeland modification through grazing practices, fire regime changes and introduction of weeds and feral animals, resulting in some species loss and change;
- exotic introductions (e.g. pine forests, weeds, including willow, and feral animals); and
- major alteration/loss of native vegetation and filling of wetlands in urban areas and transport corridors.

Broad-scale clearing has accelerated the effects of a number of processes, threatening the long-term viability of our native vegetation (e.g. native vegetation clearing and its replacement with shallow-rooted crops and pastures has contributed to rising water tables, the mobilisation of salt and other hydrological changes). Vegetation clearing has, therefore, led to landscape salinisation, increased sediment, nutrient and salt loads in rivers and streams, loss of habitat and a decline in biodiversity (Williams 2000). Further information on the risk of dryland salinity in Australia can be found in *Australia's Dryland Salinity Assessment 2000* (NLWRA 2001a).

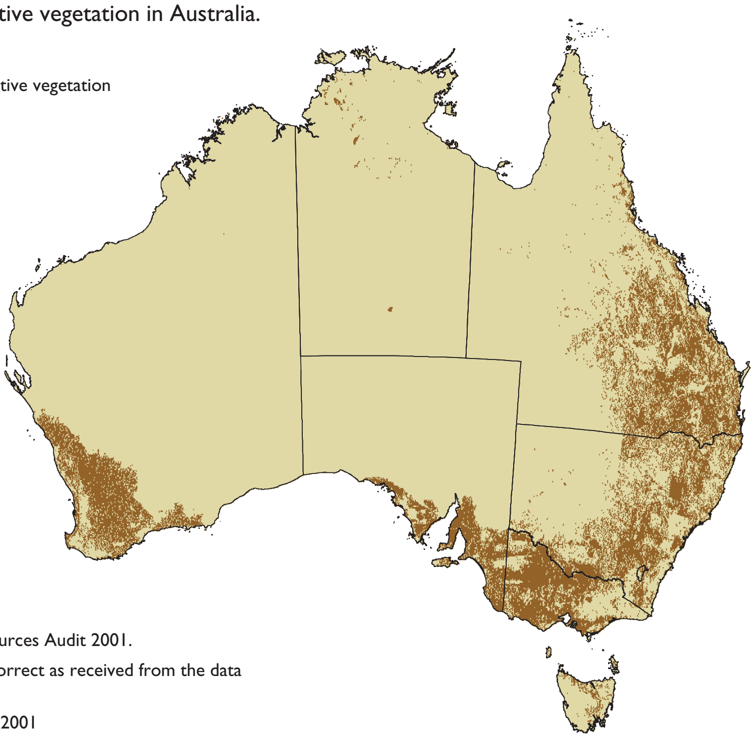
Regions most affected by intensive land use development (Table 5 and Figure 11) occur in:

- south-west Western Australia;
- southern South Australia;
- western and central Victoria;
- the midlands and northern Tasmania;
- large areas of central and the eastern lowlands of New South Wales;
- northern and eastern Australian Capital Territory;
- central and south-east Queensland; and
- small isolated patches in the Northern Territory.

In many of these regions native woody vegetation only survives as isolated trees in paddocks or linear strips (e.g. in windbreaks or along road reserves and stock routes). Native grasslands now grade into exotic sown pastures and/or weed fields. Often the remnants that do occur are on land that is unproductive for agricultural land uses or held by a landholder with a strong commitment to nature conservation.

Management of remnants, while important, is costly. For example, where surrounding land use is 'hostile' (e.g. urban uses as a source of exotic animals, wildfires and weeds) and the habitat patches are small, it will be necessary to actively manage remnants to avoid degradation (Williams 2000).

Figure 11. Extent of native vegetation in Australia.



Source:

National Land and Water Resources Audit 2001.

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Table 5. Native vegetation remaining in the intensively (defined as the intensive land use zone [Graetz et al. 1995]) used areas of Australia.

	Area native vegetation remaining (km^2)	**Percent remaining**
Australian Capital Territory	1 620	69
New South Wales	470 604	67
Northern Territory	186 629	98
Queensland	772 452	72
South Australia	174 966	64
Tasmania	42 520	80
Victoria	84 541	37
Western Australia	234 423	56
Australia (intensive zone)	**1 967 754**	**67**

Large areas of intact native vegetation in intensively used regions are either used for forestry and nature conservation or are still within government tenure and unallocated. Few large patches are on private land.

Major threats to remnant vegetation include continued land use development, particularly:

- road and power infrastructure;
- urban expansion; and
- loss of condition, such as might occur with overgrazing and broad scale clearing for agricultural land.

Figures 12 and 13 summarise the percentage of native vegetation remaining by river basin and IBRA subregion. These maps provide useful summaries at a regional level for assessing clearing patterns in Australia, the implications at a river basin scale and the imperatives for remnant management within IBRA subregions. Those river basins and subregions with less than 30% remaining native vegetation are listed in Tables 6 and 7. Twenty-five river basins and 42 IBRA subregions have less than 30% remaining native vegetation.

Appendix 1 presents the area of major vegetation groups and percentage of native vegetation remaining in each IBRA bioregion.

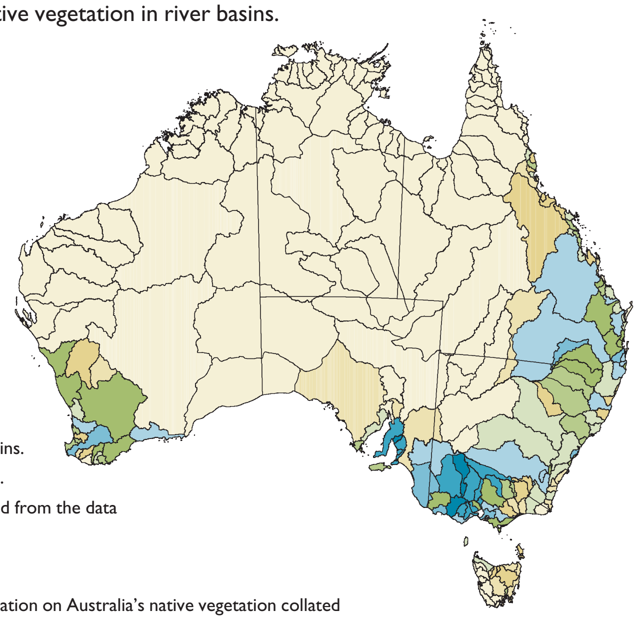
Table 6. River basins with less than 30% remaining native vegetation.

River basin	Area of native vegetation (ha)	Percent vegetation remaining
Hopkins River	55 928	5.5
Myponga River	1 256	8.2
Avoca River	122 212	8.6
Wakefield River	16 664	8.7
Gawler River	43 668	9.6
Broughton River	167 276	10.3
Onkaparinga River	11 408	12.5
Fleurieu Peninsula	14 928	15.3
Campaspe River	64 492	15.9
Loddon River	252 488	16.1
Torrens River	18 592	16.7
Wimmera – Avon Rivers	528 756	17.4
Maribyrnong River	25 348	17.4
Moorabool River	39 236	17.7
Barwon River	69 616	18.3
Broken River	130 528	18.4
Lake Corangamite	75 736	18.6
Murray–Riverina	287 788	19.1
Bunyip River	79 696	19.7
Portland Coast	77 772	19.8
Millicent Coast	852 044	24.8
Logan–Albert River	111 976	27.1
Blackwood River	611 988	27.1
Moonie River	410 728	28.6
Sydney Coast – Georges River	50 700	29.3

Figure 12. Percentage remaining native vegetation in river basins.

Percentage remaining

- 0 – 10
- 10 – 20
- 20 – 30
- 30 – 40
- 40 – 50
- 50 – 60
- 60 – 70
- 70 – 80
- 80 – 90
- 90 – 100



Source:

Derived from AUSLIG 1997 Australia's river basins.

National Land and Water Resources Audit 2001.

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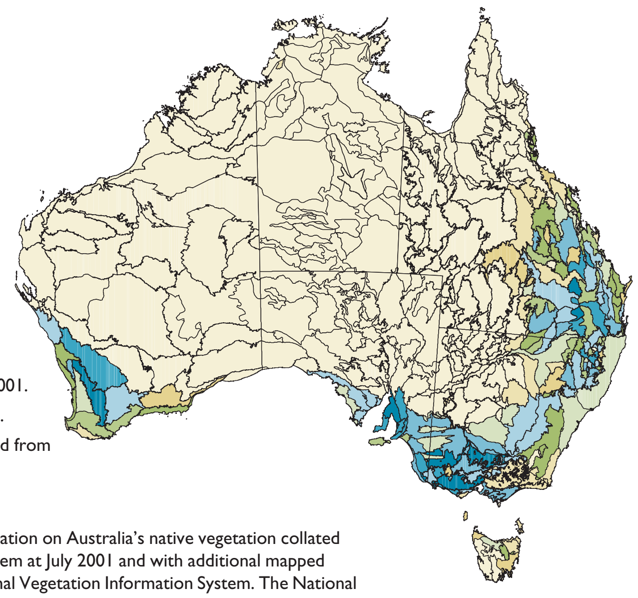
Figure 13. Percentage remaining native vegetation in subregions.

Percentage remaining

- 0 – 10
- 10 – 20
- 20 – 30
- 30 – 40
- 40 – 50
- 50 – 60
- 60 – 70
- 70 – 80
- 80 – 90
- 90 – 100



Source:

IBRA Subregions V. 5.1, Environment Australia 2001.

National Land and Water Resources Audit 2001.

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Table 7. Subregions with less than 30% remaining native vegetation.

Subregion	Area of native vegetation (ha)	Percent vegetation remaining
Victorian Riverina (VR)	91 604	5.1
Mount Gambier	4 832	5.7
Tara Downs	28 388	6.3
Victorian Volcanic Plain (VP)	158 452	7.6
Wimmera (WI)	130 636	7.7
Taroom Downs	52 880	8.2
Avon Wheatbelt P2	254 948	8.5
St Vincent	99 016	9.1
Fleurieu	38 140	10.3
Callide Creek Downs	33 000	11.1
Glenn Innes–Guyra Basalts	32 236	11.6
Dawson River Downs	116 404	11.8
Broughton	123 148	11.9
Dundas Tablelands (DT)	64 420	13.1
Warrnambool Plain (WP)	31 084	13.3
Inverell Basalts	35 068	15.2
Eastern Darling Downs	253 884	15.5
Lucindale	116 064	15.7
Mount Lofty Ranges	47 132	15.7
Moonie R. – Commoron Creek Floodout	137 516	17.1
Southern Yorke	74 916	17.2
Avon Wheatbelt P1	1 129 720	17.3
Deepwater Downs	17 332	17.7
Dulacca Downs	30 612	18.9
Gippsland Plain (GIP)	240 192	20.0
Murray Mallee (MM)	1 125 176	20.4
Armidale Plateau	59 516	20.4
Tintinara	145 140	20.5
Murray Fans	424 348	20.5
Yarrowyck–Kentucky Downs	13 536	20.8
Bridgewater	102 368	22.4
Goldfields (GO)	378 428	22.5
Moreton Basin	180 244	23.0
South Burnett	143 624	25.5
Bundarra Downs	39 464	26.0
Isaac – Comet Downs	702 260	26.0
Moonie – Barwon Interfluve, Collarenebri Interfluve	188 988	26.2
Liverpool Plains	251 124	26.7
Strzelecki Ranges (STZ)	94 668	27.5
Dandarragan Plateau	107 512	28.0
West Balonne Plains	600 240	29.1
Upper Belyando Floodout	128 848	29.4

Methods

The analysis of native vegetation extent is based on the compiled information, as detailed in previous sections.

Limitations

As noted in the previous section, the age of the data sets, their accuracy and the attributes mapped vary.

Woody cover is over-represented in central and western New South Wales and Tasmania due to the age of the data sets available for compilation into the National Vegetation Information System and development of the major vegetation groups. Some regions within these States have experienced much higher levels of clearing than reported. More accurate information for New South Wales and Tasmania is available from those States.

Native and derived grasslands are often not well mapped particularly in mapping coverages from South Australia, New South Wales and the Australian Capital Territory.

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LANDSCAPE HEALTH

An assessment of landscape health (NLWRA 2001c) has used existing information to assess regional differences in landscape health from a natural ecosystems perspective to help guide national initiatives for biodiversity conservation. The information from this study is presented by IBRA subregions.

Broad indications of environmental decline across Australia include:

- soil erosion;
- weed infestations;
- dryland salinity; and
- regional fauna extinctions.

The accumulating impact of European patterns of land use profoundly affects many Australian landscapes, ecosystems and their biological diversity. An understanding of relativities in landscape health is needed to help guide the urgent and effective responses required to prevent further long-term damage to landscape health, and where necessary, repair the damage already done.

The continent was divided into two discrete zones for analysis and reporting of some attributes: the intensive use zone (extensive clearing has occurred or is occurring) and the extensive use zone (land use predominantly relies on the use of native vegetation). The concept is similar to extensive and intensive land use zones used by Graetz et al. 1995, but unlike these—defined by 1:250 000 scale map sheets—they are defined by grouping subregions. Subregions in the intensive use zone have generally been cleared of more than 10% of the original native vegetation.

Soil erosion, Thrushton National Park, Queensland

Attributes in the assessment included:

- vegetation extent and clearing;
- land use;
- fragmentation of native vegetation;
- hydrological change;
- weeds;
- feral animals; and
- threatened ecosystems and species.

The synthesis and reporting of these attributes was undertaken for both land use zones.

Subregions in the intensive use zone have a history of land use intensification, including clearing, pasture development, cropping and plantation establishment. Assessment of general landscape health in the intensive land use zone must separate the cleared and developed areas from the undeveloped areas. The biodiversity component of landscape health in the intensive use zone relates largely to the extent, distribution and condition of the remaining native vegetation, and these are also reflected in the health of the subregion as a whole.

In the extensive use zone native vegetation is essentially continuous at the scale of this study. Biodiversity and landscape health is inextricably entwined across each subregion.

The particular condition and trend attributes used to provide a synthesis of landscape health were compiled to provide a measure of 'landscape stress' (Figure 14) across Australia by subregion.

Regeneration from clearing, Mount Sheridan Rd, Lake Grace, Western Australia

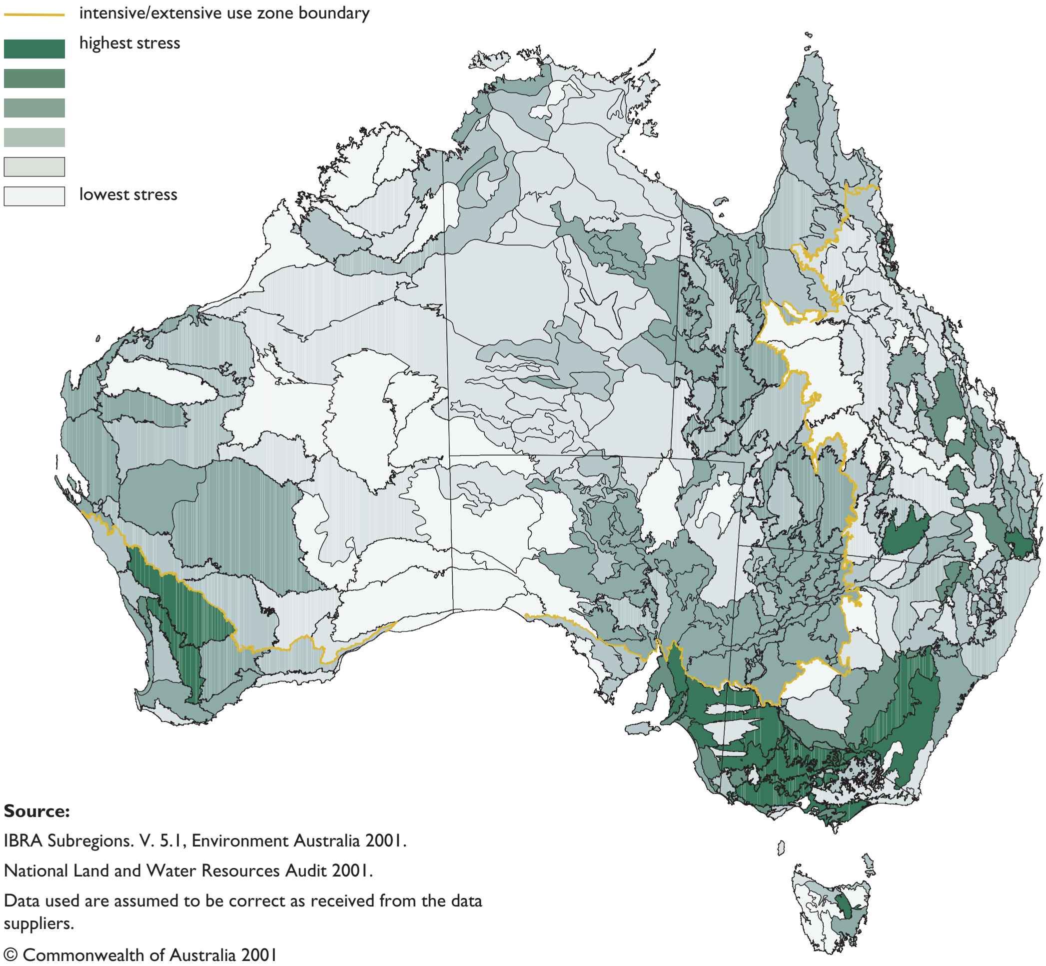
Continental landscape stress

The intensive use zone contains the most degraded landscapes—37 subregions in the two highest landscape stress ratings have less than 30% of the original native vegetation extent. Native vegetation occurs mainly as small and isolated fragments, only a small proportion of which are managed conservatively. More than two-thirds of the ecosystems representative of these subregions have less than 30% of original extent remaining and are now at risk of collapse or total loss. No subregions in the extensive use zone could be considered to be in such poor health.

Subregions in the intensive use zone in the third highest landscape stress class usually have 30–50% of original native vegetation extent remaining and although relatively fragmented, it has been cleared in such a way that moderate areas of most of the original ecosystems remain. The overall health of ecosystems in these subregions approximates that of the most heavily used subregions of the extensive use zone (those in the two highest extensive use zone stress classes) where, although there has been little or no clearing, more than 70% of their area typically has a history of relatively high total grazing pressures.

Decreasing grazing pressures in subregions in the remaining extensive use zone stress classes roughly correspond to decreasing land use pressures in the remaining intensive use zone stress classes.

Figure 14. Continental landscape stress.



Source:

IBRA Subregions. V. 5.1, Environment Australia 2001.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Remnant trees and ploughed paddock on basalt, Tasmania

NATIVE VEGETATION IN AUSTRALIA

Proportion of remaining native vegetation types in Australia

Key findings

Table 8 and Figure 15 detail the status of the 23 major vegetation groups since European settlement.

At the continental scale, the real differences in patterns of clearing between major vegetation groups are not clear. This is partly because the largest proportion of Australia, the rangelands, remains relatively free of broad-scale clearing.

The key emerging picture at the Australia-wide scale is that the most affected vegetation groups, where approximately 50% of the pre-European extent now remains, are the low closed forests and closed shrublands and the heaths. These two major vegetation groups were already very restricted in their pre-European extent so that further clearing has a major impact on aerial extent.

Major vegetation groups where 60–80% of pre-European extent remains are:

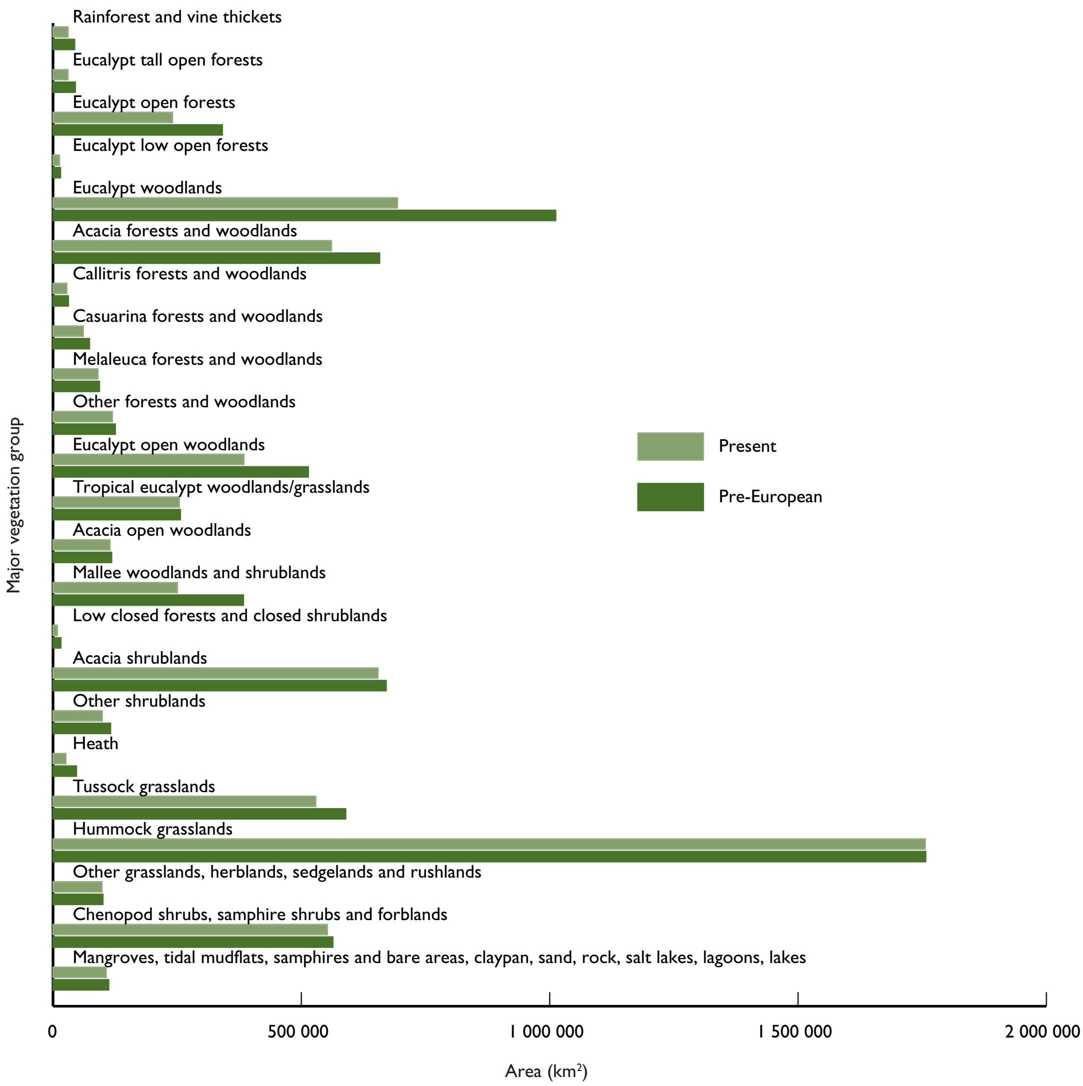
- rainforest and vine thickets;
- eucalypt tall open forests;
- eucalypt open forests;
- eucalypt woodlands;
- eucalypt open woodlands; and
- mallee woodlands and shrublands.

Of these, rainforest and vine thickets and eucalypt tall open forests were very restricted in their pre-European extent.

Table 8. Area of pre-European and present vegetation in Australia (km^2).

Major vegetation group	Present	Pre-European	Percent remaining
Rainforest and vine thickets	30 231	43 493	70
Eucalypt tall open forests	30 129	44 817	67
Eucalypt open forests	240 484	340 968	71
Eucalypt low open forests	12 922	15 066	86
Eucalypt woodlands	693 449	1 012 047	69
Acacia forests and woodlands	560 649	657 582	85
Callitris forests and woodlands	27 724	30 963	90
Casuarina forests and woodlands	60 848	73 356	83
Melaleuca forests and woodlands	90 513	93 501	97
Other forests and woodlands	119 384	125 328	95
Eucalypt open woodlands	384 310	513 943	75
Tropical eucalypt woodland/grasslands	254 228	256 434	99
Acacia open woodlands	114 755	117 993	97
Mallee woodlands and shrublands	250 420	383 399	65
Low closed forests and closed shrublands	8 749	15 864	55
Acacia shrublands	654 279	670 737	98
Other shrublands	98 947	115 824	85
Heath	25 861	47 158	55
Tussock grasslands	528 998	589 212	90
Hummock grasslands	1 756 104	1 756 962	100
Other grasslands, herblands, sedgelands and rushlands	98 523	100 504	98
Chenopod shrubs, samphire shrubs and forblands	552 394	563 389	98
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	106 999	112 063	96

Figure 15. Area (km²) of pre-European and present major vegetation groups in Australia.



Methods

This analysis is based on a comparison of the present extent of major vegetation groups and pre-European mapping.

Applications

Analysis at the Australia-wide, State and Territory and regional scales provides information on which to base broad assessments of change in extent and type of vegetation. This is a key input to assessing:

- the representativeness or otherwise of Australia's nature conservation estate and for related interpretations (e.g. setting priorities for retention of native vegetation types);
- opportunities for catchment rehabilitation, whether the issue is catchment hydrology or dryland salinity control;
- the types of vegetation suitable for rehabilitation, restoration and/or revegetation activities in an area; and
- priorities for protection of biodiversity in landscapes under stress.

Limitations

Pre-European vegetation and present native vegetation for many States and Territories do not match in mapping method or scale. Development of pre-European vegetation maps in cleared areas of Australia is usually dependent upon coarse or generalised data on landforms and soils sometimes at 1:250 000 or even 1:1 000 000 scale. Reconstructing the natural complexity of vegetation patterns from such broad interpretations is difficult. Earlier vegetation mapping for areas now cleared may similarly be coarse in scale and/or generalised, with little data from systematic field sampling to support the derivation of mapping units and the allocation of individual patches of native vegetation to mapping units.

Pre-European data is more reliable where:

- impacts of European land use is minimal;
- there is good physical and floristic information (e.g. in Victoria) which can be used for detailed interpolation; and
- the scale of the pre-European mapping and method is similar to that of the current extent mapping (e.g. in Queensland, Victoria, Northern Territory and Western Australia).

Data variability is greatest in New South Wales and South Australia, neither of which have pre-European data collated that meet the requirements of the National Vegetation Information System. In these States it is assumed that the present vegetation mapped is an approximate representation of the pre-European vegetation. The pre-European data should be regarded as an interim product.

CASE STUDY: VEGETATION CHANGE AND INFORMATION TO SUPPORT REGIONAL VEGETATION MANAGEMENT

Role

This case study demonstrates the use of the National Vegetation Information System information on major vegetation groups and information hierarchy at Level IV to determine the changes in vegetation type and extent at a subregional level. Detail is also provided on the present land use and land tenure in the region as part of the information set necessary to underpin regional planning and management decisions.

Data sets

The Isaac – Comet Downs subregion has been selected as the subregion to demonstrate this application as it has a complete vegetation data set for both pre-European and present type and extent at 1:100 000 scale. The vegetation data sets are complemented by a complete coverage of land use in the subregion at 1:100 000 scale (Calvert et al. 2000). This congruence in scales of available data facilitates analysis.

Geology and vegetation

Isaac – Comet Downs is an extensive but diverse subregion in tropical western Queensland. It is an undulating subregion dominated by Tertiary and other Cainozoic deposits, with mid-Catena deposits being slightly more prominent. Tableland and dissected remnants of the upper Tertiary surface are widespread, supporting narrow-leaved *Eucalyptus crebra* woodlands on the earths of undulating plateaus, and bendee *(Acacia catenulata)* or lancewood *(A. shirleyi)* on the rocky hills and mesas. The lower parts of the Tertiary surface are dominated by brigalow *(A. harpophylla)* and Dawson gum *(E. cambageana)* communities on undulating clay or tenure contrast soils. These communities dominate the subregion. Alluvium is also prominent and the predominantly fine-textured soils of the alluvium carry brigalow or coolibah *(E. coolabah)* woodlands. Fine-grained Permian sediments are exposed due to long term weathering, giving rise to grasslands, open woodlands and areas of brigalow (Young et al. 1999).

Land use

The dominant land use in the subregion is livestock grazing with smaller areas of dryland agriculture and a large area of irrigated agriculture near Emerald (Figure 16). Two nature conservation areas are present in the subregion, Dipperu and Taunton National Parks (0.7% of the region). One large crown reserve, that is used for grazing and forestry, accounts for 2.8% of the region. The majority of the remnant vegetation is on freehold tenure. Overall the subregion, other than the Crown estate, is a mix in about equal proportions of freehold and leasehold tenure.

Native vegetation and change

Figures 17 and 18 show the pre-European and present vegetation types and extent of the vegetation mapped by major vegetation group. Table 9 presents the area of pre-European and present major vegetation groups.

The total area of the subregion is 27 011 km^2 with 28% remaining vegetation of the pre-European extent. This diverse subregion had the fourth highest level of clearing between 1997 and 1999 (Sattler 2001).

The remaining native vegetation and areas cleared are presented in Table 10. The most impacted major vegetation groups, with less than 30% of the pre-European vegetation extent remaining, are:

- rainforest and vine thickets (0.18% of the total area);
- eucalypt open forests (0.01% of the total area);
- acacia forests and woodlands (9.21% of the total area);
- acacia open woodlands (none remaining); and
- tussock grasslands (0.47% of the total area).

All groups have restricted distributions in the subregion.

Figure 16. 1996/97 land use in the Isaac – Comet Downs subregion.

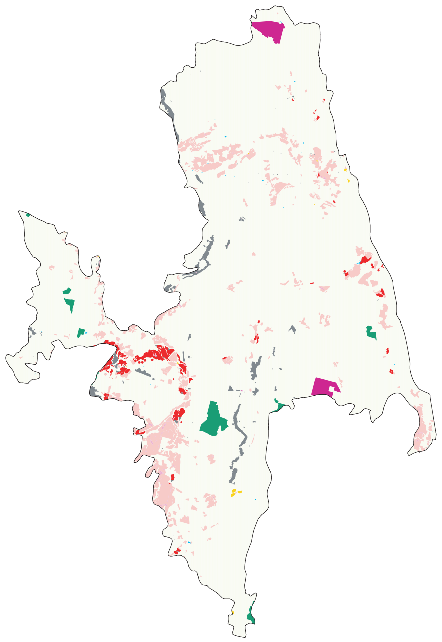


Figure 17. Pre-European vegetation Isaac – Comet Downs subregion.

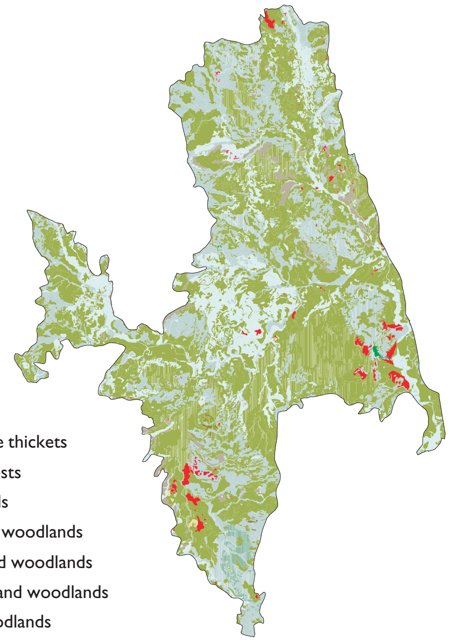
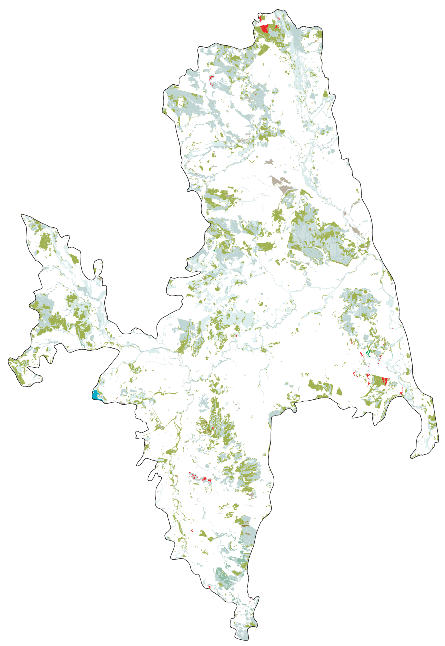


Figure 18. Major vegetation groups Isaac – Comet Downs subregion.



Source:

Fitzroy Basin 1996/97 land use mapping, National Land and Water Resources Audit and Queensland Department of Natural Resources, 2000.

IBRA Subregions V. 5.1, Environment Australia 2001.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Fine scale detail on vegetation change

Because of the richness of the National Vegetation Information System database in this region, this analysis can be repeated at all levels of the hierarchy, providing the finer definition of vegetation types required for the development of management plans. This analysis is presented at Level IV (vegetation subformation) describing the floristic and structural characteristics for the upper- and mid-strata, and structure of the lower vegetation stratum.

Table 11 shows that 17 of the 51 (or 34%) of the subformations have less than 30% remaining native vegetation. These are primarily eucalypt and acacia woodlands with grassy understorey and eucalypt/acacia mixed open forests and low closed forests with shrubs and grassy understorey. Remnant management, connectivity between remnants and minimisation of any further clearing are key management responses for these vegetation types. As to how this is implemented in the subregion, which land areas, what interaction with tenure types is a task for the regional groups, armed with the knowledge that this assessment provides.

At the other end of the perspective, eleven (22%) of the subformations have more than 70% remaining vegetation. These are primarily eucalypt woodlands with acacia shrubs and grassy understorey, being the areas of lower site quality for agricultural and grazing development. Again, armed with this information, regional groups can develop vegetation management strategies.

Table 9. Pre-European and present major vegetation groups in the Isaac – Comet Downs subregion.

Major vegetation groups	Pre-European extent Area (ha)	Pre-European extent Percent of total area	Present extent Area (ha)	Present extent Percent of total area
Cleared (primarily agricultural, grazing, urban and infrastructure)	–	–	1 955 790	72.41
Rainforest and vine thickets	34 386	1.27	4 860	0.18
Eucalypt open forests	1 731	0.06	397	0.01
Eucalypt woodlands	715 377	26.48	340 154	12.59
Acacia forests and woodlands	1 470 403	54.44	248 738	9.21
Callitris forests and woodlands	506	0.02	245	0.01
Casuarina forests and woodlands	23 429	0.87	8 651	0.32
Eucalypt open woodlands	380 877	14.10	125 895	4.66
Acacia open woodlands	1 704	0.06	0	0
Other shrublands	2 863	0.11	1 427	0.05
Tussock grasslands	68 541	2.54	12 629	0.47
Other grasslands, herblands, sedgelands and rushlands	1 162	0.04	774	0.03
Bare areas, claypans, sand, rock, salt lakes, lagoons, freshwater lakes (increase in area includes the water storages, supplying water for the high value irrigation development)	100	~ 0.00	1 518	0.06

Table 10. Changes to major vegetation groups in the Isaac – Comet Downs subregion since from pre-European settlement.

Major vegetation groups	Area cleared (ha)	Percent of pre-European extent remaining
Rainforest and vine thickets	29 525	14.13
Eucalypt open forests	1 334	22.95
Eucalypt woodlands	375 223	47.54
Acacia forests and woodlands	1 221 665	16.91
Callitris forests and woodlands	260	48.51
Casuarina forests and woodlands	14 779	36.92
Eucalypt open woodlands	254 982	33.05
Acacia open woodlands	1 704	0
Other shrublands	1 436	49.83
Tussock grasslands	55 911	18.42
Other grasslands, herblands, sedgelands and rushlands	388	66.64

Table 11. Vegetation sub-formation in the Isaac – Comet Downs subregion.

Vegetation sub-formation (Level IV)	Pre-European area (ha)	Present area (ha)	Vegetation cleared (ha)	Percent of pre-European extent remaining
Acacia low open woodlands/dichanthium tussock grassland	1 704	0	1 704	0
Eucalypt woodlands/coniferous woodlands/mixed unable to determine structural formation	468	0	468	0
Eucalypt woodlands/acacia tall sparse shrubland/grassy tussock grassland	16	1 916	-1 900	100
Coniferous woodlands/coniferous isolated shrubs/grassy tussock grassland	214	10	205	5
Acacia open forests/mixed open shrubland	467 518	45 973	421 545	10
Mixed low closed forests/mixed low woodlands	184	19	165	10
Acacia open forests/mixed tall open shrubland/grassy sparse tussock grassland	833 373	96 682	736 691	12
Mixed low closed forests/mixed tall open shrubland/grassy isolated tussock grasses	34 202	4 841	29 360	14
Eucalypt woodlands/mixed tall open shrubland/grassy open tussock grassland	10 559	1 561	8 998	15
Eucalypt woodlands/mixed tall open tussock grassland	16 611	2 457	14 154	15
Acacia open forests/mixed tall shrubland/grassy sparse tussock grassland	12 940	1 921	11 019	15
Acacia low isolated trees/astrebla and iseilema open tussock grassland	68 541	12 629	55 911	18
Eucalypt open forests/mixed tall open shrubland	1 616	353	1 263	22
Mixed woodlands	5 413	1 387	4 026	26
Eucalypt open woodlands/mixed sparse shrubland/spinifex sparse tussock grassland	147 066	38 275	108 791	26
Eucalypt woodlands/mixed tall isolated shrubs/grassy tussock grassland	14 757	3 876	10 881	26
Eucalypt woodlands/mixed open tussock grassland	7 422	2 067	5 355	28
Eucalypt open woodlands/mixed tall sparse shrublands	19 071	5 674	13 396	30
Eucalypt woodlands/mixed isolated shrubs/grassy open tussock grasslands	39 553	12 696	26 856	32
Eucalypt woodlands/mixed tall sparse shrublands	44 271	14 792	29 479	33
Eucalypt open woodlands/mixed tall sparse shrublands/grassy open tussock grasslands	78 362	28 517	49 845	36
Casuarina open woodlands	23 429	8 651	14 779	37
Eucalypt open woodlands/mixed low isolated shrubs/grassy open tussock grasslands	131 874	50 068	81 805	38
Eucalypt woodlands/mixed low tussock grasslands	123 629	47 204	76 425	38
Eucalypt mallee woodlands/spinifex woodlands	115	45	71	39
Eucalypt woodlands/mixed tall isolated shrubs/grassy open tussock grasslands	2 694	1 064	1 629	40
Melaleuca tall open shrublands	373	166	207	44
Eucalypt woodlands/grassy tussock grasslands	205 217	93 522	111 696	46
Eucalypt woodlands/acacia tall open shrublands/grassy open tussock grasslands	17 254	8 354	8 900	48
Eucalypt woodlands/acacia tall open shrublands	97 006	47 896	49 110	49
Eucalypt woodlands/melaleuca woodlands/mixed sparse rushlands	7 224	3 641	3 583	50
Mixed open shrublands	2 490	1 261	1 229	51
Eucalypt open woodlands	395	229	166	58
Acacia open forests/mixed low woodlands	36 245	21 627	14 618	60
Cyperaceae low open sedgelands	1 162	774	388	67
Eucalypt woodlands/dichanthium tussock grasslands	56	38	19	67
Acacia low woodlands/mixed sparse shrublands/grassy sparse tussock grasslands	30 893	20 943	9 950	68
Acacia woodlands/acacia tall sparse shrublands/grassy sparse tussock grasslands	88 919	61 235	27 684	69
Acacia open forests/mixed tall open shrublands	514	357	157	69
Eucalypt woodlands	69 568	51 290	18 278	74
Eucalypt open woodlands/acacia open shrublands/grassy open tussock grasslands	4 110	3 132	978	76
Mixed woodlands/mixed tall open shrublands	901	708	193	79
Coniferous open forests/acacia sparse shrublands/grassy open tussock grasslands	291	235	56	81
Eucalypt woodlands/chenopod sparse shrublands/grassy open tussock grasslands	46 492	40 006	6 487	86
Eucalypt woodlands/grassy open tussock grasslands	1 635	1 423	212	87
Eucalypt woodlands/mixed shrublands/grassy sparse tussock grasslands	732	654	78	89
Eucalypt woodlands/mixed open cycadland	61	55	6	91
Eucalypt woodlands/acacia low sparse shrublands/grassy tussock grasslands	2 123	1 938	185	91
Eucalypt woodlands/acacia sparse shrublands/grassy open tussock grasslands	1 550	1 447	104	93
Eucalypt woodlands/acacia open shrublands/grassy open tussock grasslands	163	163	0	100

A negative value indicates an increase in extent of vegetation type

Hor Sumr Contents

Ringbarked trees, Womblebank, Queensland

CLEARED NATIVE VEGETATION: what and where?

What are the key types of native vegetation lost?

Key findings

Table 12 details the clearing of native vegetation by major vegetation groups across Australia. At a continental scale, approximately 13% of the total land has been cleared. This clearing has been concentrated (see Figure 11), reflecting settlement patterns and areas most capable of supporting development. Clearing has occurred predominantly for human settlement and agriculture in the higher rainfall regions and where there are more fertile soils, generally excluding the arid interior and tropical far north. Major vegetation groups that have been cleared since European settlement are shown in Figure 19.

The condition of the vegetation varies even if the broad native vegetation fabric is still intact, condition may still be declining (discussed separately in later sections on vegetation condition).

Eucalypt open forests: about 30% of pre-European extent cleared, accounting for 10% of total clearing:

Eucalypt open forests were extensively cleared in the latter half of the 19th century for:

- timber production—export (e.g. jarrah) and the local market (e.g. blackbutt); and
- agriculture and grazing (cleared or ringbarked).

Continued loss of these communities would have occurred if substantial areas had not been set aside in Crown reserves for timber production and later for nature conservation. The reservations for state forests are a good example of the foresight of resource managers at the time. Other examples are the various reservations of river foreshores, tidal waters and mangrove communities in many States and Territories as crown land administration systems developed. The Bulletin of the late 1890s through to the early 1900s includes much discussion about the reservation of lands for forestry and public uses, including opposition to the concept of state forests by various agricultural interests.

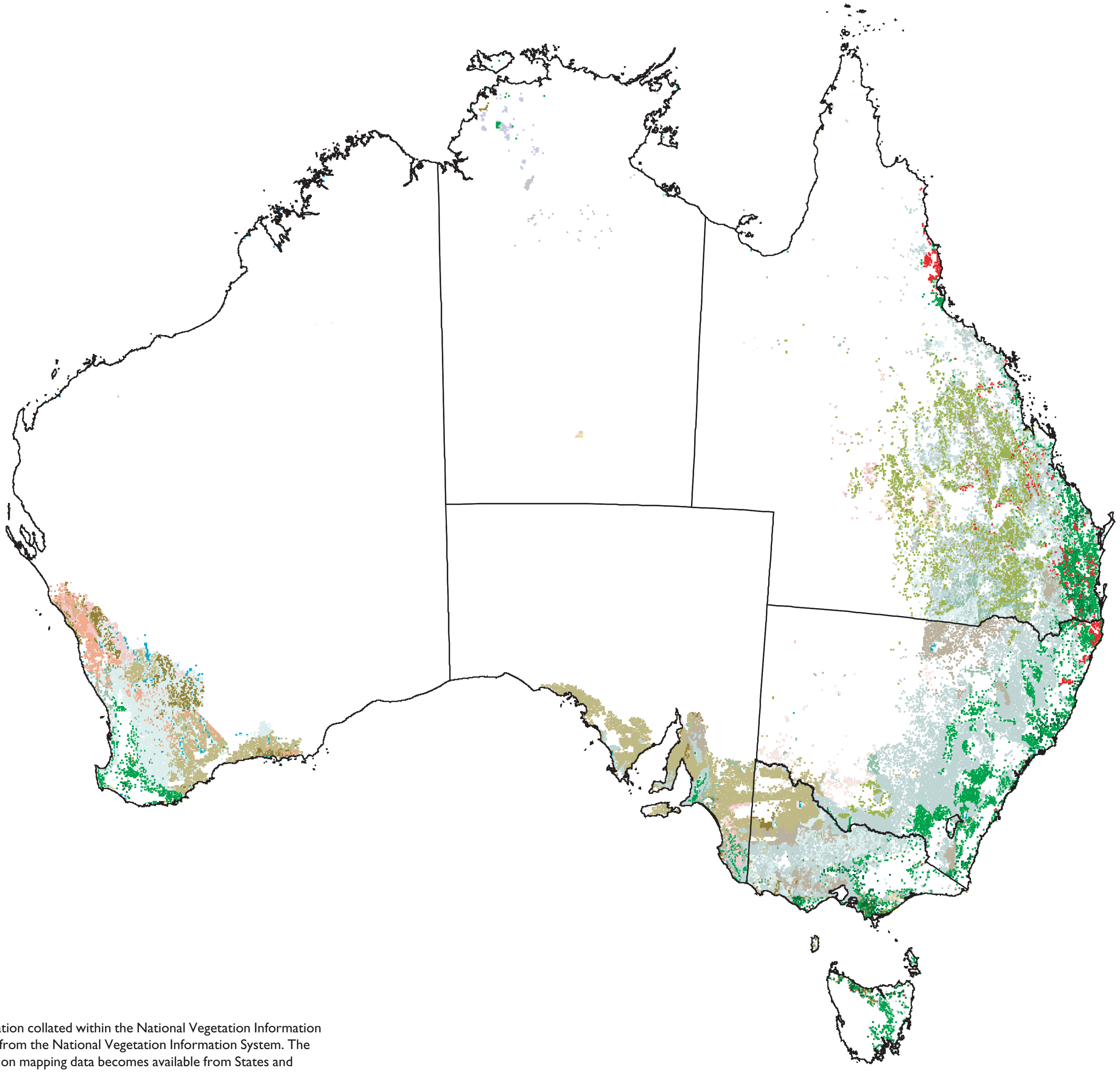
Eucalypt woodlands and eucalypt open woodlands: approximately 31% and 25% of pre-European extent cleared, accounting for 32% and 13% of total clearing respectively:

Eucalypt woodlands and eucalypt open woodlands are an important component of cereal cropping and pastoral zones. Cleared areas are very extensive, resulting in the loss of the broad fabric of the landscape from a vegetation perspective. Within the remnants, the shrubby understorey has often been removed mechanically, by frequent fire, or by the invasion of exotic species or overgrazing of native tussock grasses (annuals often replacing perennials). Eucalypt open woodlands areas mapped as native vegetation may be highly modified.

Inland acacia forests and woodlands: approximately 15% of pre-European extent cleared, accounting for 10% of total clearing:

Agricultural and pastoral development have led to major changes in extent and condition of these landscapes, expecially in brigalow (*Acacia harpophylla*) and mulga (*A. aneura*) communities. Extensive areas of brigalow, that once extended from Collinsville in Queensland to Narrabri in New South Wales, have been cleared. Approximately 4 million hectares of this brigalow was cleared as part of government land development schemes (Webb 1984). Few substantial areas remain in the southern

Figure 19. Cleared major vegetation groups.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

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Table 12. Area (km²) of major vegetation groups cleared* in Australia and the percentage cleared as a proportion of the total area of clearing in Australia.

Major vegetation group	Area (km²)	Percent cleared across Australia as total of clearing
Rainforest and vine thickets	13 262	1.4
Eucalypt tall open forests	14 688	1.5
Eucalypt open forests	100 484	10.3
Eucalypt low open forests	2 144	0.2
Eucalypt woodlands	318 598	32.5
Acacia forests and woodlands	96 933	9.9
Callitris forests and woodlands	3 239	0.3
Casuarina forests and woodlands	12 508	1.3
Melaleuca forests and woodlands	2 988	0.3
Other forests and woodlands	5 944	0.6
Eucalypt open woodlands	129 633	13.2
Tropical eucalypt woodlands/grasslands	2 206	0.2
Acacia open woodlands	3 238	0.3
Mallee woodlands and shrublands	132 979	13.6
Low closed forests and closed shrublands	7 115	0.7
Acacia shrublands	16 458	1.7
Other shrublands	16 877	1.7
Heath	21 297	2.2
Tussock grasslands	60 214	6.1
Hummock grasslands	858	0.1
Other grasslands, herblands, sedgelands and rushlands	1 981	0.2
Chenopod shrubs, samphire shrubs and forblands	10 995	1.1
Mangroves, tidal mudflats, samphires and bare areas, claypan, sand, rock, salt lakes, lagoons, lakes	5 064	0.5

* Clearing does not include grazing, thinning or other activities. In particular, parts of the rangelands may be heavily disturbed.

Brigalow Belt. The government also encouraged clearing of mulga country. The expansion of grazing across the mulga lands occurred from the 1850s to the 1890s.

Mallee woodlands and shrublands: approximately 35% of pre-European extent cleared, accounting for 14% of total clearing:

As with the Brigalow Belt, encouragement for clearing was provided by government in the temperate mallee woodlands areas. Clearing was encouraged for cereal cropping and pastoralism and was often a condition of leases.

Rainforest communities: most lowland occurrences cleared, approximately 30% of pre-European extent cleared, accounting for 1% of total clearing:

The broad range of rainforest and vine thicket communities across Australia found within this major vegetation group masks the level of regional depletion of some rainforest and vine thicket types.

In the coastal lowlands, floodplains and more undulating sections of the coastal ranges of eastern Australia much of the rainforest communities have been cleared. These were among the earlier native vegetation communities to be exploited for timber (using coastal rivers to gain access and transport timber out for export). Notable examples of subtropical rainforests being cleared for timber, dairy or agriculture (e.g. sugar cane or tobacco) are:

- the Big Scrub in northern New South Wales, reduced from an estimated 75 000 ha to just 300 ha by 1900 (Floyd 1987) and the Illawarra Rainforests;the Hoop Pine scrubs of south-east Queensland (Young & McDonald 1987); and
- the tropical rainforests of the Atherton and Eungella Tablelands and coastal wet tropics floodplains of the Daintree, Barron, Johnstone, Tully – Murray, Herbert, Proserpine and Pioneer rivers.

In the Brigalow Belt of Queensland and north-western New South Wales, extensive areas of vine thickets, notably the softwood scrubs, were substantially cleared for agriculture or grazing as part of Brigalow land development.

Heath communities: approximately 45% of pre-European extent cleared, accounting for 2% of total clearing:

Heaths have been heavily impacted by clearing for sand mining, agriculture, grazing or development mainly in southern coastal areas. Mallee communities, which occur in association with some heath communities, have similarly had extensive areas cleared, mainly for pastoral development in Victoria and South Australia.

Tussock grasslands: approximately 10% of pre-European extent cleared, accounting for 6% of total clearing:

Many of the tussock grasslands (Mitchell grass) of eastern Australia have been either substantially cleared or heavily modified from grazing. The mapping of this type in the National Vegetation Information System reflects where there is good information on native grasslands. There are known to be many other areas either not mapped or subject to change through grazing and introduced species such as buffel grass and other introduced pasture grasses. The Audit's rangelands report (NLWRA 2001d) discusses pasture management and condition in further detail.

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Logging south of Coffs Harbour, New South Wales

Methods

This analysis is based on the present extent of native vegetation and data on the type and area of these groups cleared in Australia from the pre-European mapping. All summary findings are based on the data sets compiled for the National Vegetation Information System and development of the major vegetation groups.

Applications

This analysis at the Australia-wide, State and Territory and regional scales provides information on which to base assessment of change in land cover and type of vegetation, a key input to vegetation management activities. Loss of particular vegetation types across regions impacts on biodiversity values and landscape function and this analysis highlights those major vegetation groups.

At the regional scale, the National Vegetation Information System compilation provides an excellent basis for regional planning groups to understand the changes in vegetation extent that have occurred and set their regional priorities for vegetation management in the context of this information. The assessment of major vegetation groups across Australia provides a broader context.

Limitations

As detailed previously, issues of attributes, scale and currency of available mapping limits the precision of this analysis. The broad nature of the major vegetation groups masks the distinct vegetation types and regional clearing patterns that would emerge at a finer scale of analysis.

CLEARED NATIVE VEGETATION: what and where?

Which bioregions have lost most native vegetation?

Sand mining damage, Stradbroke Island, Queensland

Key findings

Australia has 85 designated bioregions (Environment Australia 2000). The extensive clearing of native vegetation has been concentrated in comparatively few regions. Five bioregions (some of the key agricultural zones of south-eastern and south-west Australia) (Table 13 and Figure 20) have less than 30% of native vegetation remaining:

- Victorian Midlands (Victoria);
- Victorian Volcanic Plains (Victoria and South Australia);
- Naracoorte Coastal Plain (Victoria and South Australia);
- Avon Wheatbelt (Western Australia); and
- South East Coastal Plain (Victoria).

Twenty-two bioregions have between 30% and 70% of native vegetation remaining:

- Kanmantoo;
- New South Wales South Western Slopes;
- Eyre Yorke Block;
- Nandewar;
- Swan Coastal Plain;
- New England Tableland;
- South Eastern Queensland;
- Brigalow Belt South;
- Tasmanian Northern Midlands;
- Geraldton Sandplains;
- Esperance Plains;
- Riverina;
- Brigalow Belt North;
- Mallee;
- Jarrah Forest;
- South Eastern Highlands;
- Murray Darling Depression;
- New South Wales North Coast;
- Tasmanian Northern Slopes;
- Darling Riverine Plains;
- Sydney Basin; and
- Central Mackay Coast.

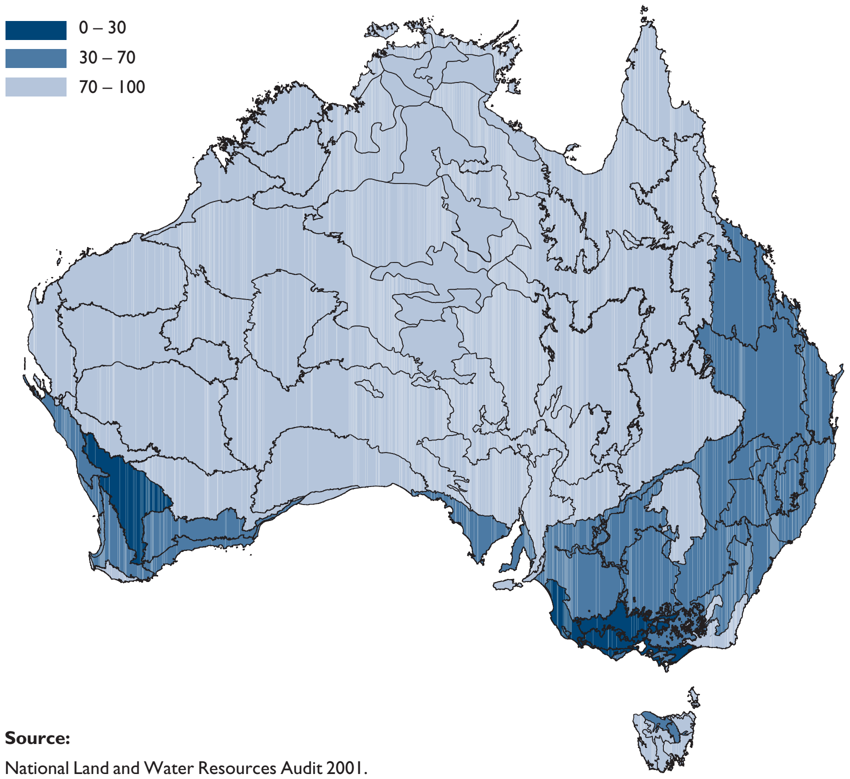
Fifty-eight bioregions have greater than 70% of native vegetation remaining.

Detailed information on each major vegetation group cleared and the percentage of pre-European vegetation remaining for the five bioregions with less than 30% remaining native vegetation is presented in Table 14. This break-up is extremely valuable in assessing the status of each vegetation group within a region, in particular for regions where the total clearing may not be high but particular vegetation groups within the region are being targeted for clearing.

Table 13. Summary figures of clearing and remaining native vegetation for IBRA bioregions with less than 30% of native vegetation remaining.

	Victorian Midlands	Naracoorte Coastal Plain	South East Coastal Plain	Avon Wheatbelt	Victorian Volcanic Plain
Area cleared (ha)	2 704 748	1 948 364	1 339 960	8 132 108	1 998 844
Total area of bioregion (ha)	3 782 384	2 541 888	1 697 036	9 517 188	2 162 192
Percent cleared native vegetation	71.5	76.7	79.0	85.4	92.4
Percent remaining native vegetation	28.5	23.3	21.0	14.6	7.6

Figure 20. Percentage native vegetation extent by IBRA bioregion.



Source:

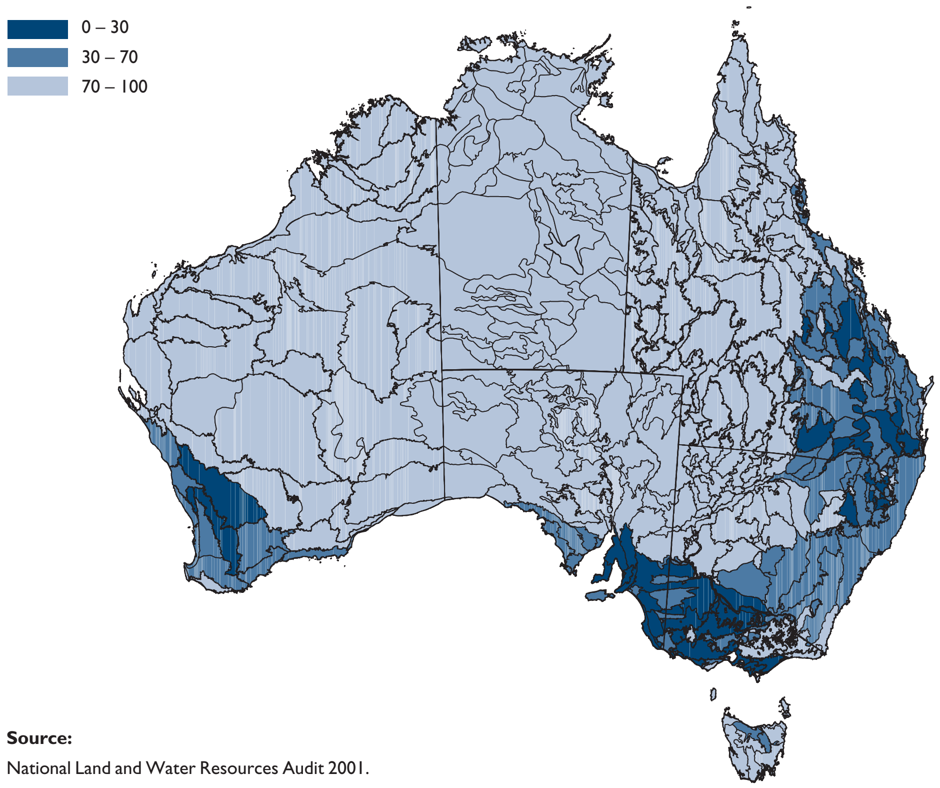
National Land and Water Resources Audit 2001.

IBRA Bioregions V. 5.1, Environment Australia 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure 21. Percentage native vegetation extent by IBRA subregion.



Source:

National Land and Water Resources Audit 2001.

IBRA Subregions V. 5.1, Environment Australia 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

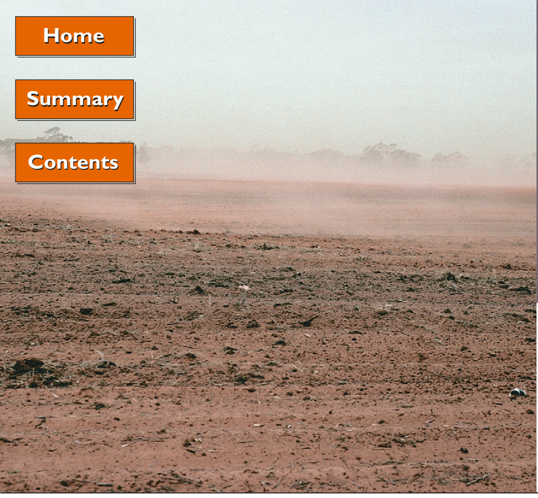
Table 14. Area (ha) of major vegetation groups and clearing for IBRA bioregions with < 30% of native vegetation remaining.

	MAJOR VEGETATION GROUPS																			
	Rainforest and vine thickets	Eucalypt tall open forests	Eucalypt open forests	Eucalypt low open forests	Eucalypt woodlands	Acacia forests and woodlands	Callitris forests and woodlands	Casuarina forests and woodlands	Melaleuca forests and woodlands	Other forests and woodlands	Eucalypt open woodlands	Mallee woodlands and shrublands	Low closed forests and closed shrublands	Acacia shrublands	Other shrublands	Heath	Tussock grasslands	Other grasslands, herbland, etc	Chenopod shrubs, samphires, etc	Mangrove group
Naracoorte Coastal Plain																				
present vegetation	–	12	46 652	1 308	146 048	36	–	328	4 552	104	5 092	161 060	16 644	12 724	76 764	45 388	7 760	26 068	19 496	23 488
cleared vegetation	–	0	229 888	40	528 040	0	–	0	9 320	1 712	49 424	521 712	10 740	243 268	52 192	444	242 620	7 552	41 160	8 692
pre-European veg.	–	12	276 540	1 348	674 088	36	–	328	13 872	1 816	54 516	682 772	27 384	255 992	128 956	45 832	250 380	33 620	60 656	32 180
percent remaining	–	100	16.87	97.03	21.67	100	–	100	32.81	5.73	9.34	23.59	60.78	4.97	59.53	99.03	3.10	77.54	32.14	72.99
Victorian Volcanic Plain																				
present vegetation	–	656	34 392	40	49 616	180	–	–	4	708	1 020	1 932	4 484	0	852	36	4 512	872	9 320	54 724
cleared vegetation	–	12 740	31 368	112	759 796	1 316	–	–	72	11 260	266 260	964	34 808	16	63 208	52	770 592	44 988	920	364
pre-European veg.	–	13 396	65 760	152	809 412	1 496	–	–	76	11 968	267 280	2 896	39 292	16	64 060	88	775 104	45 860	10 240	55 088
percent remaining	–	4.90	52.30	26.32	6.13	12.03	–	–	5.26	5.92	0.38	66.71	11.41	0	1.33	40.91	0.58	1.90	91.02	99.34
South East Coastal Plain																				
present vegetation	8	14 864	109 444	928	65 112	1 008	–	–	548	35 464	1 056	–	19 736	928	9 336	9 248	1 028	22 156	37 200	29 012
cleared vegetation	120	46 164	328 952	316	635 084	17 880	–	–	4 004	14 476	3 292	–	147 780	2 004	11 920	2 356	48 040	51 460	2 396	480
pre-European veg.	128	61 028	438 396	1 244	700 196	18 888	–	–	4 552	49 940	4 348	–	167 516	2 932	21 256	11 604	49 068	73 616	39 596	29 492
percent remaining	6.25	24.36	24.96	74.60	9.30	5.34	–	–	12.04	71.01	24.29	–	11.78	31.65	43.92	79.70	2.10	30.10	93.95	98.37
Avon Wheatbelt																				
present vegetation	–	4	720	–	525 408	4	–	6 836	532	952	36 588	87 024	52 176	271 356	216 184	31 916	–	–	103 800	51 580
cleared vegetation	–	36	1 696	–	92	152	–	17 668	2 012	4 532	4 824 552	813 108	339 224	488 420	848 204	387 540	–	–	235 996	168 876
pre-European veg.	–	40	2 416	–	525 500	156	–	24 504	2 544	5 484	4 861 140	900 132	391 400	759 776	1 064 388	419 456	–	–	339 796	220 456
Percent remaining	–	10.00	29.80	–	99.98	2.56	–	27.90	20.91	17.36	0.75	9.67	13.33	35.72	20.31	7.61	–	–	30.55	23.40
Victorian Midlands																				
present vegetation	–	69 756	122 372	9 912	691 112	1 420	724	–	–	300	33 892	28 056	8 180	–	23 972	14 132	1 648	17 348	19 712	35 100
cleared vegetation	–	90 048	83 044	9 520	1 836 544	7 188	2 000	–	–	3 072	552 060	23 432	5 888	–	9 168	440	68 144	14 128	8	64
pre-European veg.	–	159 804	205 416	19 432	2 527 656	8 608	2 724	–	–	3 372	585 952	51 488	14 068	–	33 140	14 572	69 792	31 476	19 720	35 164
percent remaining	–	43.65	59.57	51.01	27.34	16.50	26.58	–	–	8.90	5.78	54.49	58.15	–	72.34	96.98	2.36	55.12	99.96	99.82

Table 15. Area (ha) of major vegetation groups and clearing for the Tasmanian Northern Slopes IBRA bioregion with 64% of native vegetation remaining.

	MAJOR VEGETATION GROUPS													
	Rainforest and vine thickets	Eucalypt tall open forests	Eucalypt open forests	Eucalypt low open forests	Eucalypt woodlands	Acacia forests and woodlands	Other forests and woodlands	Eucalypt open woodlands	Low closed forests and closed shrubland	Other shrublands	Heath	Tussock grasslands	Other grasslands, herblands, etc	Mangrove group
present vegetation	47 824	76 884	250 376	–	5 636	124	168	104	3 564	496	420	344	4 448	6 228
cleared vegetation	6 572	98 392	27 460	332	48 060	6 880	–	–	39 112	–	–	–	–	–
pre-European vegetation	54 396	175 276	277 836	332	53 696	7 004	168	104	42 676	496	420	344	4 448	6 228
percent remaining	88	44	90	–	10	2	100	100	8	100	100	100	100	100

– Indicates that this major vegetation group does not exist in a particular jurisdiction or that the scale and type of mapping compiled has not captured this major vegetation group.



Dust storm, ploughed mallee, Mildura – Renmark Road, Victoria

An example of a bioregion with a much higher total percentage of native vegetation remaining is the Tasmanian Northern Slopes bioregion with 64% of native vegetation remaining. Information on remaining native vegetation extent, clearing and percentage relative to pre-European extent is presented in Table 15. Within this bioregion a number of major vegetation groups have either been cleared or have less than 30% of their pre-European extent remaining. They include eucalypt low open forests, eucalypt woodlands, acacia forests and woodlands and low closed forests and closed shrublands.

Many bioregions cover very large areas. It is useful to analyse the data to assess clearing levels in absolute terms (e.g. from Table 16, in 25 of the 85 bioregions native vegetation clearing exceeds 1 million hectares; these bioregions contain 91 million hectares of cleared land—92% of the total area of native vegetation cleared area in Australia; these bioregions occur across south-western Western Australia, southern South Australia, most of Victoria and New South Wales and central and southern Queensland).

Only an additional three bioregions have 800 000 – 1 000 000 ha of clearing. These are the Desert Uplands bioregion in Queensland, the Cobar Peneplain in New South Wales and the Swan Coastal Plain bioregion in Western Australia. The remaining 14 bioregions have 100 000 – 800 000 ha of native vegetation removed.

Table 16. Bioregions with greater than 800 000 ha of native vegetation cleared.

IBRA bioregion	Cleared native vegetation (ha)	Total area of region (ha)	Percent cleared native vegetation	Percent remaining native vegetation
Desert Uplands	811 564	7 032 020	11.5	88.5
Cobar Peneplain	820 516	7 350 240	11.2	88.8
Swan Coastal Plain	915 752	1 512 400	60.5	39.5
Sydney Basin	1 142 868	3 632 932	31.5	68.5
Mitchell Grass Downs	1 167 240	33 513 668	3.5	96.5
Flinders Lofty Block	1 300 556	7 126 092	18.3	81.7
South East Coastal Plain	1 339 960	1 697 036	79.0	21.0
Esperance Plains	1 402 020	2 906 644	48.2	51.8
Nandewar	1 748 584	2 698 724	64.8	35.2
New England Tableland	1 774 852	3 004 080	59.1	40.9
Geraldton Sandplains	1 921 976	3 966 988	48.4	51.6
Naracoorte Coastal Plain	1 948 364	2 541 888	76.7	23.3
Jarrah forest	1 959 380	4 507 968	43.5	56.5
Victorian Volcanic Plain	1 998 844	2 162 192	92.4	7.6
New South Wales North Coast	2 220 440	5 925 384	37.5	62.5
Victorian Midlands	2 704 748	3 782 384	71.5	28.5
Mulga Lands	3 307 320	25 299 496	13.1	86.9
South Eastern Queensland	3 376 096	5 943 728	56.8	43.2
Mallee	3 389 464	7 394 820	45.8	54.2
Darling Riverine Plains	3 428 472	10 652 152	32.2	67.8
South Eastern Highlands	3 697 800	8 743 444	42.3	57.7
Eyre Yorke Block	3 954 300	6 078 720	65.1	34.9
Riverina	4 580 904	9 589 472	47.8	52.2
New South Wales South Western Slopes	5 715 272	8 673 896	65.9	34.1
Brigalow Belt North	6 430 308	13 552 556	47.4	52.6
Murray Darling Depression	7 450 212	19 749 136	37.7	62.3
Avon Wheatbelt	8 132 108	9 517 188	85.4	14.6
Brigalow Belt South	14 948 992	26 926 740	55.5	44.5

Bioregions contain distinctive geomorphic units that closely align with land capability and development potential, termed subregions. The subregions mentioned previously developed as part of the Audit's Landscape Health initiative (NLWRA 2001c) provide a scale of analysis more appropriate to regional vegetation management planning.

- Of 22 bioregions with 30–70% of native vegetation remaining, 27 of a total of 130 subregions within these bioregions have less than 30% of native vegetation remaining; 33 subregions have greater than 70% of native vegetation remaining (Figures 20, 21)
- Of 28 bioregions with greater than 800 000 ha of native vegetation cleared since European settlement, 39 of a total 174 subregions within these bioregions have less than 30% native vegetation remaining; 61 subregions have greater than 70% of native vegetation remaining

This information with detailed vegetation types within bioregions and subregions is available on the Australian Natural Resources Atlas and provides the level of detail likely to be of value to regional groups as they plan for vegetation management and biodiversity conservation.

Applications

At the bioregion scale, the analysis provides an overview of the status of bioregions in terms of their native vegetation cover (a broad surrogate for biodiversity condition). At the subregion scale, the analysis provides information relevant to vegetation management planning, identifying key land types where management activities such as rehabilitation and protection for biodiversity conservation may be a priority.

Limitations

Bioregions cover large areas and are often bisected by administrative boundaries (e.g. local and State/Territory government boundaries or State/Territory land administration boundaries). Patterns of vegetation clearing are often influenced by these management factors. Therefore, the bioregion analysis is limited as an absolute indicator of bioregion condition.

The analysis is also limited by the quality of the present vegetation information compiled into the National Vegetation Information System and in development of the major vegetation groups. The limitations and guidelines provide information on the present vegetation products. In particular, recent clearing in some areas of Tasmania, New South Wales and Queensland are not mapped.

AUSTRALIAN CAPITAL TERRITORY

Major vegetation groups and their status in each State and Territory

Namadgi National Park, Australian Capital Territory

Key features

Dominated by the Brindabella and Booth Ranges and associated foothills, the vegetation of this small Territory is typical of the Australian Alps and South East Highlands bioregions of New South Wales (Figure 22, Table 17).

The largest area of the Australian Capital Territory is covered by the South East Highlands bioregion where clearing has been concentrated and urban infrastructure associated with the centre of Canberra is located.

- Dominant vegetation in the higher altitude and subalpine areas is eucalypt open forests, eucalypt woodlands, eucalypt open woodlands, heath, closed shrublands and tussock grasslands.
- Patches of eucalypt tall open forests, low closed forests, callitris and eucalypt woodlands, and tussock grasslands occur at lower altitudes.

Vegetation change

In the Australian Capital Territory, 31% or 0.07 million hectares of native vegetation has been removed. The northern part of the Australian Capital Territory has been cleared for urban development, grazing, minor cropping and pine plantations.

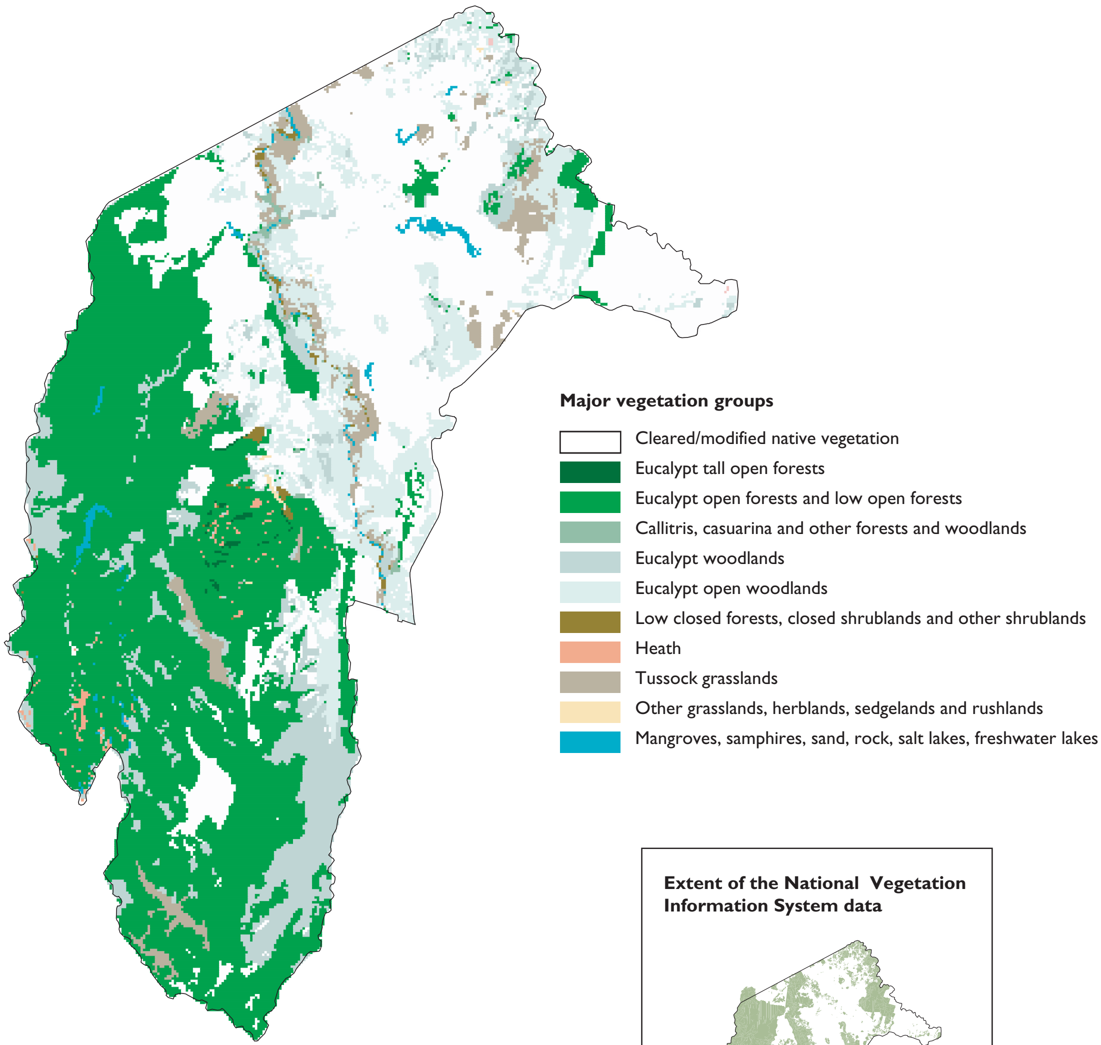
Major vegetation groups most affected are the eucalypt woodlands of the foothills of the Brindabella Ranges and the natural temperate grasslands and eucalypt grassy woodlands of the adjoining tablelands. The Brindabella and Booth Ranges cover a large proportion of the Australian Capital Territory and Namadgi National Park conserves a large area of these mountains. Three water impoundments have been constructed on the Cotter River to supply domestic water to Canberra.

Table 17. Area (km^2) of pre-European and native vegetation in the Australian Capital Territory*.

Major vegetation group	Present	Pre-European
Eucalypt open forests	937	984
Eucalypt open woodlands	270	270
Eucalypt woodlands	223	725
Tussock grasslands	91	207
Eucalypt low open forests	49	123
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	18	18
Heath	9	9
Other shrublands	8	8
Callitris forests and woodlands	5	5
Eucalypt tall open forests	4	4
Casuarina forests and woodlands	3	3
Other grasslands, herblands, sedgelands and rushlands	2	2

* in order of greatest to smallest area

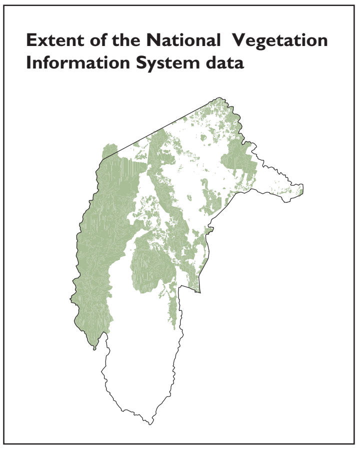
Figure 22. Present major vegetation groups in the Australian Capital Territory.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

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Dicksonia antarctica swamp, near Monga, New South Wales

NEW SOUTH WALES

Major vegetation groups and their status in each State and Territory

Key features

The vegetation of New South Wales includes major examples of a broad range of plant communities. They occur in subtropical, alpine and arid environments and reflect the diversity of geologic patterns and climatic variability. New South Wales shares many vegetation communities with the Australian Capital Territory, Queensland, Victoria and South Australia (Figure 23, Table 18).

Eastern New South Wales is dominated by eucalypt open forests moving to landscapes dominated by acacia shrublands and chenopod and samphire shrublands in the west. Eucalypt woodlands occur throughout the State. Although the State contains many endemic plants, the sandstone communities of the Sydney Basin represent the major expression of plant communities confined specifically to this State.

Grasslands are widespread throughout central and eastern New South Wales and are composed of native and 'derived' grasslands. Derived grasslands occur in areas where the tree or shrub cover has been removed by clearing or other factors (Benson 1999).

Bioregions in New South Wales

Channel Country

Most of this bioregion occurs in Queensland with parts in the Northern Territory and South Australia. It has an arid climate with very dry hot summers and short dry winters and is characterised by vast braided, flood and alluvial plains.

- Dominated by tussock grasslands, pockets of acacia shrublands and acacia forests and woodlands along drainage depressions in the west.
- In the east chenopod and samphire shrublands, grasslands and acacia shrublands dominate.

Major land uses are grazing and nature conservation including the major part of the Sturt National Park.

Broken Hill Complex

This bioregion extends into South Australia and includes the entire length of the Barrier Ranges. It has a dry, hot to warm climate.

- Acacia shrublands, chenopod shrublands and casuarina forests and woodlands dominate with a small area of callitris.
- A range of vegetation groups occur along water courses including eucalypt low open forests, and eucalypt woodlands.

Livestock grazing is the major land use with some nature conservation and native forestry.

Mulga Lands

Most of this bioregion occurs in Queensland. It is characterised by flat to gently undulating plains. Rainfall is summer dominant with increasing winter rain towards the south.

- Dominated in the west by acacia shrublands and in the east with acacia forests and woodlands.
- Other vegetation includes eucalypt open forests, casuarina and chenopod communities in drainage depressions and small areas of eucalypt woodland.

Livestock grazing is the dominant land use with some nature conservation.

Simpson–Strzelecki Dunefields

Most of this bioregion occurs in South Australia and the Northern Territory with a smaller part in Queensland.

- Dominated by dune vegetation of acacia shrublands with a spinifex (hummock grassland) understorey and linear strips of eucalypt low open forests along drainage depressions.

Dominant land uses are grazing and nature conservation including the north-west corner of the Sturt National Park.

Murray–Darling Depression

This bioregion extends into South Australia and Victoria and is characterised by gently undulating sandy and clay plains frequently overlain by dunes.

- Dominated by mallee woodlands and shrublands, casuarina forests and woodlands, acacia shrublands with some chenopod and samphire communities, grasslands and low closed forests and closed shrublands in the south.
- Pockets of callitris forests and woodlands and eucalypt woodlands occur in the north.
- Two small parts of the region in the east are dominated by mallee communities (Nombinnie Nature Reserve) in the north and grasslands in the south.

Major land uses are grazing and nature conservation (e.g. Mallee Cliffs National Park, Willandra World Heritage Area). Limited clearing of mallee, casuarina and chenopod communities has occurred in the far south.

Riverina

This bioregion extends into Victoria and a small part of the Murray River into South Australia. It has a dry climate and includes parts of the Murrumbidgee, Lachlan and Murray rivers.

- Chenopod shrubs (bladder saltbush) and tussock grasslands dominate.
- Low closed forests and closed shrublands occur along drier watercourses with eucalypt open forests, eucalypt woodlands and casuarina communities along the major watercourses.

Large areas in the south and south east of this region have been cleared. Major land uses are livestock grazing with large areas of irrigation, some dryland agriculture, native forestry and nature conservation (Willandra National Park).

Darling Riverine Plain

This bioregion extends partly into Queensland, contains the Darling River system and is characterised by alluvial fans and plains with a hot dry climate in the west and less dry in the east.

- Dominated along the Darling River by eucalypt open forests, tussock grassland and chenopod and samphire shrubs.
- Remaining area contains a wide variety of vegetation groups including chenopod and samphire shrublands, grasslands, acacia forests and woodlands, eucalypt woodland, eucalypt open woodland, low closed forests and closed shrublands and eucalypt tall open forests along the Barwon River.

Major land uses are grazing and dryland cereal cropping with some nature conservation, grazing of modified pastures, native forestry, and irrigated cropping and pastures. This bioregion spans parts of the western and central regions of New South Wales with much of the vegetation in the east and south cleared for dryland and some irrigated agriculture (cotton and cereals) or under threat of clearing for cropping.

Cobar Peneplain

This region consists of rocky outcrops with limited alluvial soils with a warm to hot dry climate.

- Dominated in the western part by eucalypt woodland, acacia shrublands, callitris forests and woodlands with small areas of acacia forests and woodlands. This area remains uncleared and is primarily used for livestock grazing.
- Patchy areas of eucalypt open woodland and grasslands occur in the east of the region which has undergone clearing for dryland agriculture.

Eleven percent of the bioregion is cleared. Major land uses are grazing of native pastures, cropping and some grazing of modified pastures, native forestry, nature conservation and irrigated cropping (cotton in the north).

Brigalow Belt South

Most of this bioregion occurs in Queensland. It has been substantially cleared for grazing and cropping.

- Eucalypt open woodlands and woodlands and mallee woodlands and shrublands dominate the remaining vegetation.
- Scattered remnants of eucalypt open forests, callitris and acacia forests and woodlands and acacia open woodlands remain.

Major land uses are grazing of native and modified pastures, native forestry and dryland agriculture (cereals, legumes, cotton, oilseeds and oleaginous fruit) with some nature conservation (e.g. Pilliga Nature Reserve) and irrigated cotton.

New South Wales South Western Slope

This bioregion has a small part within Victoria and is characterised by foothills and isolated ranges with a warm to hot and dry climate. It has been extensively cleared (66%) of eucalypt woodlands for cropping and grazing with introduced pastures.

- Remnants of eucalypt woodland, eucalypt open forests and grasslands occur with scattered occurrences of callitris, heath and chenopod and samphire shrublands.

Major land uses are dryland agriculture (cereals, legumes, oilseeds and oleaginous fruit), irrigated cropping (cereals and cotton), irrigated pastures and irrigated horticulture (e.g. tree fruits).

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Cattle grazing, north-west New South Wales

New South Wales North Coast

This biorregion is characterised by a series of escarpments, foothills and coastal plains and has a subtropical (summer and winter rainfall) to temperate climate further inland.

- Large areas of eucalypt open forests, rainforests and mangroves occur on the coast.
- Large areas on the foothills and coast plains have been cleared.
- More detailed mapping and survey has shown that this area has a high diversity of vegetation and plant species.

The area has been extensively cleared (38%) primarily for grazing of native and modified pastures with other major land uses including minimal use, native and some plantation forestry and nature conservation. The largest areas of rainforest are protected, as are many coastal communities (e.g. Oxley Wild Rivers, Barrington Tops, Myall Lakes and Lamington National Parks). Irrigation occurs along the coast and the south and dryland cropping for cereals and sugar.

New England Tableland

This bioregion consists of undulating elevated plateaus of hills and plains with a temperate (dry and hot summer) climate and extends into southern Queensland.

- Dominated by eucalypt open forests, woodlands and open woodlands.

The area has been cleared primarily for grazing of native and modified pastures, minimal use, some nature conservation, native forestry and dryland cropping (cereals).

Nandewar

This bioregion extends into southern Queensland and is located on the north western slopes of New South Wales with a temperate (hot summer) climate with winter and summer rain.

- Dominated by eucalypt open forests and open woodlands and mallee woodlands and shrublands.

The area has been extensively cleared primarily for grazing of native pastures, dryland cropping (cereals and legumes) and some grazing of modified pastures. Other land uses include minimal use, nature conservation(Kaputar National Park is the largest protected area) and native forestry.

Sydney Basin

This bioregion is characterised by dissected plateaus (sandstones and shales) with a temperate (mild to hot summer) climate.

- Dominated by a large range of vegetation types including eucalypt woodlands, eucalypt open forests and scattered patches of eucalypt tall open forests, eucalypt low open forests, eucalypt woodland, heath, mallee, rainforest, mangroves, grasslands and samphire communities.

Thirty-two percent of the bioregion has been cleared (particularly on the Illawarra and Cumberland Plains) for grazing of native pastures, urban development and small areas of irrigation, forestry and grazing of modified pastures. Large areas of vegetation are protected such as the Wollemi, Yengo, Blue Mountains, Nattai and Morton National Parks.

South East Corner

This bioregion extends into Victoria and is characterised by a series of deeply dissected near coastal ranges, gently undulating terraces, coastal plains, dunes and inlets. It has a temperate, mild to warm summer climate.

- Dominated by eucalypt open forests and eucalypt tall open forests on the steep escarpment and undulating foothills.
- Scattered patches of rainforest, eucalypt woodland and open woodland, acacia forests, woodlands and shrublands, heath, mangroves and other wetland vegetation.

Major land uses include native forests, nature conservation and grazing. Clearing of eucalypt open and tall open forests and heath and grasslands on the coast has occurred mainly for urban expansion, livestock grazing and cropping.

South East Highlands

This bioregion extends into the Australian Capital Territory and Victoria. The region consists of undulating plateaus and steep dissecting ranges.

- Dominated by eucalypt woodlands and tussock grasslands in the south.
- Scattered patches of heath, eucalypt tall open forests, rainforest and swamps occur throughout the region.

The region has been extensively cleared with grazing of native and modified pastures the major land uses. Other land uses include plantations, native forests, dryland cropping, nature conservation and some irrigated cropping.

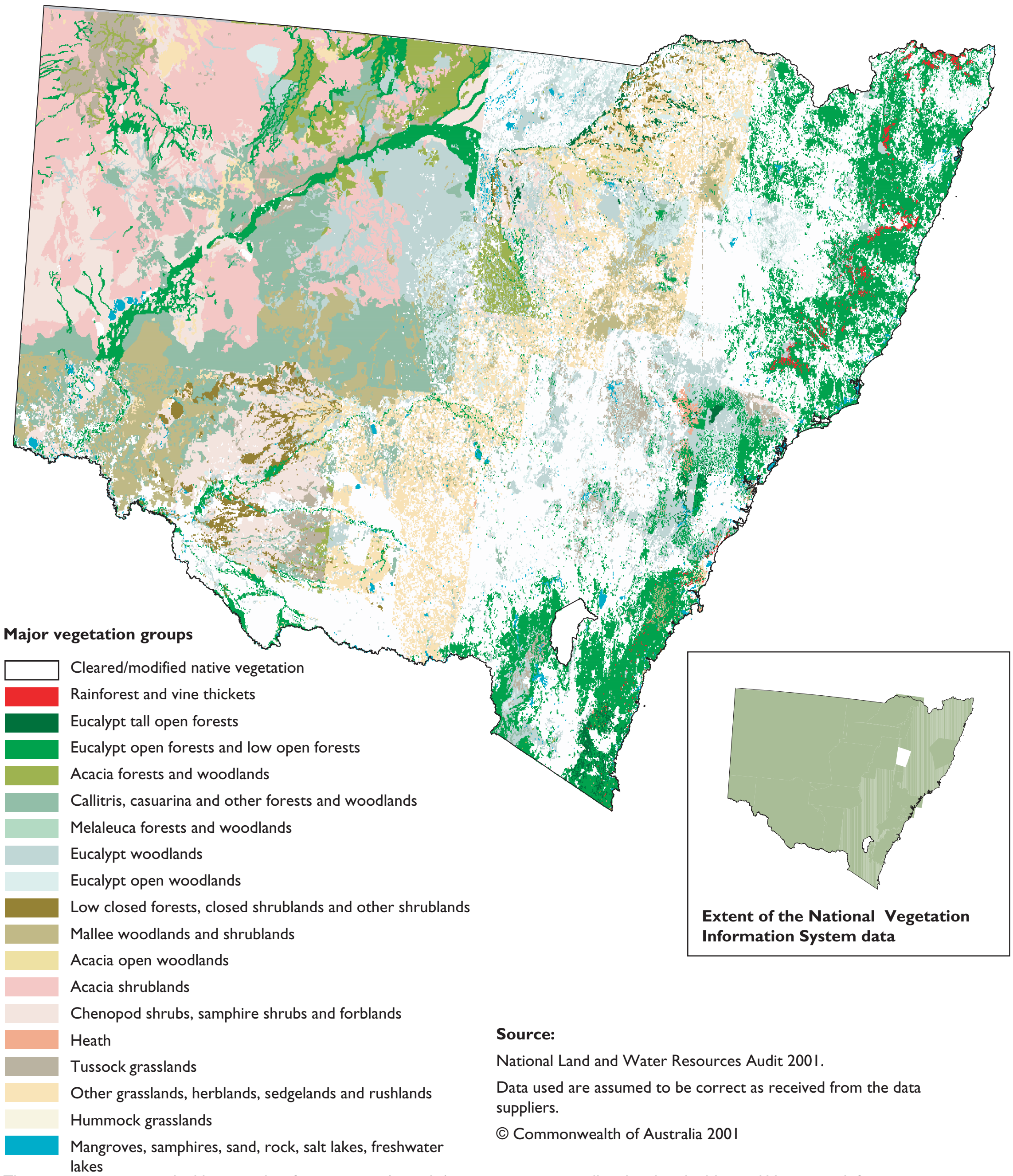
Australian Alps

This bioregion extends into Victoria and the Australian Capital Territory. The alpine region in southern New South Wales is characterised by a series of high elevation plateaus.

- Contains the only alpine and the majority of the subapline vegetation in New South Wales and is often snow covered in winter.
- Dominated by eucalypt open forests and woodlands and tussock grassland.
- Small areas of eucalypt open woodlands and heath are present.

The majority of this region is protected in the Namadgi and Kosciuszko National Parks. The region is recovering from past grazing and soil erosion. The Kosciuszko National Park is under pressure from tourism and ski development. It is the location of major water impoundments for diversion to the Murray and Murrumbidgee rivers.

Figure 23. Present major vegetation groups in New South Wales.



Extent of the National Vegetation Information System data

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Table 18. Area (km^2) of pre-European and native vegetation in New South Wales*.

Major vegetation group	Present	Pre-European
Eucalypt open forests	90 979	138 576
Acacia shrublands	77 017	77 081
Eucalypt woodlands	68 306	207 980
Other grasslands, herblands, sedgelands and rushlands	65 761	65 917
Chenopod shrubs, samphire shrubs and forblands	62 322	68 766
Casuarina forests and woodlands	40 698	42 580
Mallee woodlands and shrublands	33 889	36 746
Eucalypt open woodlands	31 245	31 247
Callitris forests and woodlands	22 132	23 724
Acacia forests and woodlands	21 184	26 099
Tussock grasslands	19 318	40 790
Eucalypt low open forests	10 883	10 894
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	5 411	5 670
Other shrublands	5 117	5 294
Eucalypt tall open forests	4 405	8 567
Low closed forests and closed shrublands	3 725	3 761
Rainforest and vine thickets	2 218	4 836
Heath	1 154	1 245
Other forests and woodlands	141	189
Acacia open woodlands	138	138
Melaleuca forests and woodlands	14	130
Hummock grasslands	4	4

* in order of greatest to smallest area

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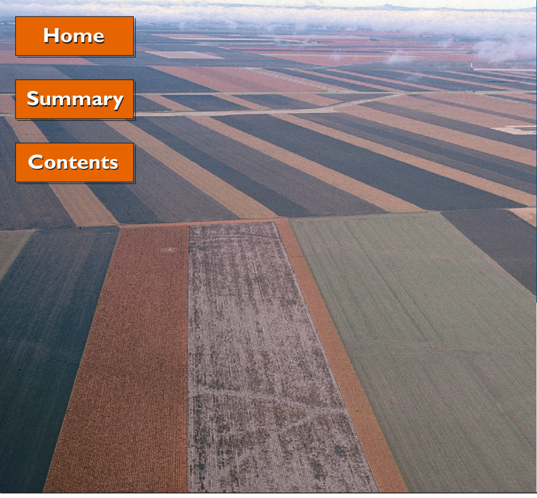

Wheat harvest, Narromine, New South Wales

Vegetation change

In New South Wales, 30%, or 23.4 million hectares, of native vegetation has been removed in the coastal lowlands and floodplains of northern New South Wales, the central coast from the Hunter to Illawarra and the south coast around Bega district. The alluvial plains, adjoining north-west slopes and New England Tableland of the Murray–Darling Basin have also been extensively cleared, as have the south-west slopes and southern highlands such as the Monaro Tableland. New South Wales has one of the largest areas of cleared land in Australia.

The main cause of decline and change to native vegetation since European settlement have been clearing for cropping and grazing by stock, grazing by feral animals, logging, weed invasion, mining, soil degradation through compaction, salinisation and acidification and pollution including nutrification of waterways (Benson 1999).

Major vegetation groups most affected are the eucalypt woodlands, tussock grasslands, acacia forests and woodlands, chenopod shrublands, eucalypt open forests, eucalypt tall open forests and rainforest and vine thickets.

Much of the New South Wales mapped data available for compilation in the National Vegetation Information System does not reflect the current extent of native vegetation. The data over-represents the amount of tree cover in the State as clearing has occurred since the mapping was undertaken. More recent extent figures summarised by subregion are presented in the Landscape Health report (NLWRA 2001c) and are available from New South Wales Department of Land and Water Conservation. Pre-European data is interim and area estimates from this comparison have been included for indicative purposes. Currently a program exists to map pre-European vegetation at a finer level of mapping across the State.

The Audit's assessment of landscape health provides a summary on a subregional basis of the landscape stresses in New South Wales including clearing, grazing, feral animals and weeds (NLWRA 2001c).

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NORTHERN TERRITORY

Major vegetation groups and their status in each State and Territory

Mulga distribution patterns south of Alice Springs, Northern Territory

Key features

The Northern Territory has a diversity of vegetation that is maintained by its variety of climate and soils (Parks and Wildlife Commission, no date):

- the climate gradually moves from seasonally wet tropical in the north to arid in the south; and
- areas of rocky escarpment and plateau break a low relief landscape in the north while the south contains rocky ranges.

In the north, the vegetation is typically tropical savanna (eucalypt woodland and eucalypt open woodland with a grassy understorey). This landscape experiences dramatic seasonal changes with intense growth in the wet season (summer) and widespread fires in the dry season (winter). Famous worldwide for the tropical wetlands and rugged sandstone escarpments of Kakadu National Park the wetlands are of importance for conservation, providing breeding areas, habitat and refuge for important wildlife populations (Parks and Wildlife Commission, no date) (Figure 24, Table 19).

From the north a transition area moves from eucalypt woodlands into areas of melaleuca and acacia forests and woodlands and south into the spinifex (hummock grasslands), Mitchell grass (tussock grasslands) and acacia woodlands and shrublands. The vegetation increases in diversity around Alice Springs with areas of mulga, mallee, chenopods, hummock grasslands, small pockets of eucalypt woodlands and salt lakes.

The Northern Territory is the only area in Australia that does not have conspicuous temperate flora.

Bioregions in Northern Territory

Tiwi–Cobourg

This bioregion has gently sloping terrain and includes the mainland Cobourg Peninsula and the Tiwi Islands. It is within the tropical monsoonal north of Australia, with a distinct wet dry season and high temperatures throughout the year.

- Dominated by eucalypt open forests and smaller areas of tropical eucalypt woodlands/grasslands and mangroves.
- Patches of rainforest and vine thickets, acacia shrublands, samphire shrublands, melaleuca forests and woodlands and grasslands occur.

Major land uses are traditional Indigenous uses and nature conservation.

Arnhem Coast

This bioregion has gently undulating plains and low plateaus and is within the tropical monsoonal north of Australia, with distinct wet and dry seasons, and high temperatures throughout the year. It includes the northern Arnhem coast and Groote Eylandt.

- Dominated by eucalypt open forests and tropical eucalypt woodlands/grasslands.
- Patches of mangroves, melaleuca forests and woodlands and the grasslands group occur.

The major land use is traditional Indigenous use.

Darwin Coastal

This bioregion has gently undulating plains and is within the tropical monsoonal north of Australia, with a distinct wet dry season and high temperatures throughout the year. It includes the city of Darwin.

- Dominant vegetation is eucalypt open forests, tropical eucalypt woodlands/grasslands, melaleuca forests and woodlands and grasslands group on the floodplains.
- Patches of the mangroves group and other shrublands are present.

Major land uses are traditional Indigenous uses, nature conservation (including parts of Kakadu National Park and World Heritage Area and Litchfield National Park), urban and other intensive uses and grazing. Approximately 85 000 hectares have been cleared.

Pine Creek

This bioregion consists of hilly to rugged terrain and is within the tropical monsoonal belt of northern Australia.

- Dominant vegetation is tropical eucalypt woodlands/grasslands with some eucalypt open forests, melaleuca forests and woodlands and rainforest and vine thickets.

The region has undergone some localised clearing and the major land uses are grazing, nature conservation (including parts of Kakadu National Park and World Heritage Area and Litchfield National Park), traditional Indigenous uses and other intensive uses including horticulture.

Arnhem Plateau

This bioregion consists of rugged dissected terrain and plateaus and is within the tropical monsoonal belt of northern Australia.

- Dominant vegetation is eucalypt woodlands and open woodlands (spinifex understorey) with some eucalypt open forests and rainforest and vine thickets.

Major land uses are traditional Indigenous uses and nature conservation (including parts of Kakadu National Park and World Heritage Area).

Central Arnhem

This bioregion consists of gently sloping terrain and low hills and is within the tropical monsoonal belt of northern Australia.

- Dominant vegetation is tropical eucalypt woodlands/grasslands and eucalypt open forests.
- Smaller patches of eucalypt woodlands, melaleuca forests and woodlands and samphire shrublands on the coast are present.

The major land use is traditional Indigenous use.

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Daly Basin

This bioregion consists of gently undulating plains and scattered low plateau remnants and has a tropical monsoonal climate with distinct wet and dry seasons and high temperatures throughout the year.

- Dominant vegetation is tropical eucalypt woodlands/grasslands and eucalypt open forests.
- Smaller patches of eucalypt woodlands and melaleuca forests and woodlands are present.

The major land use is grazing on native pastures and traditional Indigenous uses with some horticulture, grazing on modified pastures and nature conservation. The region has undergone some clearing (approximately 167 000 ha) for these developments.

Victoria Bonaparte

This region extends into Western Australia and consists of a number of basins and the interior is dominated by the Victoria River Plateau, a large highly dissected plateau up to about 350 m above sea level. It has a dry winter, warm monsoon climate.

- Dominant vegetation is tropical eucalypt woodlands/grasslands, eucalypt open woodlands, tussock grasslands, eucalypt woodlands and melaleuca forests and woodlands.
- Small patches of eucalypt open forests and samphire shrublands on the coast occur.

The major land use is grazing on native pastures, traditional Indigenous uses and nature conservation.

Ord–Victoria Plains

This bioregion extends into Western Australia and consists of level to gently undulating plains with scattered hills and a climate that is dry, hot and tropical with summer rainfall.

- Dominant vegetation is eucalypt and open woodlands, hummock and tussock grasslands, other forests and woodlands (*Terminalia* and *Lysiphyllum* spp.) and small areas of acacia shrublands.

Major land uses are cattle grazing and some nature conservation (e.g. Gregory National Park).

Sturt Plateau

This bioregion consists of gently undulating plains with a hot, summer rainfall climate.

- Dominated by eucalypt woodlands, acacia forests and woodlands (including lancewood—*Acacia shirleyi)*, hummock grasslands, eucalypt open woodlands.
- Small patches of melaleuca forests and woodlands, other forests and woodlands, acacia shrublands and tussock grasslands occur.

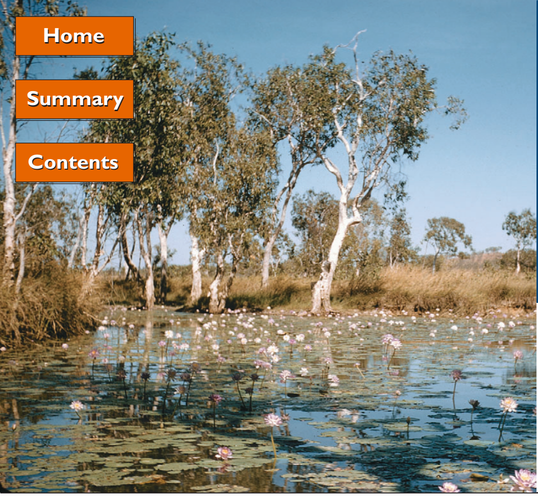
Major land uses are traditional Indigenous uses and cattle grazing.

Gulf Fall Uplands

This bioregion falls mainly in the Northern Territory with a very small part in Queensland. It consists of undulating terrain with scattered low steep hills and a dry, hot, summer rainfall climate.

- Dominant vegetation is eucalypt woodlands in the north and eucalypt open woodlands in the south with small pockets of melaleuca and acacia and other forests and woodlands.

Major land uses are cattle grazing and traditional Indigenous uses.



Near Adelaide River, Northern Territory

Mitchell Grass Downs

This bioregion extends into Queensland and consists of undulating plains with deep heavy clay soils and a hot arid climate.

- Dominant vegetation is tussock grasslands and eucalypt open woodlands in the north with small areas of chenopod shrublands, hummock grasslands, acacia open woodlands and low closed forests and woodlands.

Major land uses are cattle grazing (with much of the region dependent on the underlying Great Artesian Basin for water) and some nature conservation.

Davenport Murchison Ranges

The bioregion is characterised by a chain of rocky ranges and a hot and dry climate.

- Dominant vegetation is eucalypt open woodlands and mallee woodlands and shrublands, with acacia open woodlands, acacia shrublands and hummock grasslands in the south.

Major land uses are grazing, traditional Indigenous uses, minimal use (vacant crown land) and some nature conservation.

Tanami Desert

This bioregion extends into Western Australia and consists of hills and ranges with sand plains and a hot arid climate with summer rain.

- Dominant vegetation is hummock grasslands (*Triodia* spp.) with small areas of eucalypt open woodlands, tussock grasslands, low closed forests and closed shrublands, salt lakes, acacia shrublands and mallee communities.

Major land uses are traditional Indigenous uses, grazing and some minimal use and nature conservation (Puurta Co-Management Area).

Great Sandy Desert

This bioregion extends into Western Australia and includes extensive sand plains, dune fields, lakes and remnant rocky outcrops with a hot, arid climate. The monoliths Uluru and Kata Tjuta are in the very south-east of the bioregion.

- Dominated by hummock grasslands with small areas of acacia shrublands, low closed forest and closed shrublands, lakes (Lake Neale and Lake Amadeus), eucalypt open woodlands and chenopod shrublands.

Major land uses are traditional Indigenous uses, grazing and nature conservation (including the Uluru–Kata Tjuta National Park and World Heritage Area).

Burt Plain

This bioregion consists of plains and low rocky ranges with an arid climate.

- Dominant vegetation is acacia shrublands and open woodlands, and mallee woodlands and shrublands.
- Small areas of eucalypt open woodlands occur in drainage depressions.

The major land use is cattle grazing with some traditional Indigenous uses.

Channel Country

This bioregion extends largely into Queensland and South Australia with a small area in New South Wales. It is characterised by low hills and braided river systems with an arid climate that has very dry, hot summers and short, dry winters.

- Dominated by acacia open woodlands with some acacia shrublands, mallee communities, hummock grasslands and eucalypt open woodlands in the drainage depressions.

The major land use is cattle grazing.

Simpson–Strzelecki Desert

This bioregion extends into South Australia with small areas in Queensland and New South Wales. It consists of arid dune fields and sand plains.

- Dominant vegetation is hummock grasslands with mallee woodlands and shrublands, chenopod shrublands, acacia open woodlands and eucalypt open woodlands in the north.

Major land uses are grazing, minimal use (vacant crown land) and traditional Indigenous uses.

Finke

This bioregion extends into South Australia and consists of arid sand plains, dissected uplands and valleys with a hot arid climate.

- Dominated by hummock grasslands, chenopod shrublands and acacia shrublands.
- Small areas of acacia open woodlands and eucalypt open woodlands occur.

The major land use is cattle grazing.

MacDonnell Ranges

This bioregion consists of high relief and foothills with an arid climate modified by the presence of the mountain ranges.

- Dominated by hummock grasslands and acacia shrublands with small areas of acacia open woodlands and eucalypt open woodlands.

Major land uses are traditional Indigenous uses, nature conservation (including the Finke Gorge and West MacDonnell National Parks) and cattle grazing.

Central Ranges

This bioregion extends into Western Australia and South Australia and consists of ranges and sand plains and has an arid climate.

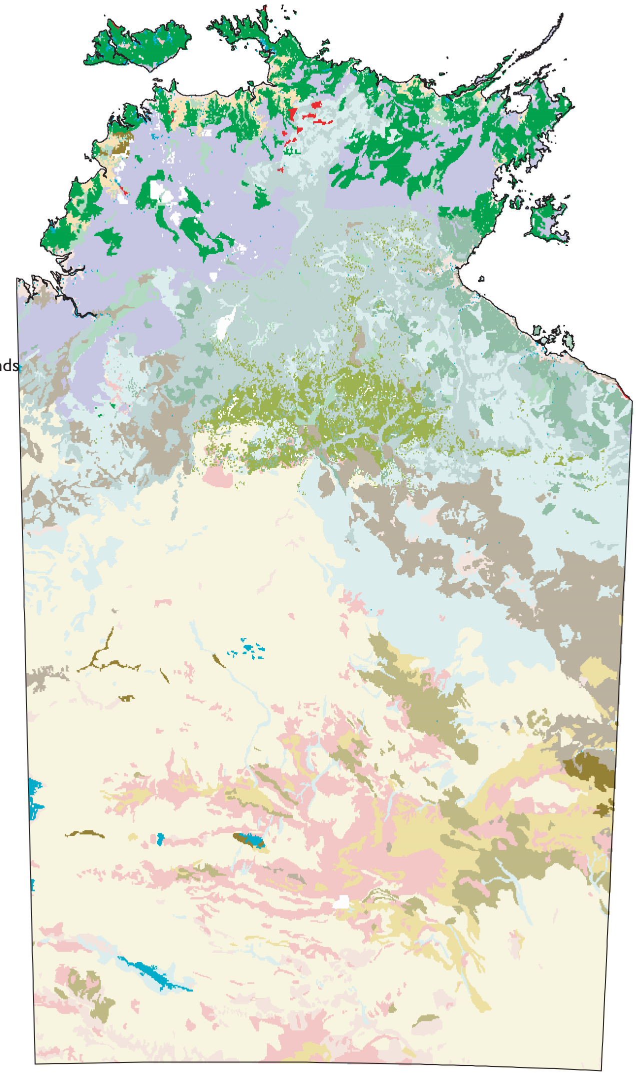
- Dominated by hummock grasslands, chenopod shrublands, acacia shrublands and mallee woodlands and shrublands.

The major land use is traditional Indigenous uses.

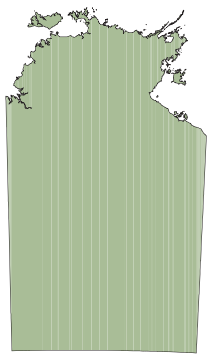
Figure 24. Present major vegetation groups in the Northern Territory.

Major vegetation groups

- Cleared/modified native vegetation
- Rainforest and vine thickets
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodland and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes



Extent of the National Vegetation Information System data



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

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Vegetation change

The Northern Territory has the most intact native vegetation of all States and Territories. It has not been significantly affected by intense land use pressure. Approximately 0.60 million hectares of native vegetation has been removed, but this is limited to a few areas, mainly associated with the Daly Basin, Darwin Coastal, Pine Creek and Sturt Plateau bioregions in the north and the MacDonnell Ranges bioregion in the south. Major vegetation groups affected are the tropical eucalypt woodlands/grasslands, eucalypt open forests and other eucalypt woodlands and acacia forests and woodlands.

Agricultural expansion is proposed or underway in some regions and a large proportion of the Territory is grazed. Careful land use planning will ensure that many values of the existing vegetation are conserved and that land uses are sustainable.

An assessment of landscape health in the Northern Territory including factors of clearing, grazing, feral animals and weeds provides a summary on a subregional basis of the landscape stresses (NLWRA 2001c).

Table 19. Area (km^2) of pre-European and native vegetation in the Northern Territory*.

Major vegetation group	Present	Pre-European
Hummock grasslands	490 232	490 363
Eucalypt open woodlands	175 775	175 842
Eucalypt woodlands	123 078	123 992
Tropical eucalypt woodlands/grasslands	107 254	109 430
Acacia shrublands	86 035	86 272
Tussock grasslands	83 613	83 678
Eucalypt open forests	58 471	59 346
Acacia open woodlands	48 703	48 814
Mallee woodlands and shrublands	35 450	35 450
Chenopod shrubs, samphire shrubs and forblands	33 753	33 757
Acacia forests and woodlands	29 866	30 442
Other forests and woodlands	29 497	29 508
Melaleuca forests and woodlands	19 244	19 402
Other grasslands, herblands, sedgelands and rushlands	7 633	7 666
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	5 410	5 551
Other shrublands	5 294	5 473
Rainforest and vine thickets	977	978
Eucalypt low open forests	70	70

* in order of greatest to smallest area

QUEENSLAND

Major vegetation groups and their status in each State and Territory

Key features

Queensland's flora is diverse reflecting both an array of environments and species-rich communities such as the rainforests and coastal heathlands. Queensland vegetation is best recognised by the rainforests, littoral communities and adjoining island and barrier reef environments of the Wet Tropics. The biogeography of the State is complex with a wide range of temperate, sub-tropical, tropical, monsoonal, marine and arid environments.

The eucalypt woodlands, tussock grasslands, eucalypt open woodlands, acacia shrublands, hummock grasslands and acacia forests and woodlands cover the greatest area in Queensland. Eucalypt woodlands and open woodlands occur on the east coast from Cape York Peninsula to the border with New South Wales. Western Queensland is dominated by tussock and hummock grasslands and acacia shrublands. Acacia forests and woodlands occur throughout Queensland (Figure 25, Table 20).

Bioregions in Queensland

Cape York Peninsula

This bioregion consists of gently undulating plains and plateaus with a tropical monsoon climate. Eucalypt woodlands and eucalypt open woodlands dominate Cape York Peninsula.

- Western areas are dominated by melaleuca forests and woodlands, while closer to the coast a range of low closed forests, mangroves, wetlands occur.
- Extensive areas of rainforest and eucalypt open forests occur on the eastern coast.

Major land uses are grazing of native pastures, nature conservation (e.g. Lakefield, Mungkan Kandju, Cape Melville, Jardine and Iron Range National Parks) and some native forestry.

Wet Tropics

The Wet Tropics region in the tropical east coast of northern Queensland contains rugged mountain ranges.

- Dominated by large areas of rainforests and vine thickets with eucalypt open forests.
- The low lying coastal plains support melaleuca and eucalypt communities.
- Tussock grasslands are scattered throughout the region.

Twenty-four percent of the bioregion has been cleared—large areas have been cleared inland for dairying and on the coastal plains for dryland (sugar cane) and irrigated cropping. Large areas of rainforest are protected in National Parks and state forests within the Wet Tropics World Heritage area.

Sugar cane, Mackay, Queensland

Central Mackay Coast

This bioregion has high rainfall, coastal lowlands hills and ranges.

- Dominated by eucalypt woodlands, eucalypt open forests, and rainforest and vine thickets.
- The coastal plains support a range of melaleuca, low closed forests and woodland communities, eucalypt woodland, eucalypt open forests, mangroves, samphires and sedgelands.

Major land uses are nature conservation (e.g. Eungella National Park), state forests, cattle grazing, and dryland and irrigated cropping for sugar cane on the lower lying plains. Thirty-one percent of the bioregion has been cleared.

Einasleigh Uplands

This bioregion contains undulating to hilly land with some rugged ranges and plateaus. It has a warm to hot climate.

- Dominated by eucalypt woodland and open woodland with significant patches of rainforest and vine thickets.
- It contains small areas of acacia forests and woodlands and tussock grasslands and a large area of eucalypt open forests in the east.

The region is mainly used for cattle grazing with some horticulture and cropping and small localised areas of grazing of modified pastures.

Gulf Plains

This bioregion extends slightly into the Northern Territory.

- Extensive alluvial plains are dominated by large areas of mangroves, grasslands, eucalypt open forests and tropical eucalypt woodlands moving into tussock (blue grass—*Dichanthium*) grasslands, hummock (spinifex) grasslands, melaleuca and acacia forests and woodlands and eucalypt woodlands further inland.

The majority of the region is used for extensive cattle grazing with some nature conservation (e.g. Staaten River National Park). The littoral and estuarine communities of marine plains adjoining the Gulf of Carpentaria are extensive and support major fisheries including prawn, barramundi and shark.

Mount Isa Inlier

This bioregion consists of stony hills and ranges with a hot arid climate.

- Dominated by hummock grasslands, eucalypt open woodland, low closed forests and closed shrublands, other forests and woodlands and acacia open woodlands.
- Small areas of acacia forests and woodlands, tussock grasslands and eucalypt woodlands occur.

Major land uses are extensive cattle grazing and conservation (e.g. the Riversleigh World Heritage Area).

Mitchell Grass Downs

Extending into the Northern Territory, this bioregion consists of undulating plains with deep heavy clay soils and an arid hot climate.

- Dominated by Mitchell grass (tussock grasslands), acacia forests and woodlands and open woodlands in the central and western area; eucalypt woodlands and open woodlands, acacia shrublands, low closed forests and closed shrublands; and chenopods and samphires along water courses.

Clearing of acacia forests and woodlands and chenopods has occurred in the eastern part of the region. Major land uses are extensive cattle and sheep grazing and some nature conservation.

Channel Country

This bioregion extends into the Northern Territory, South Australia and New South Wales and is characterised by low hills and braided river systems with an arid climate of very dry hot summers and short dry winters.

- The vast braided floodplains are dominated by widespread hummock and tussock grasslands, chenopod and samphire shrublands, low closed forests and closed shrublands and acacia shrublands.
- Eucalypt woodlands and open woodlands occur along watercourses and many wetlands are present.
- The north-east part has widespread areas of acacia forests and woodlands and open woodlands.

The major land use is extensive cattle grazing with some nature conservation.

Simpson–Strzelecki Dunefields

This bioregion extends into the Northern Territory, South Australia and New South Wales and consists of arid dune fields and sand plains.

- Dominated by hummock grasslands, acacia shrublands and other forests and woodlands.

Major land uses are grazing and nature conservation (including the Simpson Desert National Park).

Mulga Lands

This bioregion extends into New South Wales and is characterised by flat to gently undulating plains. It has summer dominant rainfall with increasing winter rain towards the south.

- Large areas of mulga shrublands, acacia forests and woodlands with eucalypt woodland, eucalypt open woodland, callitris, eucalypt low open forests and chenopod and samphire communities along watercourses are present.

The major land use is cattle and sheep grazing with some nature conservation. The eastern part of this region has undergone a large degree of clearing for grazing of native and modified pastures. Vegetation cleared includes eucalypt woodlands and open woodlands, casuarina forests and woodlands and acacia forests and woodlands.

Darling Riverine Plain

This bioregion extends into New South Wales and is characterised by alluvial fans and plains. The climate is hot and dry in the west, less dry in the east.

- Extensively cleared with remnant eucalypt open woodlands, eucalypt woodlands, eucalypt tall open forests and low closed forests and closed shrublands.

Major land uses are grazing, and dryland (cereals) and irrigated (cotton) cropping.

Nanadewar

This bioregion extends largely into New South Wales.

- Extensively cleared and remaining vegetation is dominated by eucalypt woodland and small pockets of eucalypt open forests.

The major land use is grazing with some forestry and nature conservation in small areas.

South East Queensland

This bioregion is characterised by hills and ranges, alluvial valleys and coastal dunes with a subtropical to temperate climate in the south.

- Remaining native vegetation includes rainforests and vine thickets and eucalypt open woodlands with small areas of eucalypt woodlands.
- Lower lying coastal plains include heath, melaleuca, grasslands, rainforest and vine thickets, eucalypt open forests, other forests and woodlands and mangrove communities.

Major land uses are grazing, state forests and plantations, nature conservation (including the Fraser Island World Heritage Area), urban development and irrigated and dryland cropping. The region has been substantially cleared (57%) for grazing, agriculture and urban development.

Brigalow Belt South

This subcoastal belt extends into New South Wales and has a subtropical to temperate (hot summer) climate in the south.

- Dominated by eucalypt woodland, with acacia forests and woodlands in the west.
- Rainforest and vine thickets, heath and eucalypt open woodlands are scattered throughout with small pockets of eucalypt open forests.
- Grasslands, melaleuca communities and mangroves occur on the coast.

The region has been substantially cleared with major land uses of grazing, state forests, nature conservation (including Carnarvon National Park), cropping (dryland cereals and cotton, legumes and oilseeds), grazing on modified pastures and some irrigated cotton in the south. The major vegetation groups cleared are acacia forests and woodlands, eucalypt woodlands, eucalypt open woodlands, tussock grasslands and rainforests and vine thickets.

Brigalow Belt North

This subcoastal belt occurs east of the Great Dividing Range and includes the Fitzroy and Burdekin Rivers. It has a subtropical, dry winter climate.

- Dominated by eucalypt woodland, eucalypt open woodland, acacia forests and woodlands and patches of eucalypt open forests, rainforest and vine thickets and tussock grasslands.
- Coastal communities include melaleuca, acacia open woodlands, mangroves and samphires.

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Brigalow forest, near Tambo, Queensland

This bioregion has been substantially cleared (47%). The major land uses are grazing of native and modified pastures, native forestry, dryland and irrigated cropping and some nature conservation. Cropping in the south is mainly for cereals and irrigated sugar on the coast near Townsville. Major vegetation groups cleared are acacia forests and woodlands, eucalypt woodlands, eucalypt open woodlands and patches of tussock grasslands, rainforests and vine thickets, eucalypt open forests and melaleuca communities on the coast.

Desert Uplands

This region in central northern Queensland consists of sand plains with a hot, dry climate.

- Dominated by eucalypt woodland and open woodland with scattered occurrences of acacia forests and woodlands and small areas of hummock and tussock grasslands, eucalypt open forests and wetland communities.

Large areas have been cleared (12%) to south and north. Major land uses are grazing of native and some modified pastures, small areas of nature conservation (e.g. White Mountains National Park) and a very small area of cropping in the east.

Vegetation change

Eighteen percent (30.4 million hectares) of Queensland's native vegetation has been cleared, mainly in the coastal lowlands and floodplains from Cairns south to the New South Wales border and in the inland Brigalow Belt. Queensland has one of the largest areas of cleared land in Australia.

Major vegetation groups most affected are:

- rainforest and vine thickets;
- eucalypt open forests communities in far north Queensland and south-east Queensland; and
- eucalypt woodland, eucalypt open woodland, acacia forests and woodlands, casuarina forests and woodlands in the Brigalow Belt.

The rate of clearing in Queensland has increased from 289 000 ha/yr from 1991 to 1995 to 340 000 ha/yr from 1995 to 1997.

The State-wide average annual remnant vegetation clearing rate for the 1997 to 1999 period was 446 000 ha/yr. The regional ecosystem remnant clearing from 1997 to 1999 occurred on freehold tenures (70%), leasehold tenures (29%) and other tenures (1%).

The areas with the highest remnant vegetation clearing rates from 1997 to 1999 are largely within the central and southern areas of the Brigalow Belt and the adjacent eastern area of the Mulga Lands bioregions. In the four bioregions where the vegetation survey and mapping is completed, 58% of the State's remnant vegetation cleared from 1997 to 1999 occurred in the Brigalow Belt bioregion, 12% in the Desert Uplands bioregion, 2% in the Southeast Queensland bioregion, and 0.4% in the New England Tableland bioregion (Accad et al. 2001).

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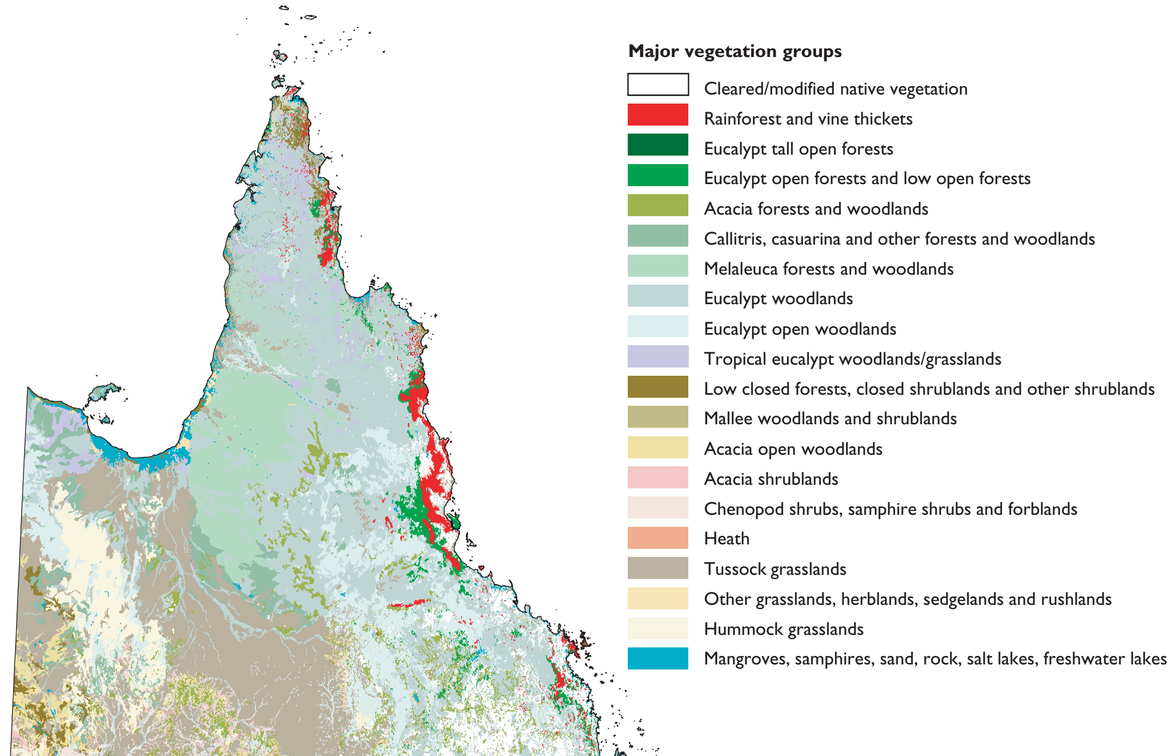
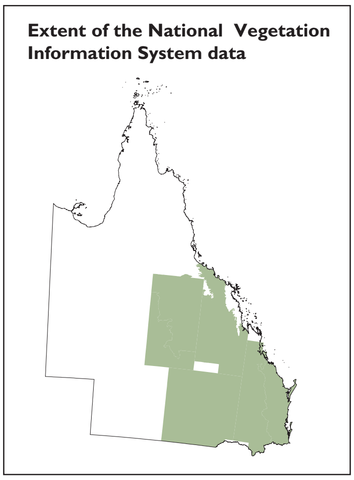
Figure 25. Present major vegetation groups in Queensland.





Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

The majority of remnant vegetation cleared during this time was of eucalypt open woodlands and woodlands dominated by poplar box (*Eucalyptus populnea*), coolibah (*E. coolabah*) or silver-leaved ironbark (*E. melanophloia*).

The Queensland Herbarium is continually updating vegetation information and holds the most current vegetation mapping for Queensland.

Grazing by stock is also a significant factor in changes to the species composition and structure of the native vegetation. The extent and impacts of these changes is not fully understood or mapped (Boulter et al. 2000).

An assessment of landscape health in Queensland which includes factors of clearing, grazing, feral animals and weeds provides a summary on a subregional basis of the landscape stresses (NLWRA 2001c).

Table 20. Area (km^2) of pre-European and native vegetation in Queensland*.

Major vegetation group	Present (remnant 1997)	Pre-European
Eucalypt woodlands	367 293	473 272
Tussock grasslands	282 547	294 662
Eucalypt open woodlands	134 421	165 065
Acacia shrublands	100 660	104 368
Hummock grasslands	91 809	92 009
Acacia forests and woodlands	91 534	182 089
Chenopod shrubs, samphire shrubs and forblands	81 944	82 070
Melaleuca forests and woodlands	70 014	72 173
Other forests and woodlands	49 266	49 692
Acacia open woodlands	36 734	39 861
Eucalypt open forests	35 150	62 646
Tropical eucalypt woodlands/grasslands	20 653	20 684
Rainforest and vine thickets	19 558	30 055
Other shrublands	16 419	16 780
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	15 143	15 442
Other grasslands, herblands, sedgelands and rushlands	4 771	4 963
Callitris forests and woodlands	4 134	5 601
Casuarina forests and woodlands	1 545	11 951
Heath	470	633
Low closed forests and closed shrublands	445	449
Eucalypt tall open forests	429	3 976
Eucalypt low open forests	111	111
Mallee woodland and shrublands	14	14

* in order of greatest to smallest area

Rangelands of South Australia

SOUTH AUSTRALIA

Major vegetation groups and their status in each State and Territory

Key features

South Australia is dominated by arid lands and has extensive areas of mallee, chenopod (saltbush, bluebush) shrublands, acacia shrublands (mulga and myall) and hummock grasslands. Small areas only of eucalypt open forests and woodland are found in the south-east of the State (Figure 26, Table 21).

Bioregions in South Australia

Channel Country

This bioregion extends to Queensland, Northern Territory and New South Wales. It has an arid climate with very dry, hot summers and short, dry winters. It is characterised by vast braided, flood and alluvial plains.

- Dominated by mixed forests and woodlands, hummock and tussock grasslands and chenopod and samphire shrublands.
- Small areas of acacia shrublands, acacia open woodlands and eucalypt woodlands occur.

Major land uses are cattle grazing and nature conservation (Innamincka Regional Reserve).

Simpson–Strzelecki Dunefields

This bioregion extends to the Northern Territory with small areas in Queensland and New South Wales. The bioregion is characterised by long parallel sand dunes, fringing dune fields, extensive saltpans, sand plains and dry watercourses and a hot, dry climate. Lake Eyre and Lake Frome are two major salt lakes.

- Dominant vegetation is hummock and tussock grasslands, acacia open woodlands, acacia shrublands small areas of mixed forests and woodlands and salt lakes.

Major land uses are grazing and nature conservation including the Simpson Desert Regional Reserve and Conservation Park, Lake Eyre National Park, Strzelecki Regional Reserve and Lake Frome Regional Reserve.

Broken Hill Complex

This bioregion extends into New South Wales, includes the entire length of the Barrier Ranges and has a dry hot to warm climate.

- Dominated by chenopod and samphire shrublands, other shrublands, casuarina forests and woodlands and small areas of acacia shrublands.

The major land use is grazing of native pastures.

Stony Plains

The majority of the bioregion falls within South Australia with only the northern most tip of the area lying across the border in the Northern Territory. The region experiences extreme temperatures and climate change with hot dry spells for much of the summer period and mild dry winters and is characterised by lowland sand and stony plains.

- The gilgai gibber tableland supports chenopod shrubland vegetation.
- Acacia forests and woodlands (gidgee—*Acacia cambagei*) and eucalypt woodlands (coolibah—*Eucalyptus coolabah*) or river red gum (*E. camaldulensis*) follow the creek lines.
- Other vegetation present includes tussock grasslands, acacia open woodlands, acacia shrublands and other shrublands.

Major land uses are cattle and sheep grazing with some nature conservation (Witjira National Park).

Finke

This bioregion extends to the Northern Territory and is characterised by arid sand plains with dissected uplands and valleys. The climate is arid and hot.

- Dominated by tussock grasslands, acacia shrublands and chenopod and samphire shrublands.

Major land uses are cattle grazing and traditional Indigenous uses.

Central Ranges

This bioregion extends to Western Australia and the Northern Territory. The bioregion is characterised by east–west trending rocky ranges of the Petermann, Musgrave and Mann Ranges and red sand plains. It has hot summers with temperatures that can exceed 50°C and cool to cold winters. Winter rainfall accounts for most of the rain in the region.

- Vegetation includes acacia shrublands, tussock and hummock grasslands.

Major land uses are traditional Indigenous uses.

Great Victoria Desert

This bioregion extends into Western Australia and is characterised by dunes and swales with local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky areas. The climate is arid, warm to extremely hot in summer and mild to warm winters. Rainfall generally occurs in the winter and summer.

- Diversity of vegetation groups including chenopod and samphire shrublands, acacia shrublands and open woodlands, eucalypt open woodlands, casuarina and mallee communities and small areas of heath.

Major land uses are traditional Indigenous uses and nature conservation including the Unnamed Conservation Park, Tallaringa Conservation Park, Yellabinna Regional Reserve and Yumbarra Conservation Park.

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Nullarbor

The bioregion extends to Western Australia and has a semi-arid climate with mild winters and includes the Nullarbor Plain.

- Dominant vegetation is chenopod and samphire shrublands, mallee and casuarina communities, other shrublands and tussock grasslands.

Major land uses are traditional Indigenous uses and nature conservation including the Nullarbor Regional Reserve and National Park and Yalata Indigenous Protected Area.

Gawler

The Gawler Ranges forms the southernmost extent of the bioregion, with the northern part of the region characterised by plains and salt lakes. It has mild to hot summers, cool to mild winters, and a low variable annual rainfall.

- Vegetation includes acacia shrublands, mallee woodlands and shrublands, chenopod and samphire shrublands and eucalypt woodlands and tussock grasslands surrounding the salt lakes.

Major land uses are sheep grazing and nature conservation including the Lake Gairdner and Lake Torrens National Parks.

Eyre Yorke Block

This bioregion consists of undulating to occasionally hilly plains and sands.

- Dominated by mallee woodlands and shrublands, with areas of eucalypt woodlands, chenopod and samphire shrublands, callitris woodlands, melaleuca shrublands, and tussock grasslands.

This region has been cleared (65%) extensively and the major land uses are cropping for cereals, grazing of native and modified pastures, and nature conservation including the Pinkawillinie Conservation Park and Coffin Bay National Park.

Flinders Lofty Block

This bioregion has a general pattern of mountain ranges and wide flat plains and contains the Flinders and Olary Ranges. It has a semi-arid to arid climate with hot dry summers and cool mild winters.

- Vegetation is very diverse and includes tussock grasslands, chenopod and samphire shrublands, acacia forests and woodlands, callitris forests and woodlands, eucalypt open woodlands, hummock grasslands, mallee woodlands and shrublands and acacia open woodlands in the north.

Major land uses in the north are grazing and nature conservation including the Flinders Ranges and Gammon Ranges National Parks and the Nantawarrina Indigenous Protected Area.

- The undulating lowlands in the south of the bioregion were extensively cleared for crops in the early days of settlement, and subsequent over-grazing has reduced the vegetation density and diversity.
- Vegetation remaining includes casuarina communities, eucalypt woodlands and very small areas of eucalypt open forests.

Major land uses are dryland cropping for cereals, grazing of native and modified pastures, urban development and small areas of forestry and irrigated vines.

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Heath woodland, near Keith, South Australia

Murray–Darling Depression

The bioregion extends into New South Wales and Victoria.

- Dominant vegetation in the far north of the region which remains uncleared is mallee woodlands and shrublands, casuarina forests and woodlands and chenopod and samphire shrublands.

Major land uses are grazing and nature conservation.

- The middle and southern parts of the region have been extensively cleared and include some large areas of mallee woodlands and shrublands and heath, tussock grasslands, acacia shrublands, other forests and woodlands and other grasslands. In the far south very small fragments of eucalypt woodlands, heath and eucalypt open woodlands remain.

Major land uses are grazing of native and modified pastures, cereal cropping and nature conservation.

Kanmantoo

This bioregion covers Kangaroo Island as well as some land on the mainland. Substantial areas in the central, central northern and eastern parts have been cleared (66%).

- Vegetation on Kangaroo island is dominated by mallee woodlands and shrublands, eucalypt woodlands and small patches of eucalypt open woodland, other shrublands, heath and low closed forests and closed shrublands.

Major land uses are grazing of native and modified pastures, nature conservation (Cape Bouguer, Ravine Des Casoars and Cape Gantheume Wilderness Protection Areas and Flinders Chase National Park) with small areas of cropping for cereals, oilseeds and oleaginous fruit and legumes.

- Vegetation on the mainland includes mallee woodlands and shrublands, eucalypt woodlands, eucalypt open forests and other forests and woodlands.

Major land uses are grazing of native and modified pastures and small areas of plantations, nature conservation and cropping for cereals.

Naracoorte Coastal Plain

This bioregion extends into Victoria.

- Extensively cleared with remaining vegetation including mallee woodlands and shrublands, heath and other shrublands, mangroves, sedgelands, eucalypt woodlands, chenopod and samphire shrublands and eucalypt open woodlands.

Major land uses are grazing of native and modified pastures, cereal cropping and some irrigated cropping, plantations, nature conservation and small areas of state forests.

Victorian Volcanic Plain

The majority of this bioregion is in Victoria.

- The South Australian portion is cleared except for small fragments of eucalypt woodlands.

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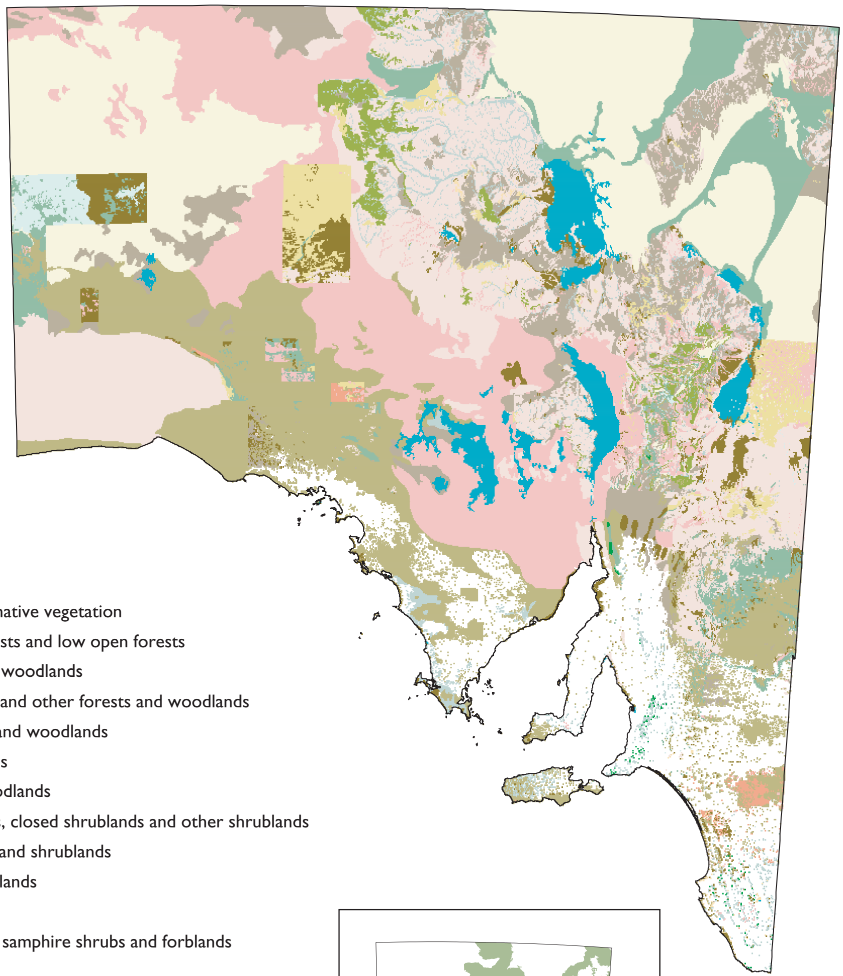
Figure 26. Present major vegetation groups in South Australia.



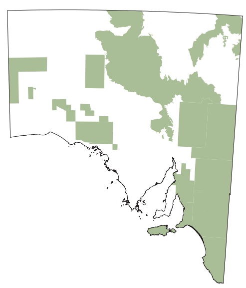
Major vegetation groups

- Cleared/modified native vegetation
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



Extent of the National Vegetation Information System data

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Vegetation change

In South Australia, 11% or 10.4 million hectares of native vegetation has been removed, principally in the higher rainfall areas in the south. Remnant vegetation in these areas is highly fragmented, in particular in the Eyre Yorke Block, Kanmantoo, Flinders Lofty Block, Naracoorte Coastal Plain and Murray–Darling Depression bioregions.

The most affected major vegetation groups are the mallee woodlands and shrublands, eucalypt woodlands, acacia shrublands, hummock grasslands and eucalypt open forests.

Where extant mapping is not available and for the areas where vegetation has been cleared, broad pre-European mapping was used to fill the gaps. However, the pre-European mapping was based on a much broader structural classification system that was not directly comparable with the classification system of the extant mapping. Area estimates from this comparison have been included for indicative purposes only. A program now exists to map pre-European vegetation with the same classification standards as the extant mapping that will enable future comparisons.

The Audit assessment of landscape health provides a summary on a subregional basis of the landscape stresses in South Australia including clearing, grazing, feral animals and weeds (NLWRA 2001c).

Table 21. Area (km^2) of pre-European and native vegetation in South Australia*.

Major vegetation group	Present	Pre-European
Chenopod shrubs, samphire shrubs and forblands	182 644	183 263
Hummock grasslands	175 363	175 363
Acacia shrublands	151 769	155 311
Mallee woodlands and shrublands	118 531	181 354
Tussock grasslands	81 187	88 736
Other forests and woodlands	34 958	37 807
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	28 769	28 898
Other shrublands	25 658	28 268
Acacia open woodlands	25 414	25 414
Eucalypt woodlands	16 459	31 955
Acacia forests and woodlands	15 414	15 414
Casuarina forests and woodlands	15 261	15 261
Eucalypt open woodlands	7 652	7 652
Heath	2 680	2 680
Callitris forests and woodlands	1 023	1 023
Other grasslands, herblands, sedgelands and rushlands	772	772
Eucalypt open forests	396	4 152
Eucalypt low open forests	17	17
Melaleuca forests and woodlands	7	18
Low closed forests and closed shrublands	3	3

* in order of greatest to smallest area

TASMANIA

Major vegetation groups and their status in each State and Territory

Green cushion plant (*Abrotanella forsterioides*), Mount Wellington, Tasmania

Key features

Tasmania is dominated by alpine, montane and coastal environments. Vegetation types include elevated alpine moorlands and herblands, cool temperate rainforests, extensive sedgelands and rushlands, eucalypt tall open forests rising up to 100 m in height, through to dry eucalypt forests and coastal heaths (Figure 27, Tables 22, 23).

Bioregions in Tasmania

King

This bioregion is characterised by coastal plains and deeply dissected lowland hills with mild summers and winter and summer rainfall.

- Dominated on King Island by low closed forests and closed shrublands, heath, the grasslands group and small areas of eucalypt open forests and eucalypt woodlands.
- Dominated on the main island by eucalypt tall open forests, eucalypt open forests, rainforest, the grasslands group and other forests and woodlands.

Major land uses on King Island are grazing of native and modified pastures and nature conservation (Lavinia Nature Reserve). Major land uses on the main island are native forests, grazing of native and modified pastures, nature conservation, some plantations and irrigation.

Flinders

This bioregion is characterised by coastal plains and a granitic island chain with mild summers and winter and summer rainfall.

- Dominated on Flinders Island by heath, eucalypt open forests, low closed forests and closed shrublands, eucalypt woodlands, other grasslands group and tussock grasslands and some eucalypt tall open forests.

Major land uses on Flinders Island are minimal use (vacant crown land), grazing of native and modified pastures, nature conservation (e.g. Wingaroo Nature Reserve) and some native forests.

- Dominated on the main island by eucalypt open forests, heath and low closed forests and closed shrublands.

Major land uses are grazing of native and modified pastures, nature conservation, native forests, minimal use (vacant crown land), some plantations and irrigation such as vegetables and herbs.

Tasmanian Northern Slopes

This bioregion is characterised by warm coastal plains and deeply dissected lowland hills with mild summers and winter and summer rainfall.

- Dominated by eucalypt tall open forests, eucalypt open forests, rainforest and small areas of eucalypt woodlands, the grasslands group, low closed forests and closed shrublands and heath.

Major land uses are grazing of native and modified pastures, native and plantation forestry, nature conservation and dryland and irrigated agriculture.

Ben Lomond

This bioregion is characterised by mountain ranges with mild summers and winter and summer rainfall.

- Dominated by eucalypt open forests, eucalypt tall open forests, rainforests and eucalypt woodlands.
- Smaller areas of heath, eucalypt open woodlands and tussock grasslands occur.

The major land uses are native forests, grazing of native and modified pastures, minimal uses, nature conservation (e.g. Ben Lomond National Park), plantations and dryland (cereals) and irrigated (modified pastures and horticulture) agriculture.

Tasmanian Northern Midlands

This bioregion is characterised by inland lowland plains with mild summers and winter and summer rainfall.

- Dominated by eucalypt open forests, eucalypt woodlands and open woodlands, other grasslands, tussock grasslands and other shrublands.

Major land uses are grazing of native and modified pastures, cropping (primarily cereals), urban/intensive development and some irrigated agriculture, nature conservation and native forests. This bioregion is largely cleared.

Tasmanian West

This bioregion is characterised by lowlands, low hills and low ranges with mild summers and winter and summer rainfall.

- Dominated by the grasslands group, rainforest and vine thickets, low closed forests and closed shrublands, eucalypt open forests with small areas of heath, eucalypt tall open forests and eucalypt woodlands in the areas where finer scale mapping is available.

Major land uses are nature conservation (e.g. Franklin – Gordon Wild Rivers and Savage River National Parks, Southwest National Park and Conservation Area, Tasmanian Wilderness World Heritage Area), native forests and minimal uses (vacant and institutional crown lands).

Tasmanian Central Highlands

This bioregion is characterised by a high plateau with cool summers and winter and summer rainfall.

- High diversity of vegetation including eucalypt open forests, eucalypt woodlands, rainforest and vine thickets, the grasslands group, eucalypt tall open forests, tussock grasslands, heath, low closed forests and closed shrublands and other forests and woodlands.

Major land uses are nature conservation (e.g. Cradle Mountain – Lake St Clair and Walls of Jerusalem National Parks, Central Plateau Conservation Area, Tasmanian Wilderness World Heritage Area), minimal uses, native forests and grazing.

Eucalyptus globulus plantation, north-east Tasmania

Tasmanian Southern Ranges

This bioregion is characterised by mountainous areas with some undulating coastal lowlands, cool to mild summers and winter and summer rainfall.

- Dominated by eucalypt tall open forests, eucalypt open forests, rainforest and vine thickets, eucalypt woodlands, tussock grasslands, the grasslands group and other forests and woodlands.
- Small areas of heath and other low closed forests and closed shrublands occur.

Major land uses are nature conservation (e.g. Southwest and Mount Field National Parks; Wellington Park, Tasmanian Wilderness World Heritage Area), native forests and some grazing of native and modified pastures, plantations and horticulture.

Tasmanian South East

This bioregion is characterised by warm coastal plains and low mountain ranges with mild summers and winter and summer rainfall.

- Dominated by eucalypt woodlands, eucalypt open forests and tall open forests and the grasslands group.
- Smaller areas of rainforest, eucalypt open woodlands, heath, chenopod and samphire shrublands, low closed forests and closed shrublands, casuarina communities and tussock grasslands occur.

Major land uses are grazing of native and modified pastures, minimal uses, native forests and nature conservation (e.g. Douglas Apsley, Freycinet and Maria Island National Parks; Cygnet River Forest Reserve). Other uses include plantations, dryland (cereals) and irrigated cropping and urban developments.

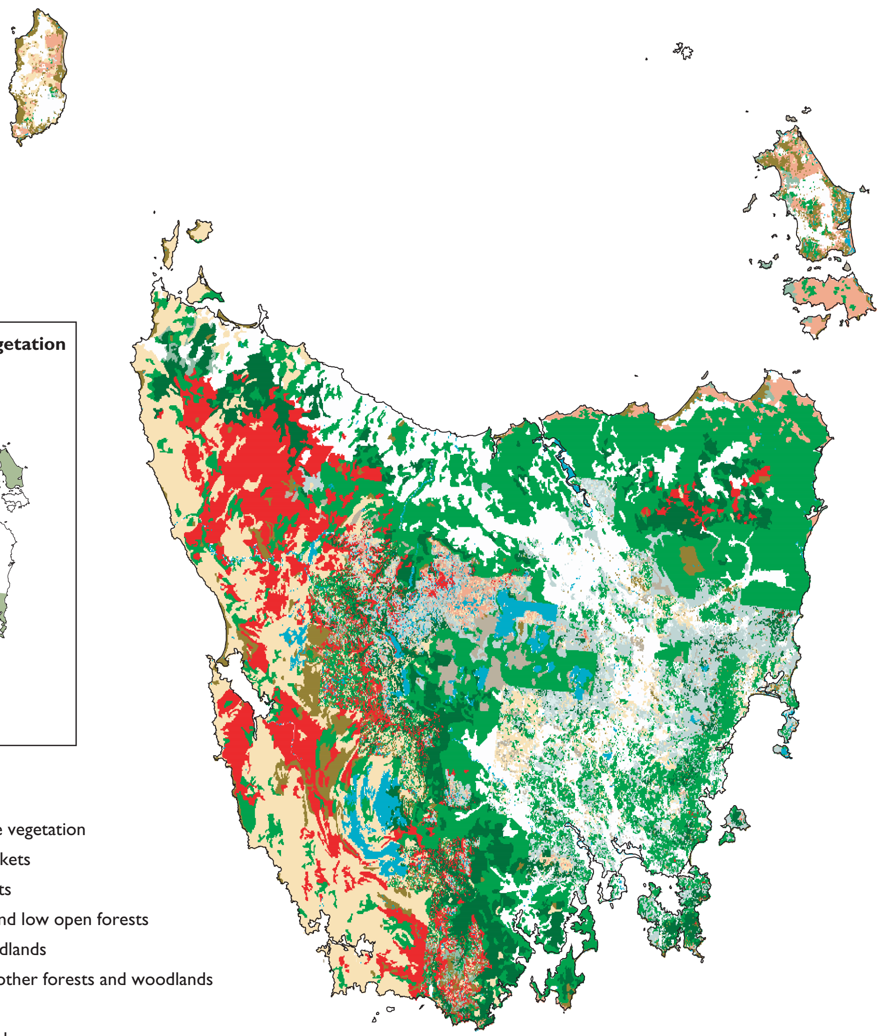
Vegetation change

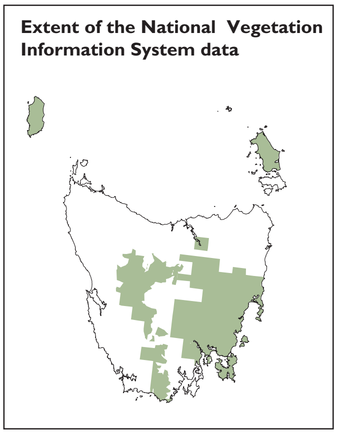
In Tasmania 16% or 1.0 million hectares of the native vegetation has been removed, mainly in the lowlands of the north west, midlands and the south east of the island as well as Flinders and King Islands. The most affected major vegetation groups are the eucalypt open forests, eucalypt woodlands and eucalypt tall open forests.

This is an overestimate of intact native vegetation, in particular forested vegetation groups, as further clearing has occurred since much of the mapping was undertaken. More recent extent figures summarised by subregions are presented in the Audit *Landscape Health in Australia* report (NLWRA 2001c).

This assessment of landscape health provides a summary on a subregional basis of the landscape stresses in Tasmania including clearing, grazing, feral animals and weeds.

Figure 27. Present major vegetation groups in Tasmania.





Major vegetation groups

- Cleared/modified native vegetation
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Table 22. Area (km²) of pre-European and native vegetation in Tasmania*.

Major vegetation group	Present	Pre-European
Eucalypt open forests	19 212	23 627
Other grasslands, herblands, sedgelands and rushlands	10 670	10 678
Rainforest and vine thickets	7 055	7 161
Eucalypt tall open forests	6 193	8 540
Eucalypt woodlands	4 609	7 181
Low closed forests and closed shrublands	2 168	2 843
Heath	1 925	1 926
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	1 880	1 880
Eucalypt open woodlands	1 108	1 251
Tussock grasslands	1 090	1 109
Other shrublands	755	788
Other forests and woodlands	359	359
Casuarina forests and woodlands	156	167
Eucalypt low open forests	106	217
Acacia forests and woodlands	28	194
Chenopod shrubs, samphire shrubs and forblands	28	28
Acacia shrublands	13	14
Callitris forests and woodlands	1	1

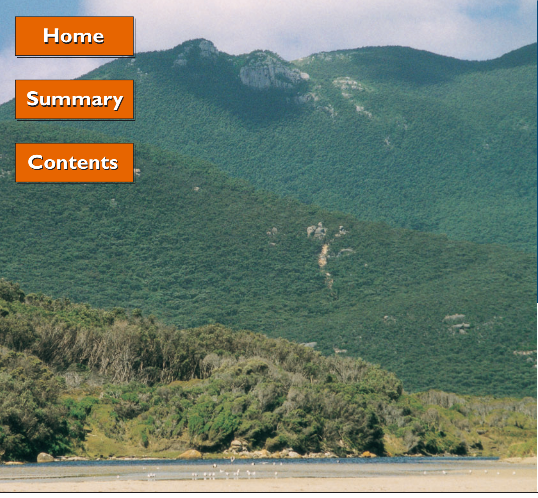
* in order of greatest to least area

Alternative summary figures provided from Tasmania as derived from Kirkpatrick et al. (1995) and from the Regional Forest Agreement private forest reserve program indicate some differences with the information provided from the major vegetation groups. These differences relate to the ready availability of more up to date information and to a differing classification of forests and woodlands. The mangroves group does not include lakes and reservoirs.

Table 23. Alternative figures for area (km²) of pre-European and native vegetation in Tasmania*.

Major vegetation group	Present	Pre-European
Eucalypt woodlands and eucalypt open woodlands	15 290	28 533
Other grasslands, herblands, sedgelands and rushlands	11 400	11 500
Eucalypt open forests and eucalypt tall open forests	9630	12 728
Rainforest and vine thickets	5 631	6 476
Heath	2 255	4 258
Low closed forests and closed shrublands	2 168	2 843
Other shrublands	755	788
Tussock grasslands	510	850
Other forests and woodlands	359	359
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	165	245
Acacia forests and woodlands	130	390
Chenopod shrubs, samphire shrubs and forblands	33	40
Casuarina forests and woodlands	14	34
Acacia shrublands	13	14
Callitris forests and woodlands	7	11

* Alpine vegetation (1135 km²) has been excluded from this table.



VICTORIA

Major vegetation groups and their status in each State and Territory

Key features

Victoria is the smallest mainland State, but a land of great contrast in vegetation types (Figure 28, Table 24). Vegetation includes:

- extensive eucalypt tall open forests with trees rising to 90 m high in the southern ranges and plateaus;
- extensive coastal heaths and wetlands;
- alpine herbfields and bogs covered by winter snows;
- eucalypt open woodlands in the hot and dry plains; and
- mallee eucalypt woodlands and shrublands in the arid environments of the north west of the State.

Bioregions in Victoria

Murray Darling Depression

This bioregion extends into South Australia and New South Wales and has a low elevation with undulating sand plains and dune fields.

- Dominated by mallee woodlands and shrublands, low closed forests and closed shrublands, heath, callitris communities, chenopod shrublands, samphires and lakes.
- The Murray River running along the northern border has callitris, eucalypt woodlands and other forests and woodland communities.

Much of this region has been cleared for cropping (cereals and legumes) and grazing and irrigated agriculture (vine fruits) along the Murray and Wimmera Rivers. Major land uses are dryland cropping, nature conservation (Murray–Sunset and Little Desert National Parks, Big Desert Wilderness Park), grazing of native and modified pastures and some native forests and irrigated cropping.

Naracoorte Coastal Plain

This bioregion extends into South Australia and is flat and low lying with a temperate, warm and dry summer climate.

- Dominated by mallee woodlands and shrublands, eucalypt open forests, low closed forests and closed shrublands and eucalypt woodlands.
- Small areas of grasslands, heath and chenopod and samphire shrublands occur throughout.
- Coastal communities include melaleuca forests and woodlands, heath, chenopod and samphire shrublands.

Much of the sandy soil has been cleared for agriculture and plantations and a number of wetlands have been drained in the region. Major land uses are grazing of native and modified pastures, native and plantation forestry and nature conservation.

Victorian Midlands

This bioregion stretches east to west across central Victoria and has warm summers with summer and winter rainfall. The region has been largely cleared (72%).

- Dominated by eucalypt woodlands, eucalypt open forests and mallee woodlands and shrublands.
- The largest area of native vegetation is in the Grampions National Park including large areas of eucalypt woodlands, heath, eucalypt open woodlands, low closed forests and closed shrublands and chenopod and samphire shrublands.

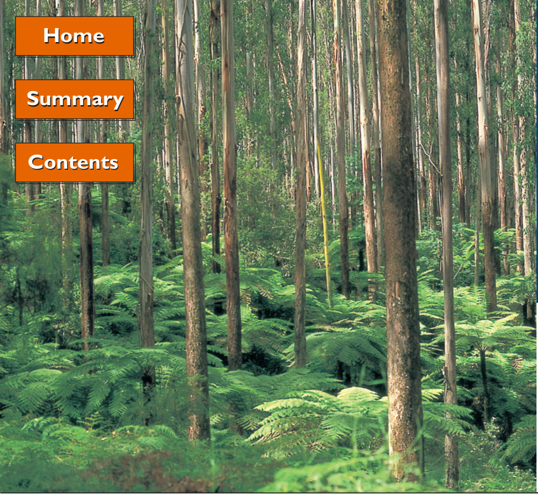
Major land uses are grazing of native and modified pastures, some cropping (large areas of cereals, legumes and oilseeds), native and plantation forestry and nature conservation.

Victorian Volcanic Plain

This bioregion has a small outlier in South Australia. The region is characterised by flat to undulating plains with a temperate climate (warm and dry summers) which have been largely cleared (92%) for sheep and cattle grazing and cropping.

- The largest patch of vegetation, eucalypt open forests, occurs in state forests.
- Eucalypt woodlands occur throughout the region with other small areas of vegetation including mallee woodlands and shrublands, low closed forests and closed shrublands, chenopod and samphire shrublands and lakes.
- Pre-European vegetation was dominated by large areas of eucalypt woodland and open woodland and tussock grasslands.

Major land uses are grazing of native and modified pastures, some nature conservation and cropping.



Mountain Ash (*Eucalyptus regnans*) forest 1939 regrowth, Black Spur, Victoria

South East Coastal Plain

This bioregion stretches along the southern coast from Portland to Lakes Entrance in the east with coastal plains and hinterland. Much of the region has been cleared (79%) for urban development, sheep and cattle grazing with a major focus on the dairy industry in the west.

- The western part of the region along the Great Ocean Road is dominated by eucalypt open forests, eucalypt woodland, small areas of eucalypt tall open forests, low closed forests and closed shrublands.
- On the coast acacia shrublands, chenopod and samphire shrublands and heath communities are present.
- On the eastern Gippsland coastal plains the vegetation is dominated by eucalypt open forests, casuarina forests and woodlands, eucalypt woodlands, chenopod and samphire shrublands and coastal occurrences of low closed forests and closed shrublands, heath, eucalypt woodland, grasslands and sedgelands and mangrove communities.

Major land uses are grazing of native and modified pastures, urban and intensive developments, native and plantation forestry, nature conservation, irrigated modified pastures and some horticulture.

Flinders

This bioregion is completely contained within the Wilsons Promontory National Park with a landscape of rugged hills, lowlands and headlands.

- Covered by native vegetation dominated by eucalypt tall open forests, rainforests, other forests and woodlands, eucalypt open forests and heaths.

South East Corner

This bioregion extends into New South Wales and contains coastal plains, river valleys, foothills, tablelands and mountains with some areas cleared in the river valleys, coastal plains and tablelands. It has mild to warm summers with summer and winter rainfall.

- Dominated by large areas of eucalypt tall open forests, eucalypt open forests and eucalypt woodlands.
- Small pockets of rainforest, acacia forests and woodlands, and heath are present with coastal occurrences of a range of forests and woodland communities.

Major land uses are native forestry and nature conservation (Bowen and Snowy River Wilderness Zones) and some plantations, and grazing of native and modified pastures.

South East Highlands

This bioregion extends into New South Wales and is characterised by the mountain ranges and foothills of the Great Dividing Range and the Otway Ranges. The region is sparsely settled with some areas cleared for agriculture and settlement.

- Extensive areas of eucalypt tall open forests, eucalypt open forests, eucalypt woodland and rainforests.
- Small pockets of grasslands and sedgelands, heath, samphire shrublands and acacia forests and woodlands occur.

The most cleared region is larger river valleys of the Strezeleki Ranges in the south. Major land uses are native forestry, nature conservation (Otway and Yarra Ranges National Parks and Avon Wilderness Park), grazing of native and modified pastures and irrigated horticulture.

Australian Alps

This bioregion extends into New South Wales and the Australian Capital Territory and is composed of a number of discrete areas which are above 1200 m in altitude and consists of a series of high plateaus and peaks along the Great Dividing Range.

- Grasslands, herblands, sedgelands and rushlands, eucalypt woodlands, chenopod and samphire shrublands, eucalypt tall open forests and pockets of heath dominate the vegetation.

Major land uses are nature conservation (parts of the Mt Buffalo and Alpine National Parks) and some native forestry.

New South Wales South Western Slopes

This bioregion extends into New South Wales and occurs on lower foothill slopes and minor ranges in Victoria. It has hot summers with summer and winter rainfall.

- Remaining native vegetation is dominated by eucalypt woodlands, callitris forests and woodlands and eucalypt tall open forests.
- Patches of low closed forests and closed shrublands, eucalypt open woodlands, grasslands and acacias forests and woodlands occur.

The area has been cleared of eucalypt woodlands for grazing and dryland agriculture with the larger remaining areas of vegetation on the rockier hilly areas. Major land uses are grazing of native and modified pastures, native forests and nature conservation.

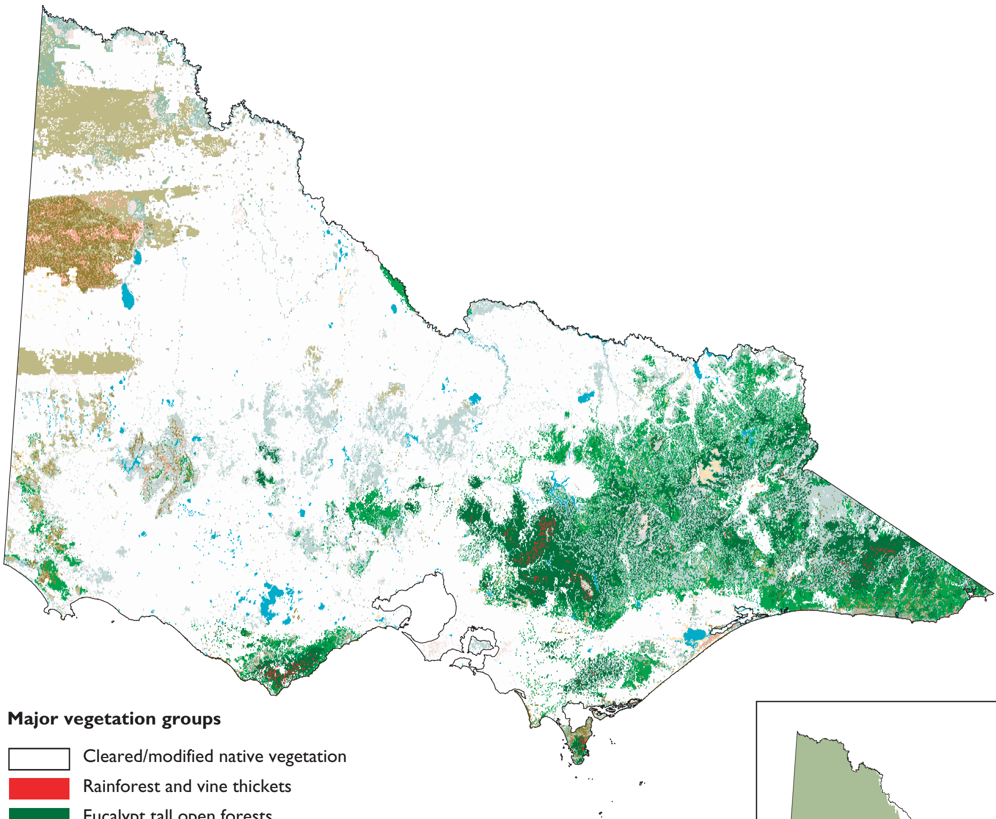
Riverina

This bioregion extends into New South Wales and consists of riverine and flood plains with isolated hills. The region has been largely cleared for agriculture including grazing, dryland and irrigated cropping.

- Most remaining vegetation occurs along water courses and is dominated by eucalypt woodlands and eucalypt tall open forests and eucalypt woodlands along the Murray River.
- Small patches of grasslands, tussock grasslands, shrublands and eucalypt open woodland occur in the region.

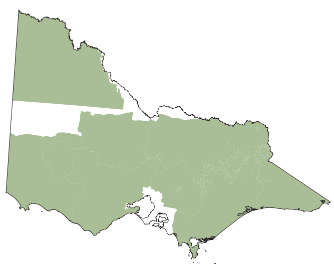
Major land uses are grazing of native and modified pastures, dryland cropping (cereals and legumes) and irrigated pastures and horticulture.

Figure 28. Present major vegetation groups in Victoria.



Major vegetation groups

- Cleared/modified native vegetation
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes



Extent of the National Vegetation Information System data

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Vegetation change

In Victoria, more than 60% or 14.6 million hectares of native vegetation has been cleared, making it proportionally the most cleared of all States. Most remaining native vegetation is on public land in state forests or protected areas and remote from historical development.

Clearing has been mainly for dryland agriculture, livestock grazing, irrigated agriculture and urban development. Remaining vegetation in these landscapes is fragmented and varies in condition. The bioregions most affected by clearing are the Murray Darling Depression, Riverina, Victorian Midlands, Victorian Volcanic Plain, Naracoorte Coastal Plain, South East Coastal Plain, South East Highlands and the South East Corner.

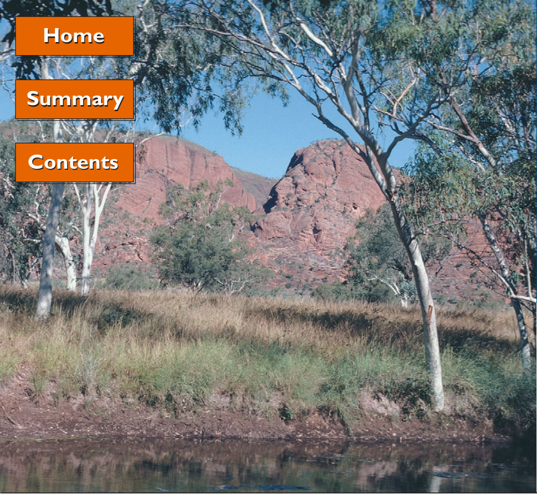
Vegetation types that had the largest areas cleared are the eucalypt woodlands, eucalypt tall open forests, eucalypt open forests and mallee woodlands and shrublands. The vegetation types most cleared relative to their pre-European extent are the tussock grasslands, eucalypt open woodlands, melaleuca forests and woodlands, acacia shrublands, low closed forests and closed shrublands, mallee woodlands and shrublands and eucalypt woodlands.

The Audit assessment of landscape health provides a summary on a subregional basis of the landscape stresses in Victoria including clearing, grazing, feral animals and weeds (NLWRA 2001c).

Table 24. Area (km²) of pre-European and native vegetation in Victoria*.

Major vegetation group	Present	Pre-European
Eucalypt woodlands	25 051	78 302
Eucalypt tall open forests	16 755	20 973
Eucalypt open forests	15 018	23 099
Mallee woodland and shrublands	10 843	37 861
Other shrublands	3 450	5 829
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	2 257	2 397
Other forests and woodlands	2 186	2 583
Chenopod shrubs, samphire shrubs and forblands	2 038	3 103
Heath	1 801	1 859
Eucalypt open woodlands	1 185	23 936
Other grasslands, herblands, sedgelands and rushlands	1 059	2 397
Low closed forests and closed shrublands	818	2 957
Tussock grasslands	614	19 175
Callitris forests and woodlands	429	584
Rainforest and vine thickets	407	445
Acacia forests and woodlands	400	825
Eucalypt low open forests	180	357
Casuarina forests and woodlands	46	46
Melaleuca forests and woodlands	45	182
Acacia shrublands	14	39

* in order of greatest to least area



WESTERN AUSTRALIA

Eucalyptus papuana, Red Rock Creek, Bungle Bungle Ranges, Kimberley Region, Western Australia

Major vegetation groups and their status in each State and Territory

Key features

Western Australia represents almost a third of the Australian continent and spans from the Great Australian Bight to the tropical coasts of the Timor Sea. It is world famous for its eucalypt tall open forests (karri and tingle communities) in the south-west and the spectacular wildflowers of the coastal heaths and subcoastal plains. Vegetation in Western Australia is more typically acacia woodlands, chenopod shrublands, hummock grasslands and mallee communities of the arid interior, with acacia shrublands and tussock grasslands in the north (Figure 29, Table 25).

Bioregions in Western Australia

Northern Kimberley

This bioregion consists of dissected plateaus and estuaries with a dry, hot, tropical climate with summer rainfall.

- Dominated by tropical eucalypt woodland/ grasslands with mangrove group, grasslands and rainforests on the coast.

Major land uses are traditional Indigenous uses, nature conservation (Prince Regent Nature Reserve and Drysdale National Park), minimal uses (vacant crown land, reserved crown land – Aboriginal and defence reserves) and grazing.

Victoria Bonaparte

This region extends into the Northern Territory and consists of a number of basins and the interior is dominated by the Victoria River Plateau, a large, highly dissected plateau up to about 350 m above sea level. The climate is semi-arid with a dry, warm monsoonal climate.

- Dominated by tropical eucalypt woodland/ grasslands, tussock and hummock grasslands and mangroves and lakes.

Major land uses are grazing, nature conservation, minimal use (vacant crown land) and irrigated agriculture (cropping, modified pastures and seasonal horticulture).

Ord Victoria Plain

This bioregion extends into the Northern Territory and consists of level to gently undulating plains with scattered hills and a climate which is dry, hot and tropical with summer rainfall.

- Dominated by tropical eucalypt woodland/ grasslands, tussock and hummock grasslands, other grasslands and acacia shrublands in the far west.

Major land uses are grazing, minimal use (vacant crown land, other reserved crown land) and nature conservation.

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Kalbarri National Park, Western Australia

Central Kimberley

This bioregion has hilly to mountainous terrain and parallel ranges with a dry, hot, subhumid to semi-arid summer rainfall.

- Dominated by tropical eucalypt woodland/grasslands, tussock and hummock grasslands.

Major land uses are extensive cattle grazing, minimal use (vacant crown land, reserved crown land – Aboriginal and defence reserves) and traditional Indigenous uses.

Dampierland

This bioregion consists of sand plains, coastal plains, alluvial plains and ranges with a dry hot semi-arid climate and summer rainfall.

- Dominated by acacia shrublands with smaller areas of hummock grasslands, tussock grasslands and the mangrove group.
- Very small areas of heath and eucalypt woodland occur.

Major land uses are grazing of native pastures and very small areas of modified pastures, minimal use (vacant crown land, reserved crown land – Aboriginal reserve), traditional Indigenous uses and nature conservation.

Tanami

This bioregion extends into the Northern Territory and consists of hills and ranges with sand plains with an arid tropical climate and summer rain.

- Dominated by hummock grasslands, tussock grasslands and other grasslands and salt lakes.

Major land uses are grazing and minimal use (vacant crown land).

Great Sandy Desert

This bioregion extends into the Northern Territory and includes extensive sand plains, dune fields, lakes and remnant rocky outcrops with a temperate–tropical climate.

- Dominated by hummock grasslands with some areas of acacia shrublands, heath, chenopod and samphire shrublands and salt lakes.

Major land uses are minimal use (vacant crown land, reserved crown land – Aboriginal reserve), traditional Indigenous uses and nature conservation (Rudall River National Park).

Pilbara

This bioregion consists of mountainous ranges and plateaus, alluvial plains, granite and basalt plains with an arid climate and summer rain.

- Dominated by hummock grasslands and acacia forests and woodlands.
- Smaller areas of acacia shrublands, tussock grasslands, chenopod and samphire shrublands, salt marshes, mangroves and eucalypt woodland along water courses occur.

Major land uses are extensive cattle grazing, minimal use (vacant crown land, reserved crown land – Aboriginal and mining reserves), traditional Indigenous uses and nature conservation.

Central Ranges

This bioregion extends into the Northern Territory and South Australia and consists of ranges and sand plains with an arid climate and summer and winter rain.

- Dominated by acacia forests and woodlands, hummock grasslands and acacia shrublands.

Major land uses are traditional Indigenous uses.

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Warren

This bioregion consists of dissected undulating terrain with depressions and plains of swamps and dune fields.

- Dominated by eucalypt tall open forests, eucalypt open forests composed of karri and jarrah, melaleuca forests and woodlands and eucalypt woodlands.
- On the coast by eucalypt woodlands, melaleuca forests and woodlands, acacia shrublands, heath, other shrublands, forests and woodlands and the grasslands group are dominant.

Major land uses are native forestry, nature conservation and grazing of native and modified pastures.

Jarrah forest

This bioregion has a warm Mediterranean climate.

- Eucalypt open forests and eucalypt woodlands with smaller areas of heath, melaleuca forests and woodlands, acacia shrublands, other shrublands, the grasslands group and a very small patch of eucalypt tall open forests dominate.

Major land uses are native forestry, nature conservation, cropping of cereals, grazing of native and modified pastures and plantations.

Swan Coastal Plain

This bioregion is dominated by a low lying coastal plain with a warm Mediterranean climate.

- Dominated in the south by eucalypt open forests and eucalypt woodlands with small areas of heath, open forests and woodlands, melaleuca forests and woodlands, acacia shrublands and other shrublands.
- In the north large areas of eucalypt open woodlands, other forests and woodlands, heath, acacia shrublands and eucalypt woodlands occur.

Major land uses are grazing of native and modified pastures, nature conservation, native forestry, plantations, intensive developments such as urban areas and irrigated cropping.

Avon Wheatbelt

This bioregion consists of an undulating landscape of low relief with a semi-arid dry and warm Mediterranean climate. This bioregion has been all but completely cleared of its native vegetation and is a fragmented landscape.

- Remnants include a diverse range of vegetation types of eucalypt woodlands, acacia shrublands, chenopod and samphire shrublands, casuarina forests and woodlands, low closed forests and closed shrublands, other shrublands, heath, mallee woodlands and shrublands and eucalypt open woodlands.

Major land uses are cropping (cereals), grazing of native and modified pastures, nature conservation and minimal use (vacant crown land, other reserved crown land).

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Mallee

This bioregion has a semi-arid dry warm Mediterranean climate.

- Substantially cleared in the west and south and dominated by mallee woodlands and shrublands, heath, eucalypt open woodlands and remnants of eucalypt woodlands.

Major land uses are grazing of native and modified pastures, cropping (cereals, oilseeds, oleaginous fruits), minimal use (vacant crown land) and nature conservation (Dundas Nature Reserve).

Esperance Plains

This bioregion consists of sand plains and ranges with a warm Mediterranean climate.

- Dominated by mallee woodlands and shrublands, other shrublands, heath, eucalypt open woodlands, eucalypt woodlands and small areas of melaleuca forests and woodlands, eucalypt open forests and acacia shrublands.

Major land uses are nature conservation (Fitzgerald River National Park, Nuytsland Nature Reserve), cropping (cereals, oilseeds, oleaginous fruits), grazing of native pastures, minimal use (vacant crown land, other reserved crown land) and some native forestry.

Hampton

This bioregion consists of dune systems on a coastal plain backed by a stranded scarp with a semi-arid climate with winter rainfalls.

- Dominated by mallee woodlands and shrublands and chenopod and samphire shrublands.

Major land uses are sheep grazing, minimal use (vacant crown land) and nature conservation.

Nullarbor

This bioregion extends into South Australia.

- Dominated by chenopod and samphire shrublands (bluebush and saltbush) and eucalypt open woodlands in the south west.
- Small areas of acacia open woodlands, acacia forests and woodlands and hummock grasslands occur in the north.

Major land uses are sheep grazing, minimal use (vacant crown land) and nature conservation (Great Victoria Desert Nature Reserve).

Coolgardie

This bioregion consists of granite rocky outcrops, low greenstone hills, laterite uplands and broad plains. There are no major rivers or creeks within the bioregion. Numerous salt lakes of varying size occur across the region. It has hot summers and mild wet winters.

- Dominated by eucalypt woodlands, eucalypt open woodlands in the east, other shrublands, heath, acacia shrublands, chenopod and samphire shrublands, mallee woodlands and shrublands.
- Small areas of acacia forests and woodlands and hummock grasslands occur in the north.

Major land uses are minimal use (vacant crown land), grazing of native pastures and some nature conservation and native forestry. Very small areas of cropping and grazing of modified pastures occur in the west.

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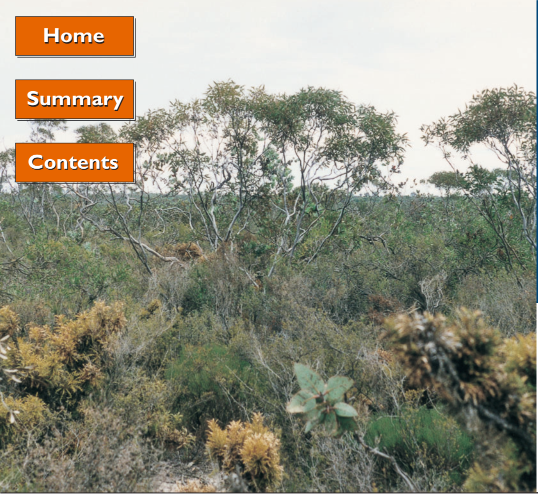


Mixed mallee, Ravensthorpe, Western Australia

Great Victoria Desert

This bioregion extends into South Australia and is characterised by dunes and swales with local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky areas. The climate is arid, warm to extremely hot in summer and mild to warm winters. Rainfall generally occurs in the winter and summer.

- Dominated by hummock grasslands, acacia forests and woodlands and mallee woodlands and shrublands.
- Chenopod and samphire shrublands and casuarina forests and woodlands occur near salt lakes with some acacia shrublands in the north.

Major land uses are minimal use (vacant crown land, reserved crown land – Aboriginal reserve), traditional Indigenous uses, nature conservation and grazing.

Murchison

This bioregion consists of low hills, mesas of duricrust separated by flat colluvium and alluvial plains with an arid climate with winter rainfall. There are three major ephemeral wetlands within the bioregion, these include Lake Barlee, Annean Lake and Wooleen Lake.

- Dominated by acacia forests and woodlands, acacia shrublands, hummock grasslands and chenopod and samphire shrublands.
- Small areas of eucalypt woodlands and open woodlands, other shrublands occur.

Major land uses are sheep and cattle grazing, minimal use (vacant crown land, other reserved crown land) and some nature conservation.

Yalgoo

The region is characterised by sand and alluvial plains, lateritic breakaways, low ranges and salt lakes. Broad alluvial valleys separate the breakaways and low ranges. The climate varies from semi-desert to Mediterranean.

- Dominated by acacia shrublands, acacia forests and woodlands, hummock grasslands and smaller areas of eucalypt woodlands and chenopod and samphire shrublands.

Major land uses are sheep grazing, minimal use (vacant crown land) and nature conservation.

Geraldton Sandplains

This bioregion consists of undulating lateritic sand plains. The coastal climate is Mediterranean with mild wet winters and hot dry summers. Inland areas experience a semi-desert climate with low unseasonal rainfall, hot summers and mild winters. The great variation in rainfall, from north to south, results in a considerable variation in vegetation and land use.

- In the north, acacia shrublands, other shrublands, heath, casuarina forests and woodlands and small areas of hummock grasslands, mallee communities, eucalypt open woodlands and chenopod and samphire shrublands occur.
- The southern part includes heath, low closed forests and closed shrublands, acacia shrublands and eucalypt woodlands and open woodlands.

Major land uses in the north are grazing of native pastures and in the south a mixture of grazing of native and modified pastures and cropping (cereals). Nature conservation (e.g. Kalbarri National Park, Shark Bay World Heritage Area) occurs throughout the region.

Carnarvon

This bioregion has low gentle undulating relief and open drainage. The coastal areas are semi-desert with winter rainfall and Shark Bay has a Mediterranean climate. Further inland, the climate is arid with winter rainfall.

- Dominated by other shrublands in the south and hummock grasslands, tussock grasslands and chenopod and samphire shrublands in the north.
- Acacia shrublands, acacia forests and woodlands occur throughout the region.

Major land uses are sheep grazing, minimal use (vacant crown land, other reserved crown land, reserved crown land – defence reserve) and some nature conservation (Shark Bay World Heritage Area).

Gascoyne

The bioregion is characterised by low rugged sedimentary and granite ranges and broad flat valleys. The bioregion experiences very hot summers and warm winters. Rainfall is erratic and unreliable.

- Dominated by acacia shrublands and acacia forests and woodlands.
- Other shrublands and acacia open woodlands, salt lakes and chenopod and samphire shrublands occur in the west.

Major land uses are cattle and sheep grazing with smaller areas of minimal use (vacant crown land, other reserved crown land, reserved crown land – Aboriginal reserves), traditional Indigenous uses and nature conservation.

Little Sandy Desert

This bioregion consists of dune fields and ranges with an arid climate and summer rainfall.

- Dominated by hummock grasslands and acacia forests and woodlands with very small areas of acacia shrublands, chenopod and samphire shrublands, eucalypt woodlands and heath.

Major land uses are minimal use (vacant crown land, some other reserved crown land, reserved crown land – Aboriginal reserves) with some nature conservation.

Gibson Desert

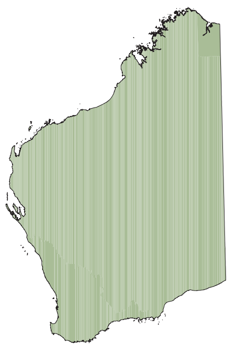
The bioregion is characterised by vast undulating sand plains, dune fields, low rocky ridges and uplands with an arid climate and mainly summer rainfall.

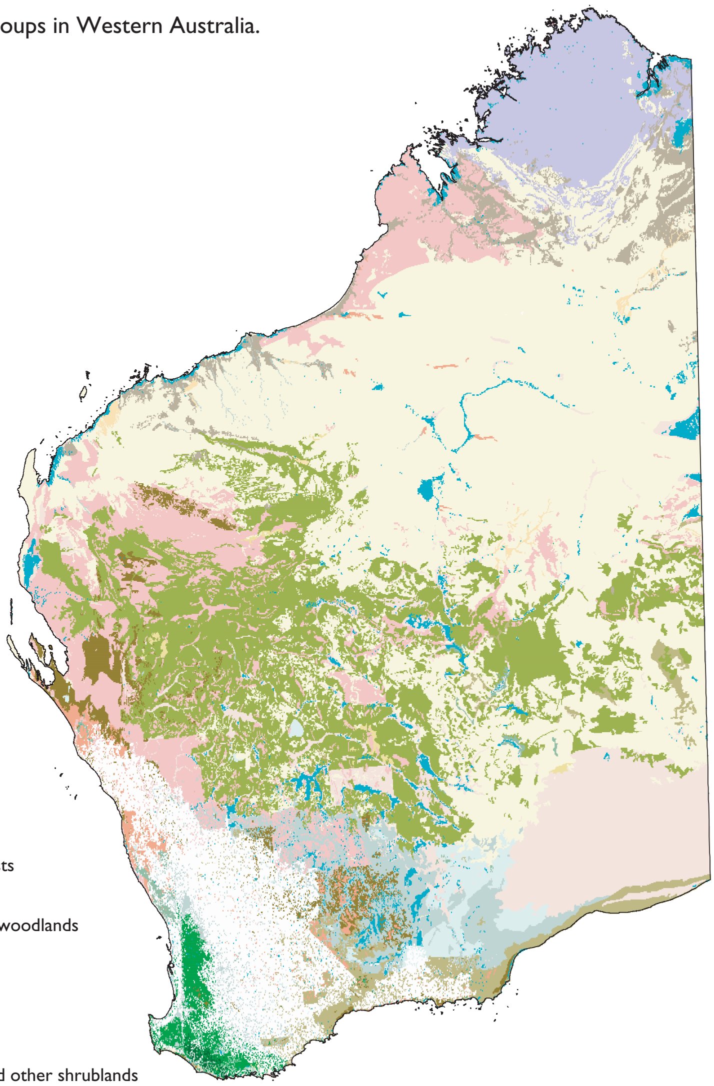
- Dominated by hummock grasslands with some acacia shrublands, acacia forests and woodlands and other grasslands group in the southern part.

Major land uses are minimal use (vacant crown land, reserved crown land – Aboriginal reserves), traditional Indigenous uses and nature conservation.

Figure 29. Present major vegetation groups in Western Australia.

Extent of the National Vegetation Information System data





Major vegetation groups

- Cleared/modified native vegetation
- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Vegetation change

In Western Australia, 7% or 18.3 million hectares of native vegetation has been cleared. This has been almost completely concentrated in the agricultural zone of the south west, where a high proportion of the remaining native vegetation consists of small remnant patches of vegetation outside state forest, protected areas or crown land.

Major vegetation groups most affected by clearing are eucalypt open woodlands, mallee woodland and shrubland, heath, other shrublands, chenopod shrublands, acacia shrublands and eucalypt open forests.

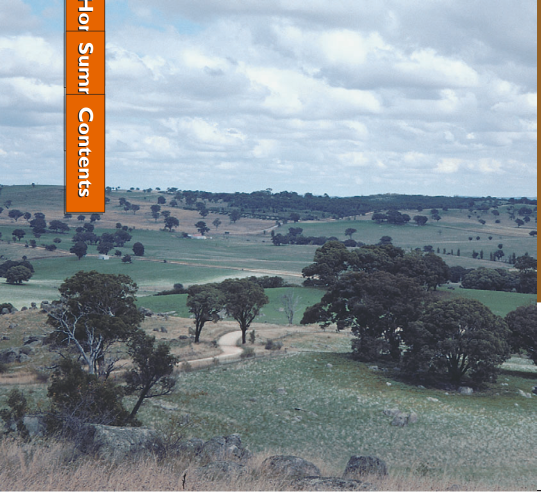
Significant areas of native vegetation remain uncleared in the deserts of the arid interior, the Pilbara region and the tropical north such as the Kimberley region. Large areas have been disturbed by grazing of cattle, sheep and feral animals.

The Audit assessment of landscape health provides a summary on a subregional basis of the landscape stresses in Western Australia including clearing, grazing, feral animals and weeds (NLWRA 2001c).

Table 25. Area (km^2) of pre-European and native vegetation in Western Australia*.

Major vegetation group	Present	Pre-European
Hummock grasslands	998 696	999 222
Acacia forests and woodlands	402 223	402 519
Acacia shrublands	238 771	247 652
Chenopod shrubs, samphire shrubs and forblands	189 665	192 402
Tropical eucalypt woodland/grasslands	126 321	126 321
Eucalypt woodlands	88 430	88 639
Tussock grasslands	60 538	60 856
Mallee woodlands and shrublands	51 693	91 975
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	48 111	52 207
Other shrublands	42 246	53 382
Eucalypt open woodlands	32 654	108 680
Eucalypt open forests	20 321	28 536
Heath	17 822	38 806
Other grasslands, herblands, sedgelands and rushlands	7 855	8 110
Acacia open woodlands	3 766	3 766
Casuarina forests and woodlands	3 139	3 348
Other forests and woodlands	2 977	5 190
Eucalypt tall open forests	2 343	2 757
Low closed forests and closed shrublands	1 590	5 850
Eucalypt low open forests	1 506	3 277
Melaleuca forests and woodlands	1 189	1 596
Rainforest and vine thickets	16	18
Callitris forests and woodlands	0	23

* in order of greatest to smallest area



Dryland rural landscape between Gunning and Crookwell, New South Wales

FRAGMENTATION OF AUSTRALIA'S NATIVE VEGETATION: applications

It is important to understand the nature of the patches or fragments of native vegetation remaining in cleared landscapes. This is a key element in the maintenance of ecosystem health, landscape function and the diversity of species within ecosystems.

Fragmented patches of vegetation may be the only remaining examples of particular vegetation groups or ecosystems in a region, contributing to the healthy functioning of that system and providing a source of material for any re-vegetation or restoration activities.

Key findings

The analysis highlights poorly functioning landscapes, where native vegetation is reduced to relic patches that are clearly under threat. The lack of viability of these small remnants provides a series of challenges for land managers. Fragments become increasingly more difficult to manage where the larger proportion of the total native vegetation is fragmented.

Table 26 and Figure 30 summarise the number of subregions found within each fragmentation index. Forty-two of Australia's subregions have less than 30% of native vegetation remaining and 22 are very highly or highly fragmented. Detailed information about these subregions is presented in Tables 27 and 28. These subregions occur in south-western Western Australia, south-eastern South Australia, central and western Victoria, the New England Tablelands bioregion in New South Wales and southern and central eastern Queensland.

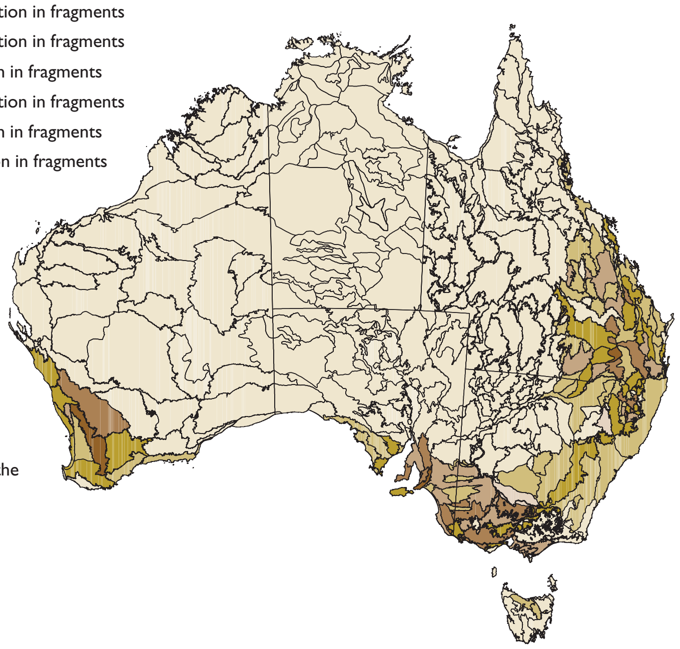
Additional important information to consider in vegetation fragmentation is the number of patches of fragmented vegetation, their shape and size. An analysis of the number of fragmented patches in each subregion has been undertaken and presented in Tables 27 and 28 for the 22 most fragmented subregions. Figure 31 presents information on the number of fragmented native vegetation patches within a subregion.

The Avon Wheatbelt P2 subregion is an example of a stressed landscape. 8.5% of the native vegetation remains, 84.5% of this vegetation is fragmented and these fragments occur in 13 438 patches. Management of these remnants is likely to be costly and will require a high level of planning and priority setting.

Table 26. Number of subregions in fragmentation classes.

Remnant class	Plant isolation index class 1 > 60% of total vegetation fragments	Plant isolation index class 2 30–60% of total vegetation fragments	Plant isolation index class 3 30–10% of total vegetation fragments	Plant isolation index class 4 < 10% of total vegetation fragments	Number of subregions in each remnant class
1 < 30%	4	18	18	2	42
2 30–70%	0	0	28	51	79
3 > 70%	0	0	0	233	233
Number of subregions in each plant isolation index class	4	18	46	286	

Figure 30. Fragmentation classes in subregions.



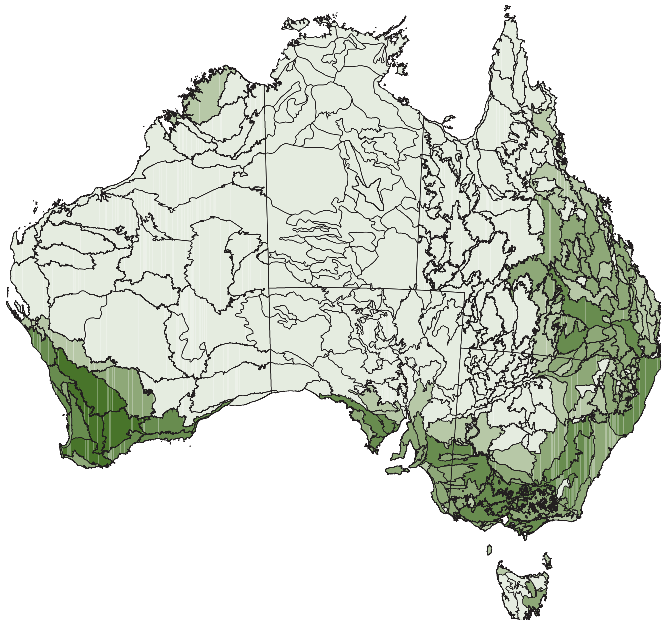
Source:

IBRA Subregions V. 5.1 Environment Australia 2001.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure 31. Number of vegetation patches in fragmented vegetation in subregions.



Source:

IBRA Subregions V. 5.1 Environment Australia 2001.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Table 27. Subregions in fragmentation index class 1-1.

Subregion	Subregion area (ha)	Area of native vegetation	Percent native vegetation remaining	Remnant class	Area fragmented native vegetation < 1000 ha	Percent fragmented native vegetation in subregion	Plant isolation index class	Number of patches
Avon Wheatbelt P2	2 992 960	254 948	8.5	1	215 368	84.5	1	13 438
Tara Downs	449 396	28 388	6.3	1	18 608	65.5	1	775
Fleurieu	370 668	38 140	10.3	1	32 420	85.0	1	723
Mount Gambier	84 228	4 832	5.7	1	4 752	98.3	1	47

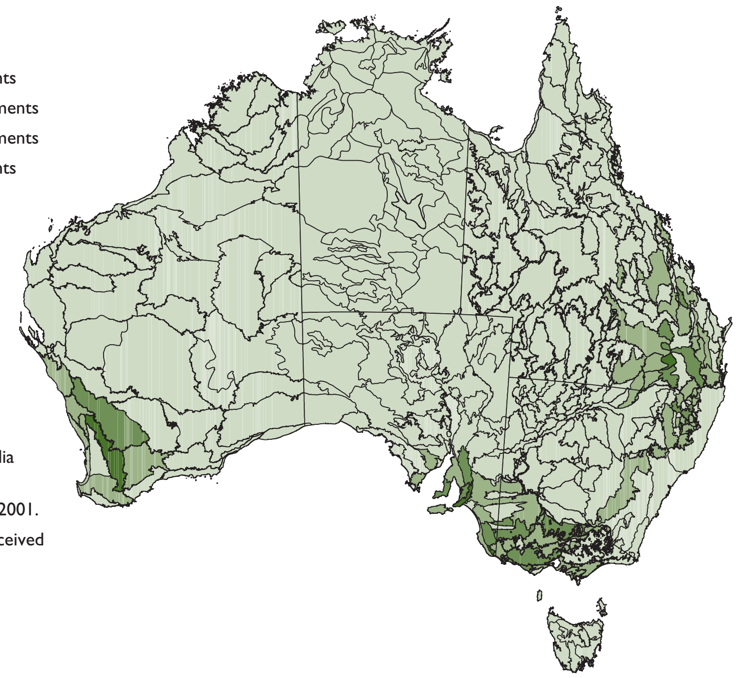
Table 28. Subregions in fragmentation index class 1-2.

Subregion	Subregion area (ha)	Area of native vegetation	Percent native vegetation remaining	Remnant class	Area fragmented native vegetation < 1000 ha	Percent fragmented native vegetation in subregion	Plant isolation index class	Number of patches
Avon Wheatbelt P1	6 524 180	1 129 720	17.3	1	409 228	36.2	2	18 633
Victorian Riverina (VR)	1 782 040	91 604	5.1	1	42 916	46.8	2	2 552
Eastern Darling Downs	1 639 340	253 884	15.5	1	104 032	41.0	2	2 200
Wimmera (WI)	1 699 344	130 636	7.7	1	49 192	37.7	2	1 617
Moonie R. – Commoron Creek Floodout	803 020	137 516	17.1	1	45 448	33.0	2	1 370
Lucindale	741 244	116 064	15.7	1	66 400	57.2	2	1 346
Broughton	1 032 948	123 148	11.9	1	37 812	30.7	2	1 235
Southern Yorke	436 436	74 916	17.2	1	23 528	31.4	2	1 053
Taroom Downs	644 068	52 880	8.2	1	30 196	57.1	2	900
Warrnambool Plain (WP)	234 380	31 084	13.3	1	13 544	43.6	2	785
Mount Lofty Ranges	300 352	47 132	15.7	1	15 940	33.8	2	548
Glenn Innes-Guyra Basalts	277 324	32 236	11.6	1	15 240	47.3	2	494
Inverell Basalts	230 992	35 068	15.2	1	17 596	50.2	2	303
Callide Creek Downs	298 160	33 000	11.1	1	12 028	36.4	2	268
Deepwater Downs	97 756	17 332	17.7	1	8 156	47.1	2	265
Dulacca Downs	162 288	30 612	18.9	1	10 812	35.3	2	241
Yarrowyck-Kentucky Downs	65 076	13 536	20.8	1	4 560	33.7	2	128

Figure 32. Plant isolation index in subregions.

Plant isolation index

1 > 60% vegetation in fragments
2 30 – 60% vegetation in fragments
3 10 – 30% vegetation in fragments
4 < 10% vegetation in fragments



Source:

IBRA Subregions V. 5.1 Environment Australia 2001.

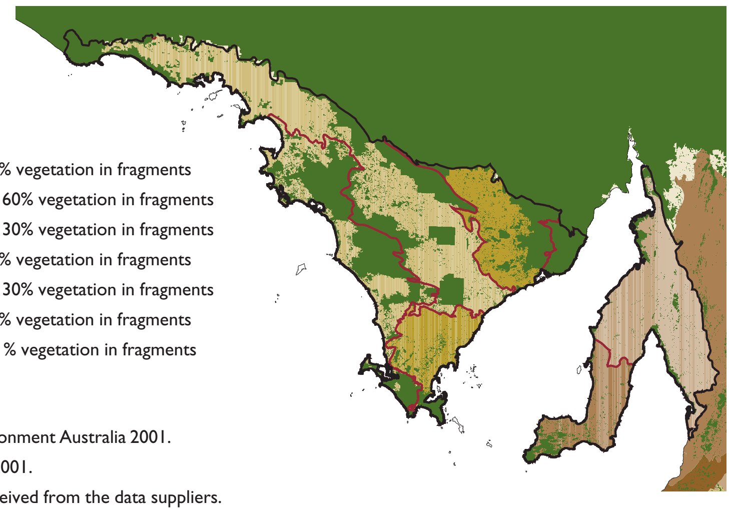
National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Figure 33. Fragmentation index classes in the Eyre Yorke Block bioregion.

Eyre Yorke block bioregion boundary

Bioregion boundaries
Subregion boundaries
Native vegetation extent
1.1 < 30% vegetation > 60% vegetation in fragments
1.2 < 30% vegetation 30 – 60% vegetation in fragments
1.3 < 30% vegetation 10 – 30% vegetation in fragments
1.4 < 30% vegetation < 10% vegetation in fragments
2.3 30 – 70% vegetation 10 – 30% vegetation in fragments
2.4 30 – 70% vegetation < 10% vegetation in fragments
3.4 > 70% vegetation < 10 % vegetation in fragments



Source:

IBRA Bioregions and Subregions V. 5.1 Environment Australia 2001.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Methods

The analysis used one of many possible methods to highlight IBRA subregions:

- that have been heavily impacted by the broad clearing of native vegetation across the landscape; and
- where native vegetation only exists today as a series of small isolated remnants.

The contribution of native vegetation fragments in patch sizes smaller than 1000 ha as a proportion of the total area of native vegetation remaining in each IBRA subregion were analysed and categorised in classes. The 1000 ha figure was chosen as most appropriate for an Australia-wide overview. In highly fragmented environments at a regional level, a lower threshold would be appropriate.

The series of classes developed to simplify interpretation were based on:

- the percentage of remaining native vegetation in the subregion (Table 29, Figure 21);
- the percentage of the total area of native vegetation in fragments smaller than 1000 ha (plant isolation index) (Table 30 and Figure 31); and
- an amalgamation of these two classes, called the fragmentation index, which enables a comparison of the remaining vegetation in a region and how fragmented that vegetation is (Table 31, Figure 31).

Table 29. Remnant native vegetation classes.

Percent native vegetation extent remaining (%)	Remnant class
< 30	1
70–30	2
> 70	3

Table 30. Plant isolation index classes.

Percent of total area of native vegetation in fragments < 1000 ha (%)	Plant isolation class
> 60	1
30–60	2
10–30	3
< 10	4

Table 31. Fragmentation index classes.

Remnant class	Plant isolation class 1	Plant isolation class 2	Plant isolation class 3	Plant isolation class 4
1	1-1 subregions little intact vegetation very high fragmentation	1-2 subregions little intact vegetation high fragmentation	1-3 subregions little intact vegetation moderate fragmentation	1-4 subregions little intact vegetation minor fragmentation
2	2-1 subregions some intact vegetation very high fragmentation	2-2 subregions some intact vegetation high fragmentation	2-3 subregions some intact vegetation moderate fragmentation	2-4 subregions some intact vegetation minor fragmentation
3	3-1 subregions Intact vegetation very high fragmentation	3-2 subregions intact vegetation high fragmentation	3-3 subregions intact vegetation moderate fragmentation	3-4 subregions intact vegetation minor fragmentation

Applications

To demonstrate the application of such analysis for a bioregion and the variability in remaining native vegetation within a bioregion, information is presented on the Eyre Yorke Block bioregion in South Australia. At the bioregional level, 35% of native vegetation remains and the bioregion therefore falls into the third remnant class (30–70% remaining).

This bioregion contains five subregions, demonstrating considerable variation in fragmentation (e.g. two subregions have less than 30% of native vegetation remaining, are moderately to highly fragmented and contained more than 1000 patches of less than 1000 ha) (Table 32, Figure 33).

Management strategies for biodiversity conservation and the activities required to manage remnants in each subregion will vary according to this analysis and the threatening processes occurring in these regions.

Limitations

This analysis presents one method to assess the level of fragmentation. There are a wide variety of methods available to estimate fragmentation, depending on the requirements of the user. Cut-offs for classes in this analysis can be modified to assess a range of scenarios. The interpretation of patch size is dependent on the scale of the mapping and the minimum mapping area.

In order to complete the information required by land managers, the results are best used in conjunction with the data on the extent of native vegetation for each subregion (e.g. in some subregions, the only significant areas of native vegetation remaining are found in either protected areas or crown reserves and the contribution of other fragments to the total area of vegetation remaining in such regions is relatively small).

Where possible, regional managers need to intersect this analysis of fragmentation with data on tenure and land use. This provides for a fuller understanding of management opportunities and allows for the development of practical priority management strategies.

Table 32. Remnant native vegetation in the Eyre Yorke Block bioregion subregions.

Subregion	Subregion area (ha)	Area of native vegetation (ha)	Percent native vegetation remaining	Remnant class	Area fragmented native vegetation < 1000 ha	Percent fragmented native vegetation in subregion	Plant isolation index class	Subregional fragmentation index class	Number of patches
Southern Yorke	436 436	74 916	17.2	1	23 528	31.4	2	1-2	1 053
St Vincent	1 085 804	99 016	9.1	1	23 520	23.8	3	1-3	1 219
Eyre Hills	1 171 684	369 572	31.5	2	67 984	18.4	3	2-3	2 676
Talia	1 089 072	689 876	63.3	2	36 108	5.2	4	2-4	1 167
Eyre Mallee	2 295 544	887 620	38.7	2	74 316	8.4	4	2-4	3 013

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Tailings dams at Weipa, Queensland

Disturbance of native vegetation

In addition to broad-scale clearing, native vegetation is affected by additional pressures, impacting on its internal integrity and long-term survival in the landscape.

Isolated vegetation fragments are even more susceptible to these pressures as their boundaries are exposed to disturbances (e.g. weed invasion) and land use practices (e.g. grazing of the understorey).

Information on these disturbances and impacts on the native vegetation:

- are valuable in assessing the status of these communities; and
- can help plan for and change land uses to minimise the impacts of disturbance and to ensure these remnant vegetation patches are viable.

The mapping of some disturbances which can be distinguished through aerial photography has been undertaken in parts of south-west Western Australia as a pilot project. In addition to mapping the extent of remnant vegetation, it demonstrates the level of additional disturbances within vegetation fragments.

Additional information was collected on:

- mining and infrastructure disturbances;
- the potential risk to native vegetation from rising water tables and associated salinisation; and
- the potential risk to each vegetation type as a consequence of clearing at the broad landscape level.

Further information is available in the final project report (Beeston et al. 2001).

The mapping of disturbances within vegetation is not available across Australia. Information is only available for small areas and has not been consistently collected. The draft framework for the assessment and monitoring of native vegetation condition (Environment Australia 2001) attempts to provide a framework within which to collect information on an attribute basis which can then be aggregated into assessments of condition depending on the user requirements.

The landscape health assessment (NLWRA 2001c) has classified a range of disturbances into an assessment of health on a subregional basis, providing a region-wide context of landscape health.

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CASE STUDY: VEGETATION MANAGEMENT, RECENT VEGETATION CHANGE, QUEENSLAND

The extent of Australia's vegetation continues to change through selective species removal, planting, thinning, regrowth and clearing. In some States and Territories, rapid rates of vegetation clearing are affecting large areas of land that have already been highly cleared and fragmented or are in marginally productive areas. Information on native vegetation to support vegetation management in these jurisdictions requires more regular updating to ensure that:

- the rates of change and trends can be monitored;
- the types of vegetation being cleared are documented; and
- vegetation management plans are relevant.

This case study demonstrates the use of National Vegetation Information System data for Queensland with a baseline of pre-European and 1995 vegetation types and extent and information on areas cleared since 1995 to assess changes in vegetation extent over time. The information on the 1997 extent of vegetation was obtained from the Queensland Herbarium and has been derived from the Statewide Landcover and Tree Study (SLATS) data and the Queensland Herbarium remnant vegetation data for the State.

A record and analysis of these changes and trends in native vegetation type and extent are in themselves an indication of the condition of native vegetation in the landscape.

Approximately 627 000 ha of vegetation was cleared between 1995 and 1997 in the study area (Figure 34), equivalent to approximately 272 000 ha each year.

The majority of the vegetation cleared between 1995 and 1997 was eucalypt woodlands (47%, 293 810 ha), acacia forests and woodlands (25%, 156 987 ha) and eucalypt open woodlands (13%, 80 210 ha). The largest change relative to the 1995 extent was for casuarina forests and woodlands where 7559 ha was cleared from 240 274 ha in 1995, accounting for 3.2% of the major vegetation group.

An assessment of change within two subregions in the study area is presented.

Changes in vegetation extent in the Inglewood Sandstones subregion and Moonie River—Commoron Creek Floodout subregion

Information is presented on:

- the pre-European major vegetation groups and extent;
- the present major vegetation groups and extent; and
- land clearing between 1995 and 1997, vegetation types and extent affected.

This information highlights the changes and pressures on these subregions. Only the Queensland component of the Inglewood Sandstones subregion has been assessed as limited information is available on the New South Wales component.

Inglewood Sandstones subregion

Fifty-nine percent of the original vegetation cover remains in this subregion. The pre-European and 1995 major vegetation groups are shown in Figures 35 and 36; change from pre-European extent is shown in Table 33. Less than 30% of the acacia forests and woodlands, casuarina forests and woodlands and tussock grasslands remain in the subregion. Eucalypt woodlands and acacia forests and woodlands have had the greatest area of vegetation cleared since pre-European settlement even though 66% of the original extent of eucalypt woodlands remains.

Table 33. Pre-European and 1995 major vegetation groups and change from pre-European for the Inglewood Sandstones subregion (Queensland component).

	Pre-European		Present (1995)		Cleared (pre-European to present 1995)	
Major vegetation group	Area (ha)	Percent total area of subregion	Area (ha)	Percent total area of subregion	Area (ha)	Percent remaining of pre-European area
Largely modified/cleared	n/a	n/a	503 076	40.52	n/a	n/a
Eucalypt open forests	766	0.06	520	0.04	246	67.85
Eucalypt woodlands	943 485	75.99	620 478	49.98	323 007	65.76
Acacia forests and woodlands	118 250	9.52	9 305	0.75	108 945	7.87
Casuarina forests and woodlands	11 642	0.94	677	0.05	10 965	5.81
Eucalypt open woodlands	160 760	12.95	102 507	8.26	58 253	63.76
Other shrublands	27	0.00	27	0.00	0	100.00
Heath	4 724	0.38	4 192	0.34	532	88.74
Tussock grasslands	949	0.08	1	0.00	948	0.14
Other grasslands group	958	0.08	633	0.05	324	66.13
Mangrove group	0	0.00	144	0.01	n/a	n/a

The vegetation changes from 1995 to 1997 are presented in Table 34 and Figure 36 (where information was available).

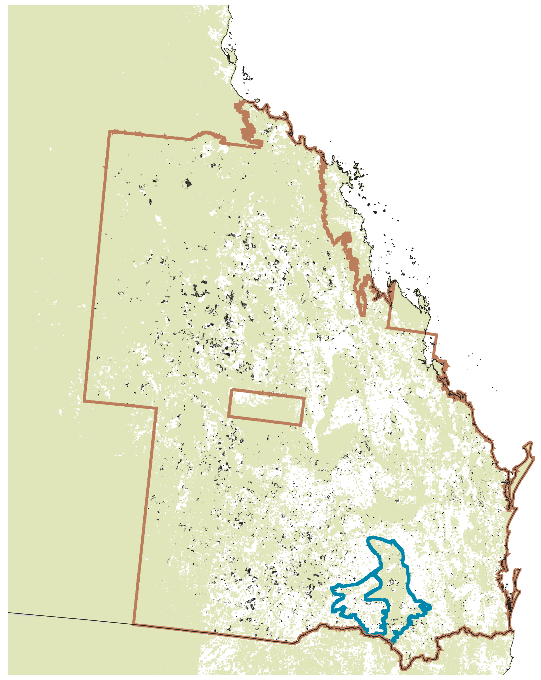
Approximately 13 750 ha were cleared, mainly eucalypt woodlands (84%), eucalypt open woodlands, (11%) and acacia forests and woodlands, (4%). Minor types cleared included heath and casuarina forests and woodlands.

Large areas of eucalypt woodlands and the major vegetation groups with less than 30% remaining vegetation continue to be cleared.

Table 34. Major vegetation groups cleared between 1995 and 1997 in the Inglewood Sandstones subregion (Queensland component).

Major vegetation group	Area cleared 1995–1997 (ha)
Eucalypt woodlands	11 609
Acacia forests and woodlands	542
Casuarina forests and woodlands	11
Eucalypt open woodlands	1 547
Heath	37
Other grasslands group	2

Figure 34. Vegetation cleared between 1995 and 1997 in the Brigalow Belt region.



Coastline and State and Territory boundary
Vegetation change study area
Subregions in study
Vegetation cleared between 1995 and 1997
Remnant native vegetation 1997 extent

Source:

Queensland Herbarium 1995 and 1997 Lancover

IBRA Subregions V. 5.1 Environment Australia 2001.

Data used are assumed to be correct as received from the data suppliers.

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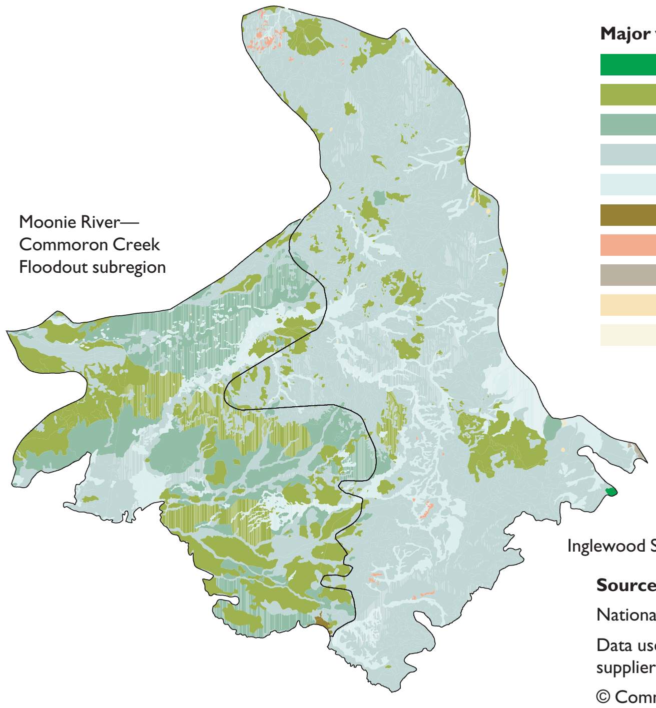
Figure 35. Pre-European major vegetation groups in two Queensland subregions.



Major vegetation group

- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Moonie River—Commoron Creek Floodout subregion

Eighteen percent of the original vegetation cover of this subregion remains. The pre-European and 1995 major vegetation groups are shown in Figures 35 and 36; change from pre-European extent is shown in Table 35. Less than 30% of the acacia forests and woodlands and casuarina forests and woodlands remain in the subregion. Acacia forests and woodlands and casuarina forests and woodlands have had the greatest area of vegetation cleared since pre-European settlement followed closely by eucalypt woodlands.

Table 35. Pre-European and 1995 major vegetation groups and change from pre-European for the Moonie River – Commoron Creek Floodout subregion.

	Pre-European		Remnant (1995)		Cleared	
Major vegetation group	Area (ha)	Percent total area of subregion	Area (ha)	Percent total area of subregion	Area (ha)	Percent remaining of pre-European area
Largely modified/cleared	n/a	n/a	660 049	82.20	n/a	n/a
Eucalypt woodlands	212 812	26.50	72 765	9.06	140 048	34.19
Acacia forests and woodlands	263 788	32.85	14 342	1.79	249 447	5.44
Casuarina forests and woodlands	255 518	31.82	15 661	1.95	239 857	6.13
Other forests and woodlands	160	0.02	137	0.02	23	85.38
Eucalypt open woodlands	69 263	8.63	38 271	4.77	30 992	55.25
Other shrublands	1 381	0.17	1 381	0.17	0	99.99
Other grasslands etc	31	0.00	30	0.00	1	95.22
Mangrove etc	0	0.00	322	0.04	n/a	n/a

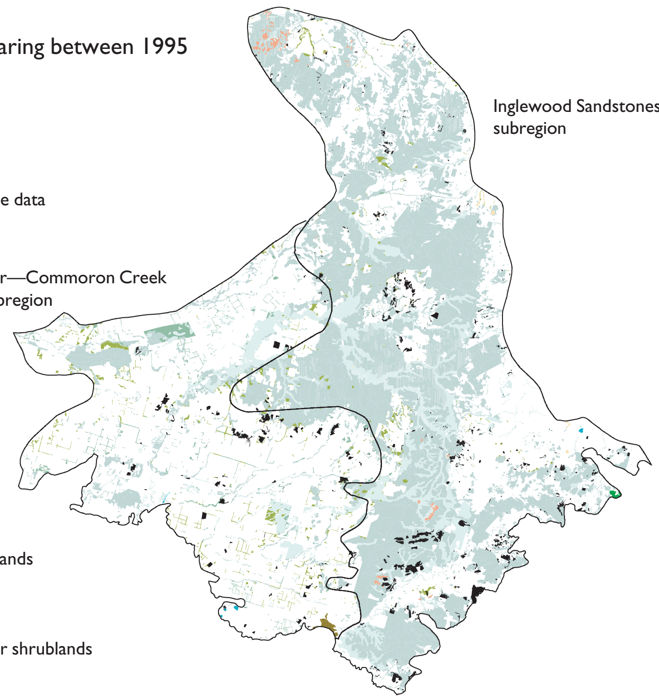
Figure 36. Major vegetation groups and clearing between 1995 and 1997 in two Queensland subregions.

Source:

Queensland Herbarium, 1995 and 1997 Landcover.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



Major vegetation group

- Largely modified/cleared (1995–1997)
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Low closed forests, closed shrublands and other shrublands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes

The vegetation changes from 1995 to 1997 are presented in Table 36 and Figure 36 (where information was available).

Approximately 880 ha were cleared, equivalent to approximately 380 ha each year. The majority of the vegetation cleared was eucalypt woodlands, (57% or 500 ha), acacia forests and woodlands (33% or 291 ha), casuarina forests and woodlands(6% or 51 ha) and eucalypt open woodlands (4% or 39 ha).

This subregion has smaller areas of vegetation being cleared but has only 18% of native vegetation remaining. Casuarina forests and woodlands have less than 30% of their original extent remaining with an additional 51 ha cleared between 1995 and 1997.

Table 36. Major vegetation groups cleared between 1995 and 1997 in the Moonie River – Commoron Creek Floodout subregion.

Major vegetation group	Area cleared 1995–1997 (ha)
Eucalypt woodlands	500
Acacia forests and woodlands	291
Casuarina forests and woodlands	51
Eucalypt open woodlands	39

Farm forestry. Katherine site enrichment planting (July 1998), mixed planting in a strip of bushland

NATURE CONSERVATION IN AUSTRALIA: applications

Australia's native vegetation cover is diverse, rich in species and complexity and has a very high degree of endemism. Native vegetation contributes to the natural values, resources and processes of biodiversity, soil and water resources, hydrology, land productivity, sustainable land use, and climate change. It also contributes to natural and cultural heritage, and Indigenous people's interests.

Nature conservation means much more than just protecting wildlife and its habitat in nature reserves. Conservation of native species and ecosystems, and the processes they support— the flows and quality of rivers, wetlands and groundwater, and soil structure and landscapes —are all crucial to the sustainability of primary industries. The management and conservation of native vegetation is the responsibility of all Australians and may be achieved through a variety of mechanisms.

The shift towards more sustainable land use systems is likely to include greater use of native Australian species than occurs in conventional agriculture today. Farming systems may in the future have portions of the landscape occupied by native perennials, some forming the basis of grazing systems, and others generating a range of products including carbon sequestration, timber, fuelwood, craftwood and pulp, cut flowers, essential oils, herbs, solvents, and pharmaceuticals. Community revegetation and regeneration activities could be underpinned and complemented by a thriving native vegetation industry and associated infrastructure for native vegetation management.

Managing for conservation values

Managing to conserve or enhance the conservation benefits of native vegetation can be achieved through a number of mechanisms, from formal reservation to incentives for conserving the values of individual remnants on private land.

Incentives schemes can be derived from and delivered at a range of scales (e.g. nationally through the taxation system and major targeted grants for national priorities; subnationally through revolving funds, industry codes of practice, accreditation systems and regulatory approaches; and regionally through regional grants, stewardship payments, planning, zoning and rating systems).

The general principles informing the design and delivery of incentives need to incorporate principles that include:

- natural resource management and resource allocation decisions being made at the lowest practicable level;
- systems that connect people as directly as possible with the consequences of their actions; and
- local ownership of problems and solutions are most likely to be genuine when revenue raising and resource allocation operate at the same level.

Examples of nature conservation mechanisms

Transition incentives

Transition incentives are one-off payments to assist landholders to meet new requirements imposed through legislative and land use planning processes. Policy or legislative change is accompanied by incentives that assist landholders in meeting new vegetation management obligations. The emphasis is on equity so as to retain landholder support and motivation for the transition to a new management standard.

An example of a transition incentive is in South Australia where payment for protecting vegetation under heritage agreements was made available following refusal of a clearance application under the native vegetation clearing legislation between 1985 and 1991.

The New South Wales Department of Land and Water Conservation recently introduced property agreements that assist landholders in managing native vegetation following the introduction of broadscale clearing controls in this State.

Farm forestry. Katherine site irrigated (April 2000)

Voluntary management agreements

Voluntary management agreements are a contract or binding agreement between a landholder and third party regarding the use and management of their land to assist in sustaining the conservation values in the long term. An integral part of these agreements is that they promote integrated agricultural and other productive land uses with the conservation of native vegetation (Binning & Young 1997).

Success of management agreements relies on:

- their development and promotion as a partnership between the parties; and
- maximisation of the values that are conserved for the wide benefit of all Australians (often referred to as 'stewardship').

Some management agreement mechanisms already operating include :

- New South Wales—voluntary conservation agreements, wildlife refuges, farming for the future, land for wildlife;
- Queensland—nature refuges;
- Victoria—land purchase, covenants, revolving funds, land management cooperative agreements, land for wildlife;
- South Australia—heritage agreements;
- Western Australia—remnant vegetation protection scheme, covenants;
- Tasmania—conservation covenant, private wildlife sanctuary, land for wildlife, forest stewardship agreements; and
- Northern Territory—covenants, partnership agreements.

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Revolving funds

A revolving fund for biodiversity conservation involves the establishment of capital funds for purchasing land with conservation significance. When such land is purchased, a covenant is placed on its title to ensure future maintenance of identified conservation values. The land is then sold to sympathetic purchasers.

Revolving funds have the potential to be a highly effective incentive, particularly if it is accepted that it is difficult, if not impossible, to get resistant landholders to change management practices. Voluntary agreements are unlikely to be of assistance in securing sustainable management of vegetation on land owned by an individual who:

- does not value vegetation highly;
- is suspicious of government involvement; or
- is not attracted to binding agreements for areas of high conservation value.

As the property right is changed, via the revolving fund and covenant, it is more likely that a landholder committed to vegetation management will purchase the land.

Regional management plans

Regional vegetation management plans are increasingly being developed between the community and government to achieve long-term sustainable development based on agreed goals. Ideally, these plans should be integrated into other regional planning initiatives to achieve effective outcomes across a range of planning and management issues. Regional management plans provide an excellent tool for identifying strategic values of native vegetation and to assist in developing priorities and options for conservation action.

An holistic approach that considers the status of native vegetation on public and private land and associated biodiversity assets across all tenures is required to provide the context for development of the regional vegetation plans. Vegetation on public land in conservation reserves needs to be considered with respect to establishing conservation targets, and actively managing fire, weeds, feral animals, dieback and salinity. Regional vegetation plan actions should mainly focus on appropriate protection, and management and revegetation regimes over private and leasehold land.

Vegetation management programs on public and private land should consider links across the landscape and coordinated actions (e.g. pest plant and animal management). The vision identified in the regional vegetation plan will be achieved through a combination of public land management and vegetation management undertaken on private land.

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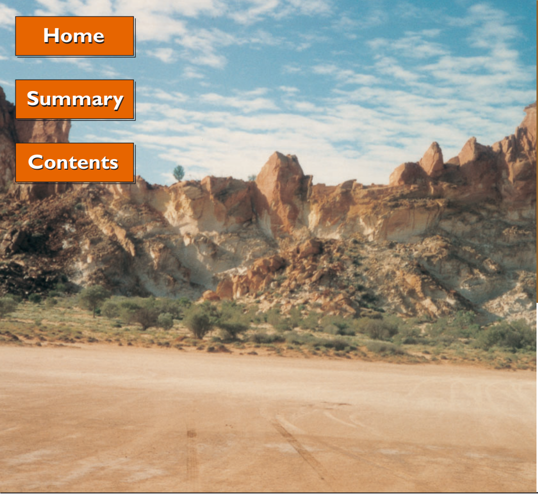


Rainbow Valley Conservation Reserve, Northern Territory

Formal reserves

Formal reserve systems are established on a sound statutory basis. Typically they are established through an Executive Council and Parliamentary process which not only formally establishes the reserves in the network, but also requires Parliamentary approval to revoke previous reservation actions. This security of tenure is one of the key distinguishing features of formal reserves. Plans of management, prepared with public consultation and formally adopted, are also a feature of formal reserves, with implementation by a State-based government agency.

Reserve systems are devised to represent the array of ecosystems and natural and cultural features throughout the landscape. Increasingly they are based on fulfilling the principles of comprehensiveness (sampling all ecosystems), adequacy (long-term viability) and representativeness (sampling the variation within ecosystems), at least for natural heritage.

Indigenous Protected Areas

An Indigenous Protected Area is an area of land in relation to which traditional Indigenous owners have entered into a voluntary agreement to promote biodiversity and cultural resource conservation. Indigenous landowners are supported to manage their lands for the protection of natural and cultural features in accordance with internationally recognised standards and guidelines for the benefit of all Australians.

Landowners prepare a plan of management for the area they propose to declare as an Indigenous Protected Area. This may include:

- holding discussions with the relavant State/Territory conservation agencies and other agencies that may be able to support the project; and
- incorporating expert advice on the values of the Indigenous Protected Area and how these should be managed and protected.

Declaration is made by formal and public announcement of the intention to manage land as an Indigenous Protected Area according the prepared plan of management.

Protected areas in Australia have six Indigenous Protected Areas adding 507 087 ha of mainly World Conservation Union (IUCN) Category VI to the National Reserve System. Recent approved additions include:

- Wattarru in South Australia (1 850 000 ha);
- Walalkara in South Australia (700 000 ha);
- Badger Island in Tasmania (1244 ha);
- Mt Chappell Island in Tasmania (325 ha);
- Guanaba in Queensland (99 ha);
- Dhimmuru in Northern Territory (92 080 ha);
- Warulkawa (Deliverence Island) in Queensland (3500 ha);
- Wattleridge in New South Wales (480 ha); and
- Paruku in Western Australia (434 588 ha).

These contribute substantial areas of land to Australia's system of protected areas and provide a level of protection to Australia's native vegetation.

Identifying conservation values

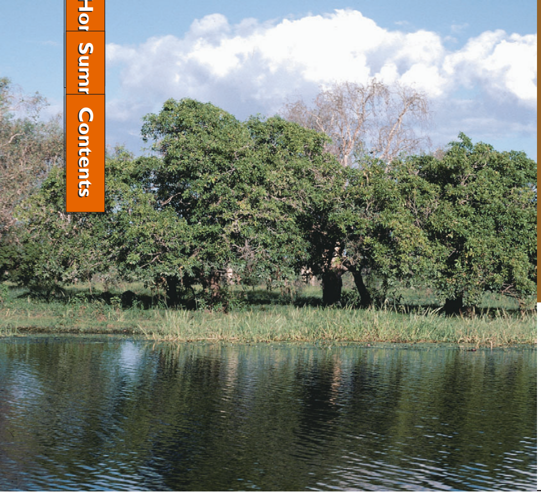
One of the great challenges in developing a strategic approach to conservation of natural resources is understanding their spatial distribution, biological values and the ecosystem services they provide. The first step is to improve our knowledge base, in both theoretical and practical terms, about how to conserve, manage, enhance or re-establish native vegetation for various combinations of objectives at various scales.

Vegetation mapping is arguably one of the most valuable information requirements for conservation planning and natural resource management. Accurate vegetation maps at the appropriate scale enable conservation and land use planning and management, and provide baselines against which changes in vegetation type and extent can be measured.

Native vegetation on private or leasehold lands has not been a traditional focus of much vegetation mapping activity. Consequently, the information base of extent, type and condition of native vegetation on private lands is incomplete, fragmented and highly dispersed across a wide range of individuals and institutions within and outside government and academia. There is a great deal of local knowledge and insight among those involved in native vegetation management and revegetation activities but not much of this is formalised or widely accessible.

Improving the coverage and quality of our information base for native vegetation on private and leasehold land is a high priority for more effective natural resource management planning.

Information of vegetation extent, type and condition is more comprehensive for publicly owned land in the formal reserve system.



Barringtonia acutangula, Cooinda, Kakadu National Park, Northern Territory

Native vegetation types in protected areas

Key findings

The World Conservation Union defines a protected area as:

> *An area of land or sea specially dedicated to the protection and maintenance of biodiversity and associated cultural resources and management through legal and/or other effective means.*

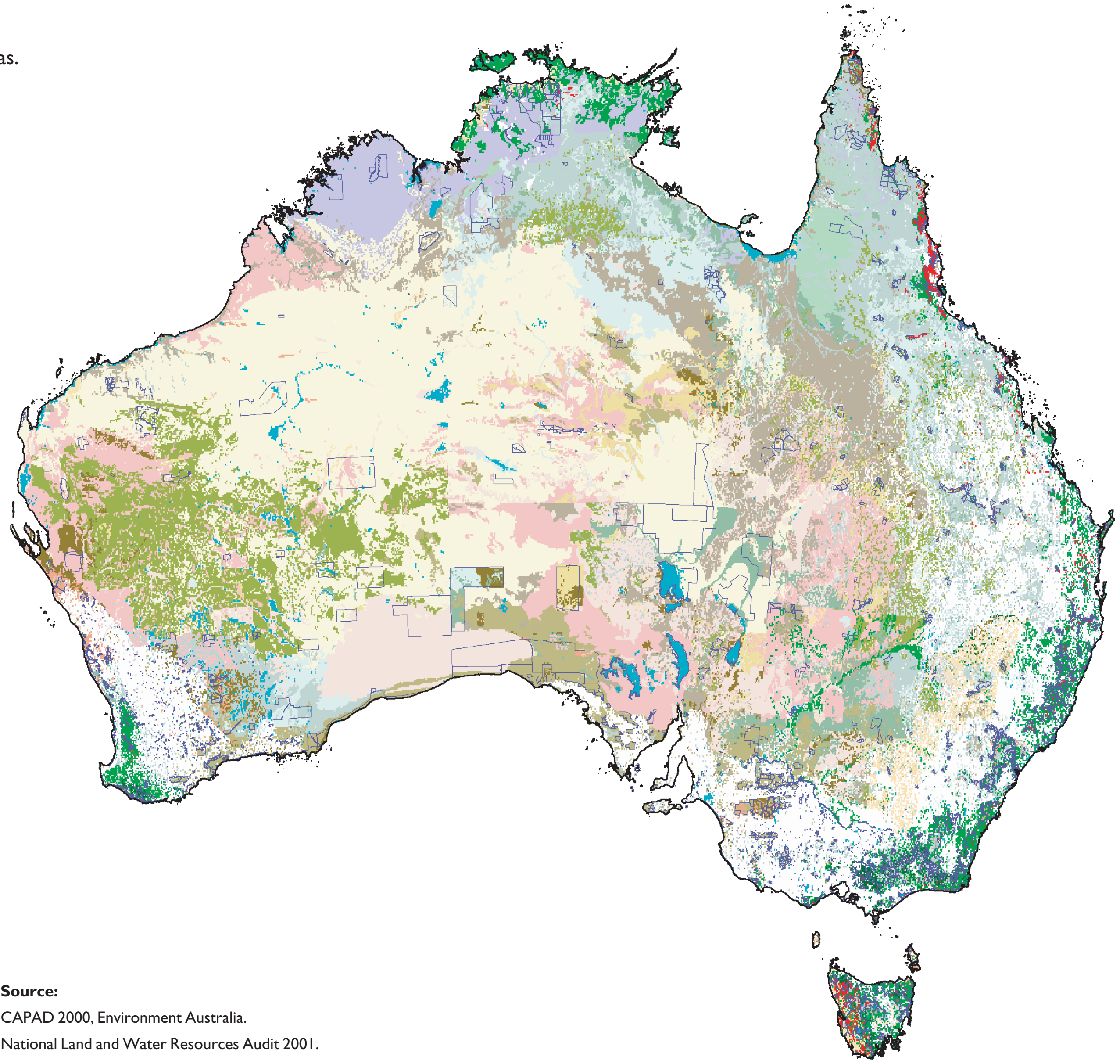
This definition is used in the analysis of vegetation types protected.

Gazetted formal protected areas total 7.8% of Australia's area. The Australian Capital Territory and Tasmania have more than 30% in protected areas and the Northern Territory and Queensland has less than 5% in protected areas (Table 37).

While the level of reservation may appear low for some States and Territories, important areas of some native vegetation types and ecosystems are included in their reserve system. Conversely, some native ecosystems may be inadequately protected in States and Territories that have high levels of reservation. To better understand the representativeness of vegetation types within protected areas, it is necessary to examine the area of each major vegetation group in protected areas. Figure 38 shows the relative proportion of major vegetation groups protected across Australia and the distribution of protected areas against major vegetation groups is presented in Figure 37.

Figure 37. Major vegetation groups and protected areas.

- Rainforest and vine thickets
- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt woodlands
- Eucalypt open woodlands
- Tropical eucalypt woodlands/grasslands
- Low closed forests, closed shrublands and other shrublands
- Mallee woodlands and shrublands
- Acacia open woodlands
- Acacia shrublands
- Chenopod shrubs, samphire shrubs and forblands
- Heath
- Tussock grasslands
- Other grasslands, herblands, sedgelands and rushlands
- Hummock grasslands
- Mangroves, samphires, sand, rock, salt lakes, freshwater lakes
- Protected areas



Source:

CAPAD 2000, Environment Australia.

National Land and Water Resources Audit 2001.

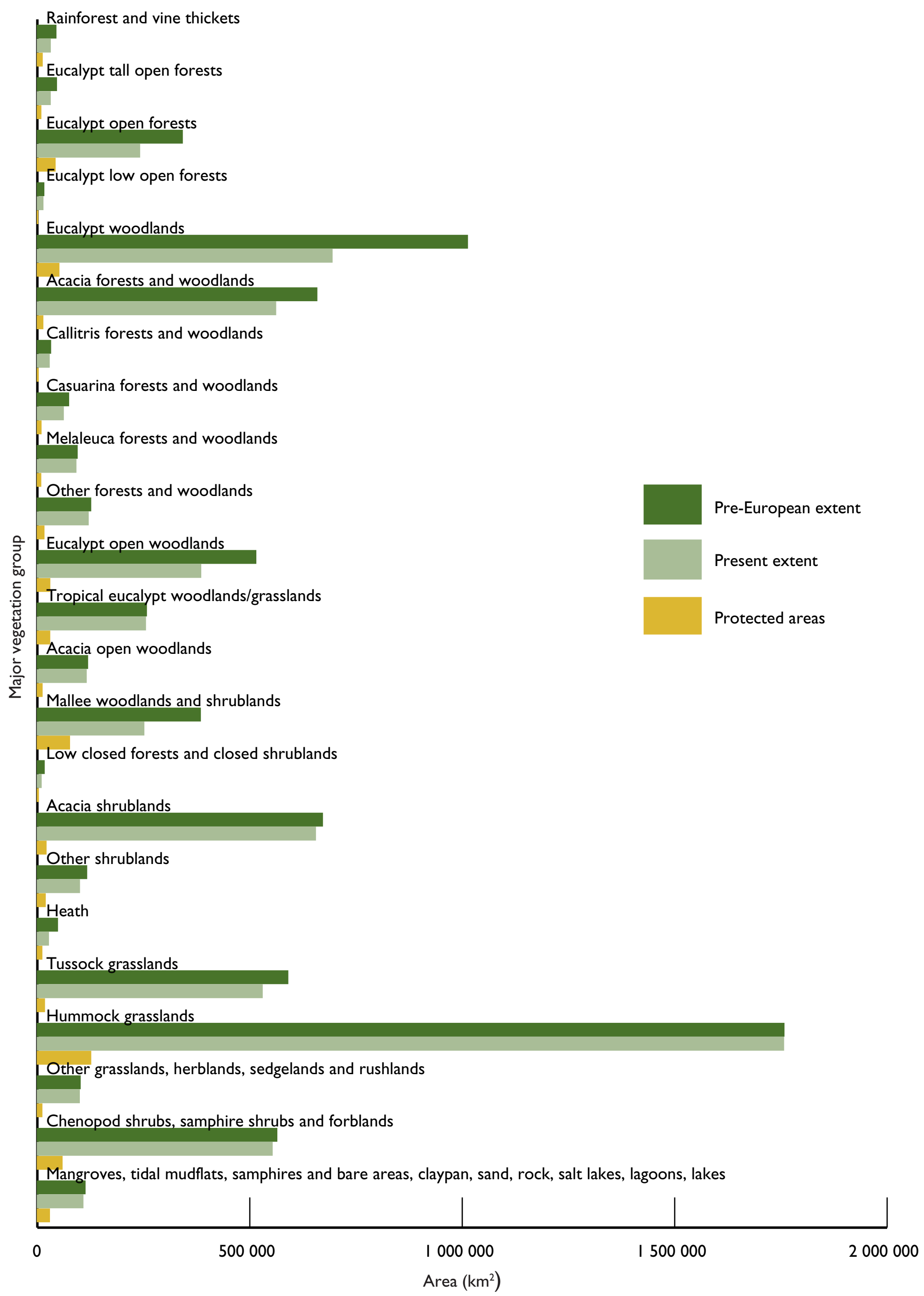
Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Table 37. Area (km²) of protected areas in Australia in 2000 (Hardy 2001).

	Western Australia	Northern Territory	South Australia	Queensland	New South Wales	Australian Capital Territory	Victoria	Tasmania	Australia
Total land area	2 525 193	1 347 816	983 789	1 726 950	801 311	2 362	227 487	67 927	7 684 327
Total protected area	159 151	51 256	216 310	69 388	49 532	1 230	33 780	22 020	602 730
Percentage of land area protected	6.3	3.8	22.0	4.0	6.2	52.1	14.8	32.4	7.8

Figure 38. Pre-European and present vegetation, and protected area (km²) for each major vegetation group.



From Table 38 it can be seen that there are substantial areas of major vegetation groups previously discussed as being heavily impacted by clearing in protected areas, recognising that some vegetation groups are better protected that others.

Each State or Territory makes a major contribution to the protective management of particular major vegetation groups, including:

- New South Wales reserves protect significant areas of eucalypt open forests, eucalypt woodlands and callitris forests and woodlands;
- Northern Territory reserves protect significant areas of tropical eucalypt woodlands/grasslands and hummock grasslands;
- Queensland reserves protect significant areas of rainforest and vine thicket in the Wet Tropics area, plus melaleuca forests and woodlands, eucalypt woodlands, eucalypt open woodlands and tussock grasslands;
- South Australian reserves protect significant areas of casuarina forests and woodlands, other forests and woodlands (e.g. Myoporum woodlands), eucalypt open woodlands, mallee woodlands and shrublands, heath, other shrublands (e.g. Leptospermum shrublands), tussock grasslands, hummock grasslands, chenopod shrublands and claypan and saltlake communities;
- Tasmanian reserves protect significant areas of rainforest, low closed forests and closed shrublands and other grasslands, herblands, sedgelands and rushlandss (e.g. the extensive button grass plains in the World Heritage Area);
- Victorian reserves protect significant areas of eucalypt tall open forests and eucalypt woodlands; and
- Western Australian reserves protect significant areas of acacia forests and woodlands, tropical eucalypt woodlands/grasslands, mallee woodlands and shrublands, acacia shrublands, heath, hummock grasslands and chenopod and samphire shrubs.

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Table 38. Area (km^2) of major vegetation groups in protected areas.

Major vegetation group	Western Australia	Northern Territory	South Australia	Queensland	New South Wales	Australian Capital Territory	Victoria	Tasmania	Australia
Rainforest and vine thickets	0	265	0	5 058	1 545	0	134	4 241	11 244
Eucalypt tall open forests	554	0	0	48	1 286	4	4 550	1 569	8 011
Eucalypt open forests	1 705	6 806	87	4 016	21 580	858	2 844	3 657	41 552
Eucalypt low open forests	106	70	17	104	509	42	77	31	957
Eucalypt woodlands	9 543	4 280	1 311	15 437	10 478	179	7 887	1 420	50 534
Acacia forests and woodlands	8 065	10	659	3 326	539	0	97	6	12 701
Callitris forests and woodlands	0	0	220	67	1 157	4	279	0	1 728
Casuarina forests and woodlands	163	0	7 363	223	647	2	42	16	8 457
Melaleuca forests and woodlands	348	1 695	1	5 744	1	0	24	0	7 812
Other forests and woodlands	751	127	10 731	2 197	2	0	1 290	252	15 350
Eucalypt open woodlands	4 236	8 190	7 050	6 990	2 166	48	333	33	29 047
Tropical eucalypt woodlands/grasslands	10 073	17 072	0	1 757	0	0	0	0	28 903
Acacia open woodlands	75	24	8 953	1 899	8	0	0	0	10 959
Mallee woodlands and shrublands	14 763	1 318	47 809	0	2 919	0	8 675	0	75 484
Low closed forests and closed shrublands	276	0	2	115	31	0	403	1 388	2 214
Acacia shrublands	12 427	1 305	2 748	2 073	1 664	0	5	3	20 225
Other shrublands	4 291	1	9 374	1 863	23	7	2 390	329	18 278
Heath	5 294	0	2 011	140	730	9	1 405	765	10 354
Tussock grasslands	2 314	701	6 166	5 033	1 994	40	165	144	16 556
Hummock grasslands	54 689	5 870	54 404	10 441	0	0	0	0	125 403
Other grasslands, herblands, sedgelands and rushlands	873	1 913	261	405	204	0	395	6 385	10 437
Chenopod shrubs, samphire shrub and forblands	21 363	441	32 696	2 003	740	0	704	5	57 952
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	3 127	265	22 900	633	300	10	272	733	28 240

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Methods

Data on the extent of native vegetation found within protected areas was analysed by intersection of the major vegetation groups with spatial data from the Collaborative Australian Protected Areas Database (Hardy 2001).

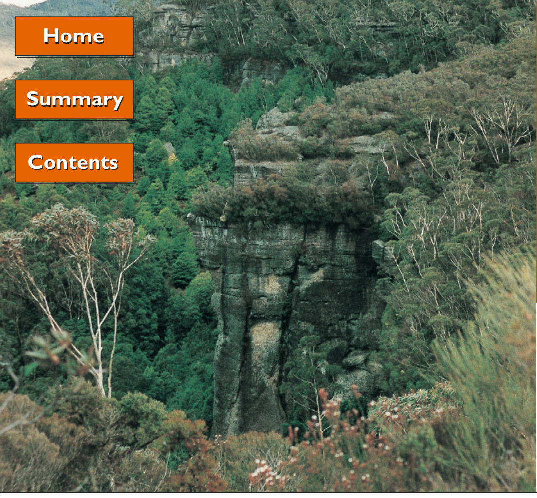
Limitations

The Collaborative Australian Protected Areas Database contains all gazetted formal protected areas within Australia, current to 2000 in Tasmania and to 1999 for other States and Territories. As the data relates to gazetted areas only it does not include many new reserves (approximately two million hectares) declared through the Regional Forest Agreement process in New South Wales, Victoria and Western Australia. It therefore underrates the level of protection afforded to forest communities such as rainforest and vine thickets, eucalypt tall open forests and eucalypt open forests. The data also does not include other recent protected area declarations where they have yet to be gazetted under State and Territory legislation and boundaries reliably defined.

The analysis, in keeping with the World Conservation Union definition, excludes:

- World Heritage Areas unless formally reserved; and
- other informal reserves (e.g. other crown reserves and private reserved lands).

These tenures would add considerably to the areas in protective management for some of the vegetation groups.



Divide between temperate rainforest and heath, Morton National Park, New South Wales

Change in area of vegetation protected between 1968 and 2000

Key findings

Table 39 outlines changes in area of the major vegetation groups found within protected areas over time. Figure 39 presents the change in extent of protected areas for 1968, 1979, 1982, 1988, 1997 and 2000.

All major vegetation groups most affected by clearing have had dramatic increases in their area within protected areas since 1968.

The protected area of many vegetation groups appears to have increased substantially from 1969 to 1979. Exceptions are:

- other forests and woodlands and tussock grasslands: major additions to the protected area for these groups occurred from 1979 to 1989; and
- rainforest and vine thickets, eucalypt tall open forests, acacia open woodlands, mallee woodlands and shrublands, chenopod shrublands and saltpan and saltlake communities: major additions to the protected area occurred from 1988 to 1998.

There are important stories of protected area declarations associated with these dramatic increases in the protected area of native vegetation. The declaration of the 1.3 million hectare Lake Eyre National Park in 1985 and the 1.8 million hectare Gibson Desert Nature Reserve in 1977 made substantial contributions to reservation of their particular vegetation groups. Smaller reserves have also made important contributions to the protection of specific vegetation associations and associated wildlife habitats.

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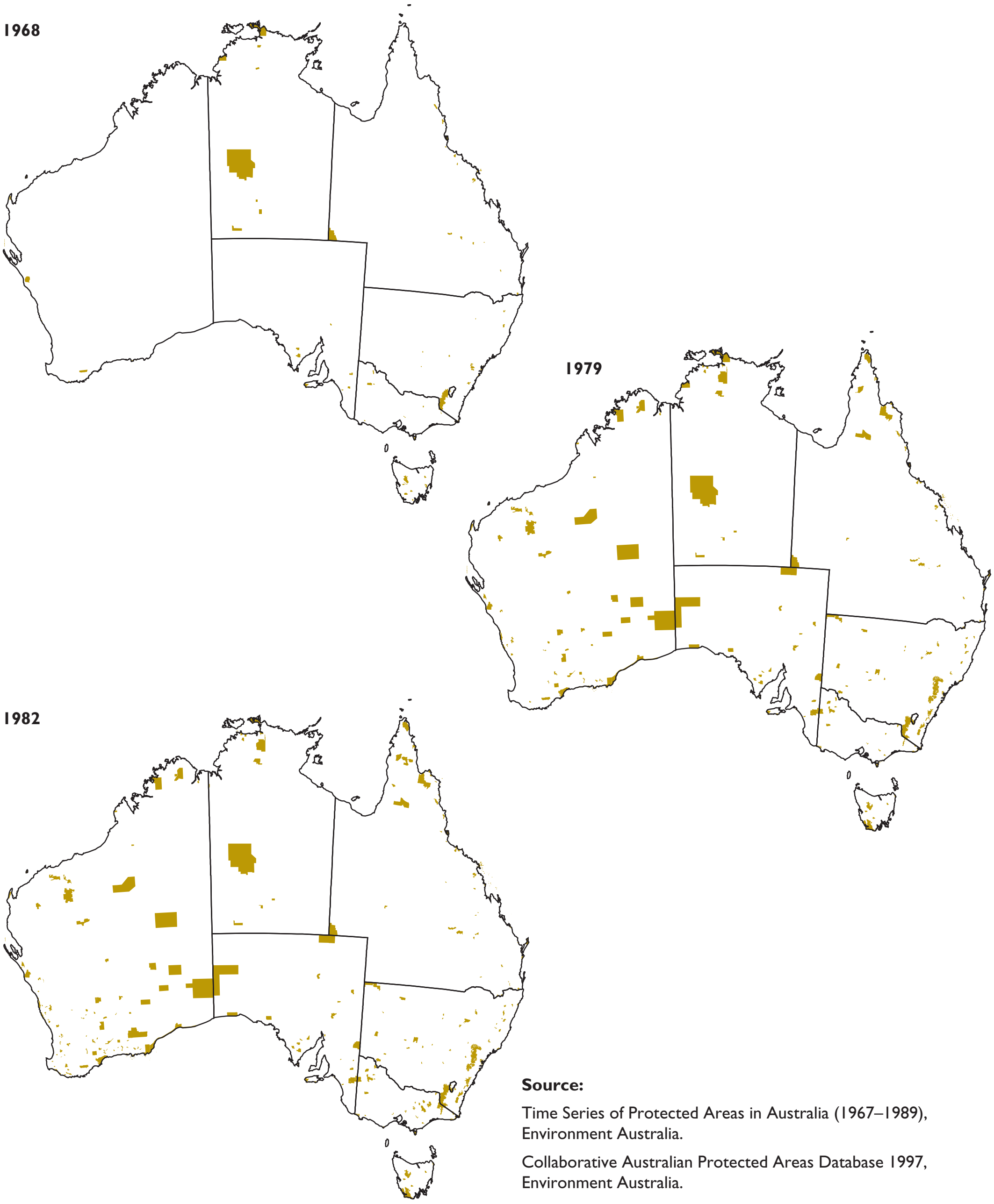
Figure 39. Changes in protected areas between 1968 and 2000.



Source:

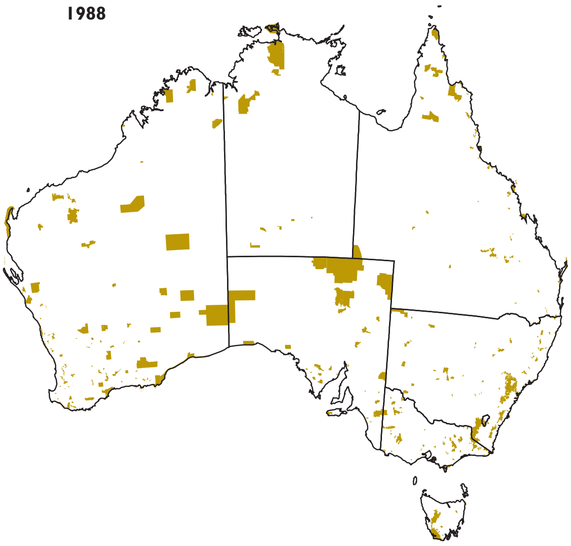
Time Series of Protected Areas in Australia (1967–1989), Environment Australia.

Collaborative Australian Protected Areas Database 1997, Environment Australia.

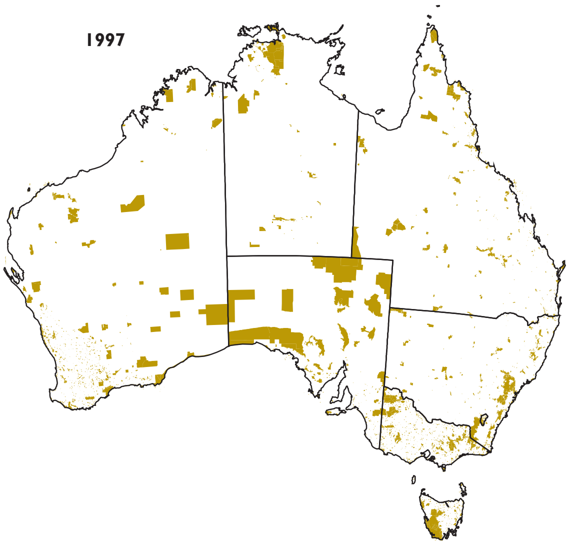
Collaborative Australian Protected Areas Database 2000, Environment Australia.

Data used are assumed to be correct as received from the data suppliers.

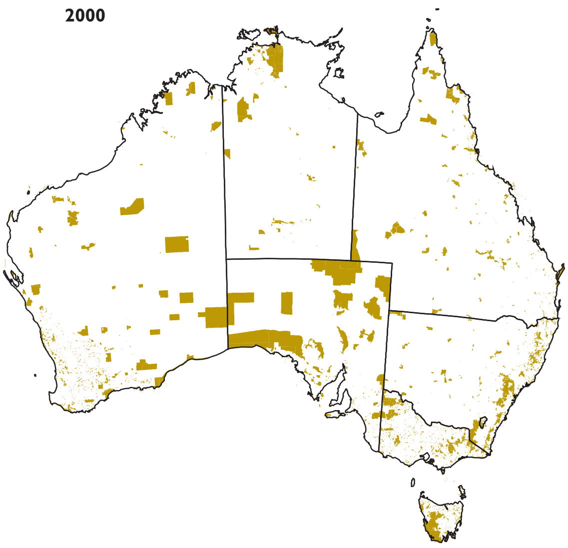
1988



1997



2000



Methods

The major vegetation groups were intersected with the Time Series of Protected Areas in Australia (1967–1989) polygon boundaries for each date, the Collaborative Australian Protected Areas Database 1997 and the Collaborative Australian Protected Areas Database 2000. Only information on terrestrial reserves are presented.

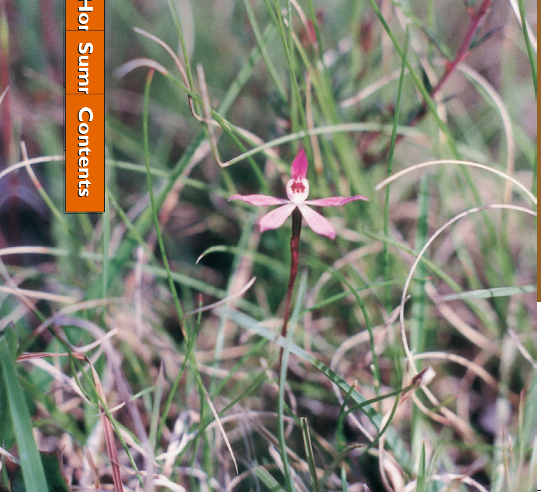
Limitations

The time series database was developed using hardcopy maps (for polygon information) and published lists of protected areas (centroids). For all years other than 1968 and 1979, areas under 5000 ha are represented as points and areas greater than 5000 ha are represented as polygons.

The data compiled for each year in the time series are based on a mixture of pre-existing digital data sets (CAPAD 1997) and digitised maps. Collaborative Australian Protected Areas Database 1997 and Collaborative Australian Protected Areas Database 2000 are a compilation of State and Territory protected area data sets. Further information on the sources of information and changes in the protected areas between 1967 and 1989 can be found in Cresswell and Thomas (1997) and Hardy (2001).

Table 39. Change in area (ha) of major vegetation groups protected from 1968 to 2000.

Major vegetation group	1968	1979	1982	1988	1997	2000
Rainforest and vine thickets	1 993	3 739	4 223	5 707	9 720	11 244
Eucalypt tall open forests	709	1 545	2 939	4 108	7 730	8 011
Eucalypt open forests	10 511	19 316	19 033	26 588	34 331	41 553
Eucalypt low open forests	192	657	699	827	1 006	957
Eucalypt woodlands	4 193	17 749	27 429	36 213	48 426	50 535
Acacia forests and woodlands	68	8 528	8 528	9 193	12 062	12 701
Callitris forests and woodlands	125	1 254	1 284	1 464	1 691	1 728
Casuarina forests and woodlands	137	7 148	7 220	7 337	8 300	8 457
Melaleuca forests and woodlands	424	5 765	5 935	6 709	7 804	7 812
Other forests and woodlands	110	1 937	2 251	10 493	15 135	15 350
Eucalypt open woodlands	732	10 799	15 180	21 216	25 928	29 047
Tropical Eucalypt woodlands/grasslands	996	16 155	15 956	26 614	28 308	28 903
Acacia open woodlands	97	172	172	254	10 892	10 959
Mallee woodlands and shrublands	3 266	26 519	27 591	30 734	70 976	75 485
Low closed forests and closed shrublands	285	670	671	1 204	2 152	2 215
Acacia shrublands	1 656	10 179	10 410	15 364	19 552	20 225
Other shrublands	913	9 974	10 370	11 508	17 887	18 279
Heath	1 540	6 356	6 769	7 030	10 185	10 354
Tussock grasslands	652	3 372	3 397	10 923	12 862	16 556
Hummock grasslands	43 587	101 133	101 133	105 763	123 636	125 404
Other grasslands, herblands, sedgelands and rushlands	1 460	5 076	4 214	6 287	10 434	10 438
Chenopod shrubs, samphire shrubs and forblands	458	25 555	25 682	30 187	56 008	57 952
Mangroves, tidal mudflats, samphires and bare areas, claypans, sand, rock, salt lakes, lagoons, lakes	608	4 731	4 754	13 639	28 693	28 242
Total area protected	**74 712**	**288 330**	**305 840**	**389 361**	**563 718**	**592 407**



Caladenia fuscata near Braidwood, New South Wales

Moving towards a comprehensive, adequate and representative system of protected areas

Key findings

A systematic approach to nature conservation is essential to efficiently and effectively protect biodiversity and a framework is needed for describing biodiversity and for planning its conservation (Sattler & Williams 1999). Biodiversity can be described in a range of ways:

- plant species;
- groups of plant species (vegetation types); and
- ecosystems that incorporate the environments in which vegetation types occur (e.g. climate, landforms, geology and soils).

Ecosystems are the preferred biodiversity assessment framework and are being increasingly recognised as reflecting the biotic and abiotic elements of the landscape (Sattler & Williams 1999). The IBRA bioregions are the accepted landscape framework for Australia (Cresswell & Thomas 1997). The IBRA subregions, further divide the IBRA bioregions and delineate the major geomorphic patterns, providing a more robust framework with greater resolution for analysing the distribution of landscapes.

The Australia and New Zealand Environment Conservation Council National Reserve System Taskforce have adopted the notion that comprehensiveness is assessed at an IBRA bioregion level and representativeness at an IBRA subregion level (i.e. ecosystems have IBRA targets , and we apply a a subregional framework to ensure that sampling occurs across their geographical range).

Table 40 provides an overview of the number of major vegetation groups within each of the reservation classes of the five IBRA bioregions with less than 30% of native vegetation remaining.

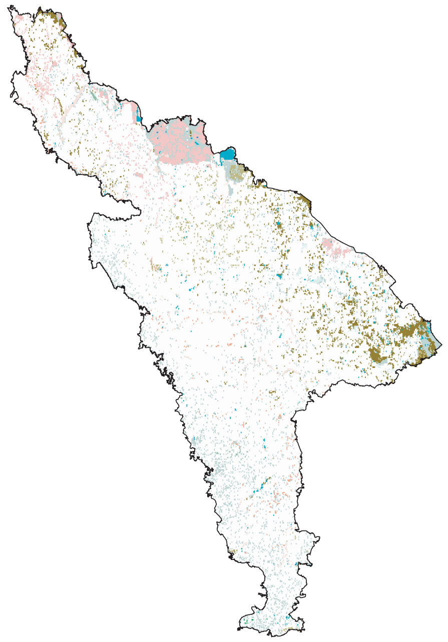
These results show that the protection status for the vegetation in these regions is low. The majority of the major vegetation groups in each region fall below reservation Class 3 with less than 10% of the pre-European extent of the vegetation group in a protected area.

The reservation classes from the Avon Wheatbelt bioregion (Table 41) have been mapped as an example (Figure 40) along with the major vegetation groups.

Table 40. Number of major vegetation groups by reservation class for IBRA bioregions with less than 30% of native vegetation remaining.

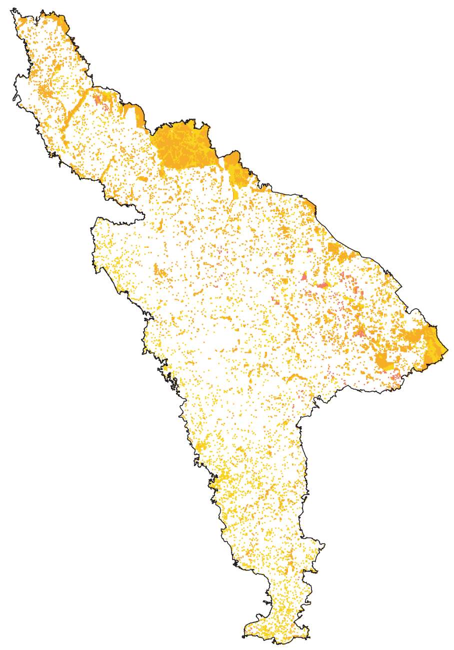
Bioregion	Class 1 0%	Class 2 < 5%	Class 3 5–10%	Class 4 10–15%	Class 5 15–30%	Class 6 > 30%
South East Coastal Plain	–	9	1	2	2	2
Victorian Midlands	3	4	3	–	2	3
Victorian Volcanic Plain	8	3	2	1	2	–
Naracoorte Coastal Plain	4	4	2	–	3	4
Avon Wheatbelt	4	9	2	–	–	–

Figure 40. Avon Wheatbelt bioregion major vegetation groups and reservation classes.



Major vegetation groups

- Eucalypt tall open forests
- Eucalypt open forests and low open forests
- Eucalypt woodlands
- Acacia forests and woodlands
- Callitris, casuarina and other forests and woodlands
- Melaleuca forests and woodlands
- Eucalypt open woodlands
- Mallee woodlands and shrublands
- Low closed forest, closed shrublands and other shrublands
- Acacia shrublands
- Heath
- Chenopod shrubs, samphire shrubs and forblands
- Mangroves, samphire, sand, rock, salt lakes, freshwater lakes
- Cleared



Reservation classes

- Class 1 (nil)
- Class 2 (< 5%)
- Class 3 (5–10%)

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the NVIS. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

York gum woodland with grazed understorey, near Gnowangerup, Western Australia

Table 41. Avon Wheatbelt (IBRA70) reservation analysis.

	Eucalypt tall open forests	Eucalypt open forests	Eucalypt woodlands	Acacia forests and woodlands	Casuarina forests and woodlands	Melaleuca forests and woodlands	Other forests and woodlands	Eucalypt open woodlands
Native vegetation (ha)	4	720	525 408	4	6 836	532	952	36 588
Cleared vegetation (ha)	36	1 696	92	152	17 668	2 012	4 532	4 824 552
Pre-European vegetation (ha)	40	2 416	525 500	156	24 504	2 544	5 484	4 861 140
Protected area (ha)	0	0	30 672	0	332	180	120	7 860
Percent native vegetation in protected area	0.0	0.0	5.8	0.0	1.4	7.1	2.2	0.2
Reservation class	1	1	3	1	2	3	2	1

	Mallee woodlands and shrublands	Low closed forests and closed shrublands	Acacia shrublands	Other shrublands	Heath	Chenopod shrubs, samphire shrubs and forblands	Mangrove group
Native vegetation (ha)	87 024	52 176	271 356	216 184	31 916	103 800	51 580
Cleared vegetation (ha)	813 108	339 224	488 420	848 204	387 540	235 996	168 876
Pre-European vegetation (ha)	900 132	391 400	759 776	1 064 388	419 456	339 796	220 456
Protected area (ha)	5 272	4 736	12 708	14 984	6 040	6 968	5 448
Percent native vegetation in protected area	0.0	1.2	1.7	1.4	1.4	2.1	2.5
Reservation class	2	2	2	2	2	2	2

Methods

The data incorporated into the National Vegetation Information System describe the vegetation types and do not delineate ecosystems. Any assessment of nature conservation priorities using the National Vegetation Information System will therefore be based on an assessment of the vegetation types.

Interpretations based on vegetation types must remember that the vegetation is heterogeneous and may mask internal ecosystem diversity of the broad vegetation groups. While progress in ecosystem mapping varies across Australia, it is unlikely to be completed for many years or at all.

The Audit's major vegetation groups therefore provide a broad base for assessing the representativeness of reserves and providing input based on vegetation types into the setting of priorities for reservation. Further analyses should be undertaken at finer levels of vegetation classification.

Analysis of the adequacy of existing levels of native vegetation protection requires examining the comprehensiveness of the protected area estate in sampling native ecosystems and, ideally, vegetation communities. This analysis examines the area of major vegetation groups within protected areas as an estimate of the proportion of the notional pre-European extent of these groups sampled in protected areas.

The extent of each major vegetation group found within protected areas within each IBRA bioregion was then calculated as a proportion of this notional pre-European extent. This provides an estimate of overall representativeness (Table 42).

Table 42. Bioregional reservation classes.

Reservation class	Level of reservation compared to pre-European extent
1	Nil
2	< 5%
3	5–10%
4	11–15%
5	16–30%
6	> 30%

These reservation classes relate to contemporary views on appropriate levels of protection in the development of a comprehensive, adequate and representative system of protected areas (e.g. a broad goal of 10% of the pre-European extent of native ecosystems has been used informally for many years as a guide to assess the adequacy of reservation levels). In the Regional Forest Agreement process, formal reservation targets were developed through the JANIS National Reserve Criteria (Commonwealth of Australia 1997a) recommending 15% of pre-European extent of forest ecosystems, unless ecosystems were rare or threatened, in which case higher targets applied.

Limitations

This analysis, as discussed in the methods, is a surrogate for mapping and priority setting at an ecosystem scale. Reservation priorities also need to take account of other factors, including:

- tenure;
- threats to the ecosystems;
- shape of areas that might be reserved; and
- whether there are resources available for their management above and beyond the management activities of the land's existing managers.

Pterygopappus lawrencii, Abrotanella forsterioides, Ben Lomond National Park, Tasmania

GUIDELINES FOR THE INTERPRETATION OF VEGETATION MAPPING PRODUCTS

The information products presented in *Australian Native Vegetation Assessment 2001* represent a subset of the potential applications for data held in the National Vegetation Information System. The National Vegetation Information System can be used for (but not limited to):

- **Mapping and describing** the distribution of native vegetation types (including Levels I to VI in the information hierarchy and the major vegetation groups).
  See comments on *vegetation types; mosaics; vegetation remnants; reliability; edge-matching; vegetation cover.*
- **Structured analyses:** the hierarchical structure of the National Vegetation Information System database allows for comparative analysis within and across the levels. By definition each level is a generalisation of the level below (e.g. Level 1 is a generalisation of Level 2).
  See comments on *vegetation mosaics, ecological dominance, reliability; edge-matching*.
- **Management association:** when combined with other data (e.g. land use, tenure/ protection status), the National Vegetation Information System data sets become a variable characterisation and management tool.
  See comments on *vegetation remnants*; *ecological dominance*.
- **Change analysis:** when linked to vegetation change data, the National Vegetation Information System becomes a point of reference and description of the type of change.
  See comment on *pre-European; vegetation remnants, revegetation; vegetation condition.*
- **Data quality and lineage:** the extensive metadata accompanying the quantitative and descriptive vegetation data provide users with context information that helps determine the fitness for purpose (e.g. data currency, scale and coverage).
  See comment on *vegetation types; reliability; edge-matching.*

The following points should be noted as a guide to readers of this report and users of the National Vegetation Information System data and its products.

Data documentation

The extensive data set documentation embedded in and linked to the National Vegetation Information System add considerable value to the underlying vegetation data and derivative products. They provide information to users that will assist in understanding the history of the data, its appropriate use and potential application. Metadata can be found through the Australian Spatial Data Directory.

Data quality

The issues of data quality and availability, reporting scale and sources need to be recognised and acknowledged where the information is used in particular applications. An understanding of:

- the original purpose and methods of data collection and mapping;
- the completeness of the data coverage;
- the scale of the mapping; and
- the currency of mapping (older data may be useful if the features are unlikely to change rapidly, use of old data in areas experiencing rapid land use change would be inappropriate), will enhance the application of the data.

The spatial extent of the vegetation data, scale, currency, classification level and mapping methods is presented for:

- pre-European vegetation data with Figures 6 and 7, Table 43 and Appendix 8; and
- present vegetation data with Figures 9 and 10, Table 44 and Appendix 8.

The analysis of gaps in the National Vegetation Information System (see *Knowledge, data and information gaps* section) provides additional information.

Dominant vegetation types

The dominant vegetation descriptions in Levels I to VI in the hierarchy, the major vegetation groups and major vegetation subgroups may not reflect the complexity of vegetation types observed on the ground.

The first vegetation types described in each mapped vegetation unit for Levels I to VI mainly reflect the dominant vegetation in the mapped area. Where the vegetation is heterogeneous or a mosaic, the additional vegetation descriptions should be considered.

Major vegetation groups and major vegetation subgroups were derived by aggregating vegetation information according to a grouping of major vegetation types from Levels I to VI. The major vegetation groups classification contains different mixes of plant species within the canopy, shrub or ground layers, but are structurally similar and are often dominated by a single genus. Using the major vegetation groups therefore limits the capacity to describe the natural variation and diversity within vegetation types.

Vegetation mosaics

Mapped vegetation units in the National Vegetation Information System contain mosaics of vegetation unable to be delineated at the scale of data capture (e.g. 1:1 000 000 scale mapping is far more generalised and less able to delineate between complex vegetation than at the 1:100 000 scale). This issue applies across all scales and is not only limited to the small scale mapping.

Defining native vegetation and ecological dominance

Different thresholds of vegetation height, cover and species composition are used to define 'native vegetation'. In some cases these variations may reflect government policy or legislation. Data custodians have not agreed on a consistent definition of ecological dominance for use in translating data sets from their 'native' formats into the National Vegetation Information System vegetation attribute framework. This may result in variations in the way dominance is ascribed to a vegetation unit.

Vegetation remnants/fragments

Small inlier patches (e.g. riparian vegetation), small remnants and fragments of native vegetation may not be mapped. This will depend on the purpose, the methods and scale of data capture. In general, finer scale data is more likely to capture small remnants either within other extensive vegetation types or occurring as isolates or fragments within the cleared areas.

Revegetation activities and regrowth

Revegetation activities and regrowth have not been specifically mapped in Stage I of the National Vegetation Information System database.

Eucalypt woodland over tussock grasslands, near Mount Armstrong, Blue Mountains, New South Wales

Vegetation cover—known issues

Woody cover is over-represented in central and western New South Wales and Tasmania due to the age of the data sets; native and derived grasslands are not well represented in South Australia, New South Wales and Australian Capital Territory; shrublands and sedgelands are not well represented in South Australia.

Vegetation condition

Vegetation condition attributes have not been collated as part of National Vegetation Information System Stage I. However, some data sets include the presence of weeds in the vegetation description. The assignment of a particular vegetation type to a major vegetation groups or major vegetation subgroups should not be interpreted as any measure of the condition of that vegetation. Audit reports that will assist include *Australian Dryland Salinity Assessment 2000*, *Landscape Health in Australia*, *Rangelands — Tracking Changes* (NLWRA 2001a, c, d) and *Ecosystem Health* and *Biodiversity* (in prep.).

Pre-European vegetation

Australia's pre-European vegetation has been reconstructed using a variety of interpolation and modelling techniques:

- mapping and information on the present types and extent;
- historical records; and
- early aerial photographs.

It is assumed that Australia had experienced no significant clearing prior to European settlement.

The underlying data used to describe the pre-European vegetation are in many cases the same as those representing the present vegetation. Some jurisdictions have assumed that vegetation types mapped as present vegetation also represent the pre-European vegetation. This presents varying problems in the interpretation of changes in the vegetation as there are very few areas in Australia that have not undergone some modification in species or structure since European settlement. Information on the condition of Australian vegetation would provide a better assessment of change in these areas.

Reliability of the vegetation information

The data (including mapped units and attributes) are only as current as the original mapping from which they are derived. The data is collated from data sets that were produced for different purposes, at different times using various methods and scales. This variation may result in an under or over representation of the area of vegetation types. Users are strongly advised to consult the associated data set documentation. See Appendix 8 for a reference list of data sets incorporated in National Vegetation Information System Stage I database.

Edge matching between data sets and jurisdictions

Vegetation types have not been consistently described between jurisdictions and/or between data sets. Caution needs to be exercised in comparing statistics derived for Australia and across jurisdictions given the different scales and mapping methods of the data sets included in the National Vegetation Information System database.

Continuous improvement

The National Vegetation Information System will be improved through the continued updating, addition of new information and data. Data quality and completeness will change over time.

The information presented on the data and information gaps in the *National Vegetation Information System*, the data documentation and original vegetation mapping reports for each source data set should be used as a further guide on the limitations of the use of the data.

Table 43. Data sets used to derive the pre-European major vegetation group data set.

National Vegetation Information System data

Data set number	Data set
110	Pryor's vegetation map of the Australian Capital Territory
201	Vegetation of south-east forests Region, Eden, NSW
206	Southern Comprehensive Regional Assessment, NSW
208	Western Sydney – Cumberland Plain, NSW
211	Hunter Regional Environmental Management Strategy (REMS), NSW
320	Vegetation Map of the Northern Territory
322	Combined coverage of vegetation units of the Northern Territory (Vegetation/Land unit Survey of Gregory National Park, Lancewood Survey, Melaleuca Survey)
402	Blackall, Queensland (1:250 000)
403	Central Western Queensland (CWQ)
405	South Central Queensland (SCQ)
407	Desert Uplands Queensland (DEU)
408	South East Queensland (SEQ)
410	South West Queensland (SWQ)
411	Cape York Peninsula Queensland
412	Brigalow Belt North Queensland (BBN)
414	Brigalow Belt South Queensland (BBS)
603	Reconstructed vegetation, Tasmania
702	Goldfields, Victoria
703	North-east RFA, Victoria
704	East Gippsland RFA, Victoria
705	Gippsland RFA, Victoria
706	Central Highlands RFA, Victoria
707	Midlands/Otways (West RFA), Victoria
708	Portland/Wimmera (West RFA), Victoria
709	Grampians, Victoria
801	Pre-European Vegetation, Western Australia

Additional data

Data set number	Data set
3	The vegetation of the Australian Tropical Savannas (1 million)
4	Springsure, Queensland (1:100 000)
5	Central Queensland Coast (CQC), Queensland (1:100 000)
6	Carnahan Natural Vegetation (1:5 000 000)
501/6	Boomsma / Carnahan Natural Vegetation derived data (1:5 000 000)

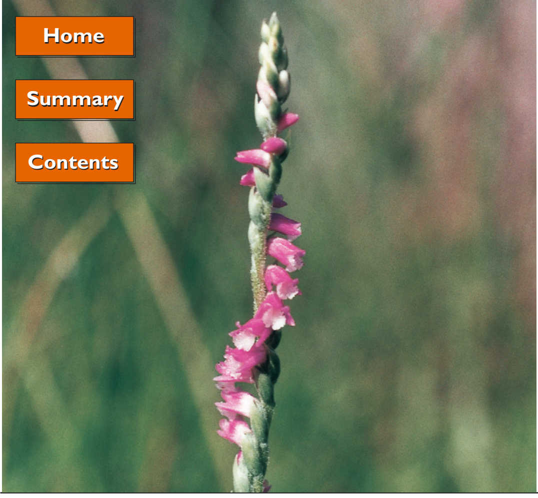
Table 44. Data sets used to derive the present major vegetation group data set.

National Vegetation Information System data

Data set number	Data set
102	Distribution of natural temperate grasslands, Australian Capital Territory
103	Extent and quality of remnant woodlands, Australian Capital Territory
104	Ainslie – Majura Reserve vegetation communities, Australian Capital Territory
105	Murrumbidgee River Corridor Vegetation, Australian Capital Territory
106	Tidbinbilla Nature Reserve, Australian Capital Territory
107	Vegetation of Mount Tennent – Blue Gum Creek, Australian Capital Territory
109	Vegetation types Cotter Catchment, Australian Capital Territory
201	Vegetation of south-east forests Region, Eden, New South Wales
202	NPWS Wheatbelt Remnant Mapping (Series 1), New South Wales
222	NPWS Wheatbelt Remnant Mapping (Series 2), New South Wales
203	NPWS Wheatbelt Remnant Mapping (Series 3), New South Wales
204	NPWS Wheatbelt Remnant Mapping (Series 4 and 5), New South Wales
205	M305 Floristic Vegetation Mapping of the Murray Darling Basin portion of New South Wales
206	Southern Comprehensive Regional Assessment, New South Wales
207	Eastern Bushlands Database, New South Wales
208	Western Sydney – Cumberland Plain, New South Wales
217	Royal Botanic Gardens Riverina Mapping, New South Wales
219	Royal Botanic Gardens north-west New South Wales
220	Royal Botanic Gardens Hawkesbury-Nepean (Sydney), New South Wales
320	Vegetation Map of the Northern Territory
322	Combined coverage of vegetation units of the Northern Territory (Vegetation/Land unit Survey of Gregory National Park, Lancewood Survey, Melaleuca Survey)
401	Blackall, Queensland (1:250 000)
403	Central Western Queensland (CWQ)
404	South Central Queensland (SCQ)
405	South Central Queensland (SCQ)
406	Desert Uplands Queensland (DEU)
409	South East Queensland (SEQ)
410	South West Queensland (SWQ)
411	Cape York Peninsula, Queensland
413	Brigalow Belt North, Queensland (BBN)
415	Brigalow Belt South, Queensland (BBS)
502	Midnorth, South Australia
503	Coongie, South Australia
504	Flinders Ranges, South Australia
505	Murray Mallee, South Australia
506	North Olary Plains, South Australia
507	Offshore Islands, South Australia
508	South East, South Australia
509	South Mt Lofty Ranges, South Australia
510	South Olary Plains, South Australia
512	Unnamed Conservation Park (CP049), South Australia
513	Tallaringa, South Australia
511	Stony Deserts, South Australia
514	Western Murray Flats, South Australia
515	Yellabinna, South Australia
516	Yumbarra Conservation Park, South Australia
517	Kangaroo Island, South Australia
601	Vegetation Management Strategy, Tasmania
602	World Heritage Area, Tasmania
710	Mallee, Victoria
720	Goldfields, Victoria
730	North-east RFA, Victoria
740	East Gippsland RFA, Victoria
750	Gippsland RFA, Victoria
760	Central Highlands RFA, Victoria
770	Midlands/Otways (West RFA), Victoria
780	Portland/Wimmera (West RFA), Victoria
790	Grampians, Victoria
802	Present Vegetation Extent, Western Australia

Additional data

Data set number	Data set
3	The vegetation of the Australian Tropical Savannas (1 million)
4	Springsure, Queensland (1:100 000)
5	Central Queensland Coast (CQC), Queensland (1:100 000)
7	Carnahan Present Vegetation (1:5 000 000)
501/6	Boomsma / Carnahan Natural Vegetation derived data (1:5 000 000)
8	Kirkpatrick & Dickinson (1: 500 000)



Spiranthes australis near Braidwood, New South Wales

KNOWLEDGE, DATA AND INFORMATION GAPS

Continuing to consolidate management relevant information on Australia's vegetation

The Audit focused on the collation of existing information on the type and extent of pre-European and present native vegetation. This included the compilation of data in areas of Australia with existing mapping which may not meet the nominal required scale, currency and level of classification, to ensure the maximum amount of information was compiled.

The goal of the data compilation was to meet information requirements for vegetation management, land use pressures and threats to vegetation identified in the National Land and Water Resources Audit Needs Analysis Report in 1998. Marine, riparian and wetland vegetation mapping, the assessment of native vegetation condition and information covering the external territories were excluded due to time, resource and data constraints.

Compilation of data and information into the National Vegetation Information System has highlighted a number of gaps in information and data coverage based on nominal thresholds:

- thematic (information and knowledge) gaps;
- spatial (scale and geographic coverage) gaps;
- currency (date) of mapping;
- vegetation classification level gaps; and
- reliability of survey and mapping methods.

Thematic gaps

Gaps in the knowledge of native vegetation in Australia has not been systematically assessed and documented. Information presented is based on a general assessment of major gaps and should be further investigated in consultation with scientific experts, policy officers and landholders.

Grasslands

- Difficult to interpret using aerial photograph interpretation techniques; site surveys are very costly.
- Limited data where regions have been mapped for the upper storey vegetation.
- Not comprehensively mapped or surveyed for the ground layer (e.g. grassy woodlands and grasslands and where regions of native and modified grasslands have not been comprehensively surveyed down to a Level V classification (vegetation association).
- Standards and methods development for mapping the extent, type and condition of grasslands, threatening processes and management requirements is needed to reliably map this vegetation type.

Non-forested vegetation

- A focus on mapping forest vegetation has in some cases overlooked non-forest structural formation types that occur within a forest ecosystem (e.g. sedgelands, grasslands, shrublands and open woodlands). This was the case in some of the Comprehensive Regional Assessment data sets that surveyed and mapped only forest structural formation types.

Avicennia marina, St Kilda Beach, near Adelaide, South Australia

Definition of native and pre-European vegetation

- Varying definitions of present and pre-European native vegetation across States and Territories may lead to misinterpretation of information (e.g. areas in Queensland have been mapped using a restricted threshold for surveying and mapping native vegetation. The Queensland Herbarium uses a definition of vegetation that is 50% of the original pre-clearing foliage cover and 70% of the original pre-clearing height of the upper storey excluding areas that contain modified native vegetation that is mapped by some other agencies).
- Pre-European mapping methods and scale of data collection are different within and between jurisdictions making the interpretation of the type and extent of pre-European vegetation types difficult and analysis compared to present vegetation often impossible.

Riparian/riverine vegetation

- Riparian vegetation and the preservation of the health and condition of riparian zones are crucial factors for long-term sustainability of catchments. Riparian zones, are often the most fertile part of the landscape and are subjected to many pressures from land use change and human activities. Significant clearing of riparian zones over the past 150–200 years in urban and rural environments has led not only to changes in vegetation composition in the land adjacent to rivers and streams, but also to changes in the waterways. Impacts of modifications to riparian areas affect environmental, productivity and quality of life across the community.
- Riparian vegetation is a major focus for on-ground activities by community groups supported by Natural Heritage Trust funding either in managing or rehabilitating these key areas. Accurate descriptions of the extent and condition of vegetation along riverine corridors are essential to quantify the resource, determine trends in the condition of riverine systems, set priorities for on-ground works and determine effectiveness of works and activities.
- Generally requires a finer scale of vegetation mapping for input into management.
- Not specifically incorporated into the National Vegetation Information System.

There is no Australia-wide approach to quantifying the extent and condition of riparian vegetation. The Audit review of riparian data (Sinclair, Knight, Mertz 2000), mapping techniques and knowledge gaps proposes using:

- an Australia-wide coverage using an initial geomorphological classification;
- a scalable data set, using the National Vegetation Information System classification as the basis for further, more detailed data collection;
- use of satellite imagery and aerial photographs for rapid appraisal and to set priorities for any field mapping; and
- although using the National Vegetation Information System classification as the basis, building a data hierarchy that incorporates management-related attributes such as weeds, bank condition and adjacent land use as part of any field mapping program.

An interim riparian mapping product was used by the Audit to assess water-borne erosion and river health (NLWRA in preparation). All streams with a catchment area greater than 50 km^2 and a length greater than 5 km were mapped across the river basins containing intensive agriculture. The proportion of each stream with cleared native riparian vegetation was determined by comparing stream data with native vegetation derived from Barson et al. (2000). Although at a resolution of 100 m and current to 1995 it is the best available data. It is still only a crude measure of riparian condition as it fails to identify narrow bands of remnant riparian vegetation in cleared areas or narrow valleys of cleared land penetrating otherwise uncleared land.

Wetlands

- Generally require a finer scale of vegetation mapping for input into management.
- Not specifically incorporated into the National Vegetation Information System.
- Range from coastal to riverine to alpine landscapes and are diverse in landscape and habitat types.
- Important for a wide range of uses including biodiversity, primary productivity and the opportunity for recruitment, landscape function and as groundwater sinks.
- Vegetation mapping as well as habitat mapping is important.

Coastal and marine vegetation

- Generally requires a finer scale of vegetation mapping for input into management.
- Not specifically incorporated into the National Vegetation Information System.
- Provide a very diverse range of habitats in potentially sensitive areas where land use impacts can be large.
- Vegetation mapping as well as habitat mapping is important.
- Existing standards need refining and methods need to be developed for mapping the extent, type and condition of these vegetation groups.

Native vegetation condition (changes in vegetation extent, structure and composition)

- Significant progress in assessing native vegetation condition for vegetation management was not possible.
- Knowledge of recent changes and trends in extent of native vegetation would significantly improve our understanding of the impact of clearing on vegetation and landscapes.
- Native vegetation resource management concepts such as condition assessment and monitoring change and trends are not resolved in terms of common definitions and approaches across Australia. A review of the draft condition framework (Environment Australia 2001) based on targeted case studies and testing, a review of requirements for condition information and prioritising requirements would enable the limited resources available for this activity to be better focused.
- Research and development activities focused on priorities for vegetation management to develop methods and bring them into operation.

Weeds

- There is little readily available information on the distribution of weeds at a scale relevant to on-ground management and a lack of association with the native vegetation it may occur in. This would be a key indicator of condition and threat to native vegetation.

Environmental and landscape information

Ecological vegetation communities (defined by associating a range of environmental and landscape attributes to the vegetation types) are unable to be defined across Australia due to a lack of consistent environmental information available at regional scales.

- Data collected on environmental and landscape features (e.g. soils, climate, geology, landforms) of the vegetation are project based or not collected.
- National standards for collecting environmental information (e.g. landforms, geology, soils attributes for vegetation management purposes) do not exist or are not widely supported.
- This information is critical for the ability to adequately represent vegetation types across the range of environments in which they occur, will allow compilation of information about vegetation communities and move towards information and mapping of ecosystems.

Scale of capture in response to management requirements

- Vegetation types under threat or with specific management requirements may require finer scale data collection (e.g. threatened ecological communities, grasslands in urban areas, riparian vegetation). This mapping has not been compiled into Stage I of the National Vegetation Information System.

Irrigated citrus, Griffith, New South Wales

Site survey

A large amount of information about the vegetation at a site is collected and analysed to develop a vegetation map for an area. Surveyed sites underpin high quality vegetation mapping.

- Data collection and analysis is a fundamental input to high quality and repeatable mapping and monitoring of vegetation types.
- Adoption of the draft site survey collection guidelines (Environment Australia 1999) to complement vegetation attributes will ensure that site information can be linked to vegetation mapping.

Links to land use/catchment/landscape issues

- Will provide integrated inventories of cover and (in context of soils) microclimate and topography.
- Information and knowledge of relationships between native vegetation cover and other land cover types in the landscape is required to assess status of native vegetation. This is particularly important in many rural and urban landscapes where remnant and fragmented vegetation is dominant.

Spatial gaps

Spatial gaps are defined in terms of the geographic coverage and scale of the mapping compiled in Stage I of the National Vegetation Information System.

Geographic coverage

Areas where no vegetation data was available to be compiled into the National Vegetation Information System for the present coverage (Figure 41) include western and northern Queensland, north-east New South Wales, small areas in Victoria, northern and western coastal regions of Tasmania, southern Australian Capital Territory and northern South Australia. For the pre-European coverage (Figure 42), no National Vegetation Information System data was compiled in central Queensland and the Wet Tropics, most of New South Wales and the north-western corner of Victoria.

These areas have further been divided between those areas where there is:

- genuinely no vegetation mapping available; and
- work in progress by the States and Territories, including data sets that have yet to be compiled into National Vegetation Information System.

Humpty Doo, Northern Territory

Areas where no vegetation mapping is available in the present coverage occur over most of central South Australia, north-western Victoria, in the area immediately to the north of Melbourne, a small area in central New South Wales, the area to the south of the Gulf of Carpentaria, central western Queensland, and southern Australian Capital Territory. In the pre-European coverage areas where no vegetation mapping is becoming available occur in the north-west of Victoria and areas of the Gulf in north-west Queensland. Small areas of no data also occur in central east Queensland and in the vicinity of Melbourne. Mapping at 1:50 000 is available in some areas of South Australia.

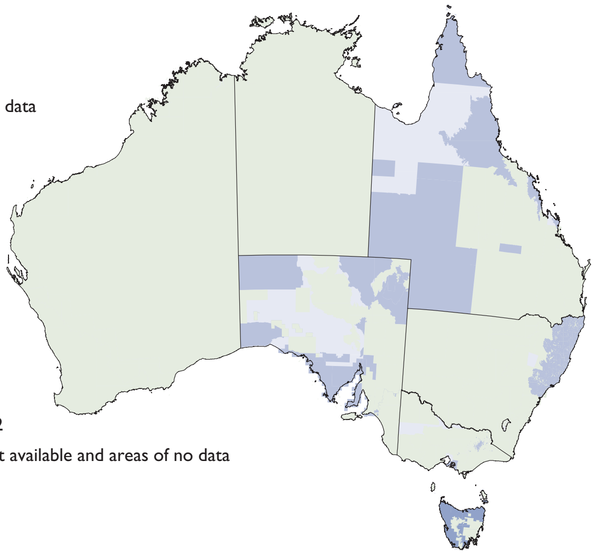
Many areas have vegetation data sets that were not included in the National Vegetation Information System either because they could not easily be translated and compiled in the available time or they were incomplete. In the present coverage these include most of northern and western Tasmania, south-western Queensland, Einasleigh Uplands and Cape York bioregions of Queensland, coastal areas in the vicinity of Rockhampton, north-east New South Wales and large patches of South Australia. In the pre-European coverage, areas of work in progress include all of the Einasleigh Uplands and Central Mackay Coast bioregions and areas of the Mitchell Grass Downs bioregion in Queensland and most of New South Wales.

Figure 41. National Vegetation Information System coverage: present vegetation.

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



Data compiled in NVIS Stage 1

No data compiled in NVIS Stage 1

Work in progress to be included in NVIS Stage 2

Work in progress where data set boundaries not available and areas of no data

No vegetation data identified

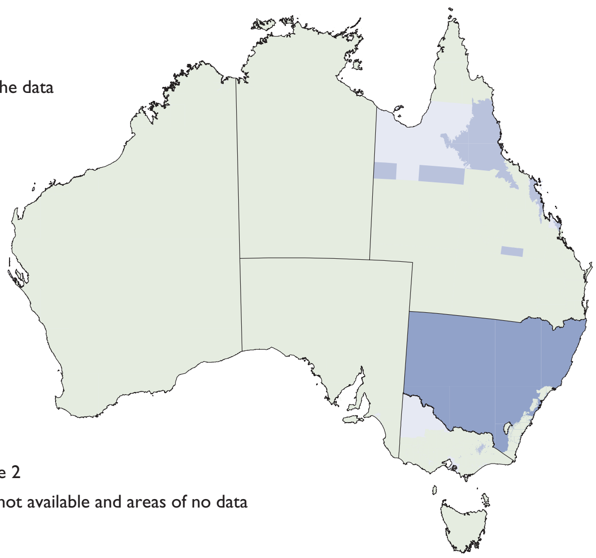
These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure 42. National Vegetation Information System data coverage: pre-European vegetation.

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



Data compiled in NVIS Stage 1

No data compiled in NVIS Stage 1

Work in progress to be included in NVIS Stage 2

Work in progress where data set boundaries not available and areas of no data

No vegetation data identified

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Scale

The nominal thresholds specified for the scale of the vegetation data (Table 45, Figure 4) differed in levels of detail for the intensive land use zone and extensive land use zone (Graetz et al. 1995). These thresholds define the scale of the data sets generally required by stakeholders for regional planning and management. Greater detail was required in the intensive land use zone, as it is the area in which human impacts and land use change are greatest and a majority of the decisions relating to natural resource and environment management applies. To meet this requirement finer scale survey and mapping work is required.

Table 45. Nominal scale thresholds required for native vegetation data sets.

Geography	Present	Pre-European
Intensive land use zone	1:100 000	1:1 000 000
Extensive land use zone	1:250 000	1:1 000 000

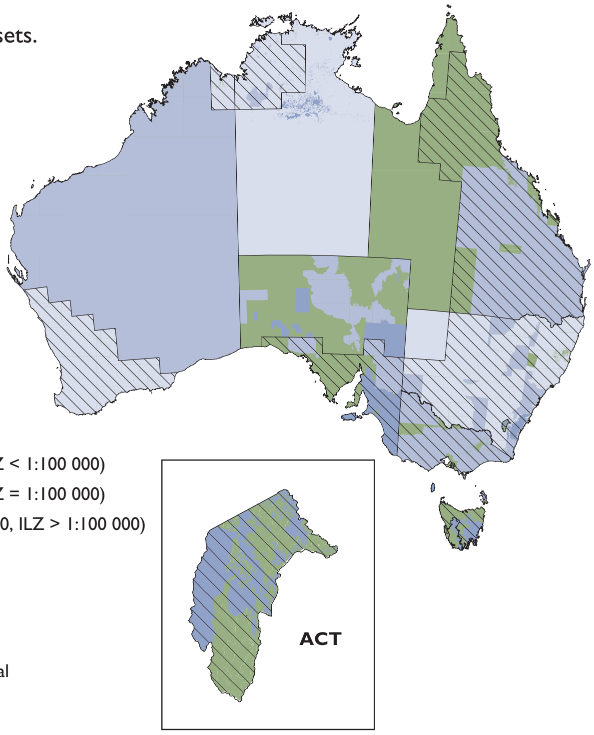
Gaps were assessed in terms of the scale of mapping compiled within the National Vegetation Information System data set compared with the scale threshold and included the following conditions:

- where publication scale for a data set was coarser than the threshold (e.g. where the only vegetation data for an area in the intensive land use zone is at 1:250 000 scale this is coarser than the threshold of 1:100 000 scale); and/or
- where no vegetation mapping was available at the requisite scales.

The present vegetation coverage shows that gaps in scale in the intensive land use zone occur where vegetation mapping is coarser than 1:100 000 scale (Figure 43). These occur in the south-west and north-west of Western Australia, the north-west of the Top End of the Northern Territory and most of New South Wales. Gaps in scale in the extensive land use zone occur over most of the Northern Territory and the north-west of New South Wales. In both these cases the vegetation mapping available is 1:1 000 000 scale.

Figure 44 shows the pre-European vegetation coverage relative to the intensive land use zone and extensive land use zone. The pre-clearing coverage in South Australia does not meet the 1:1 000 000 scale threshold.

Figure 43. Scale gaps: present vegetation data sets.



Source:

Graetz et al. 1995.

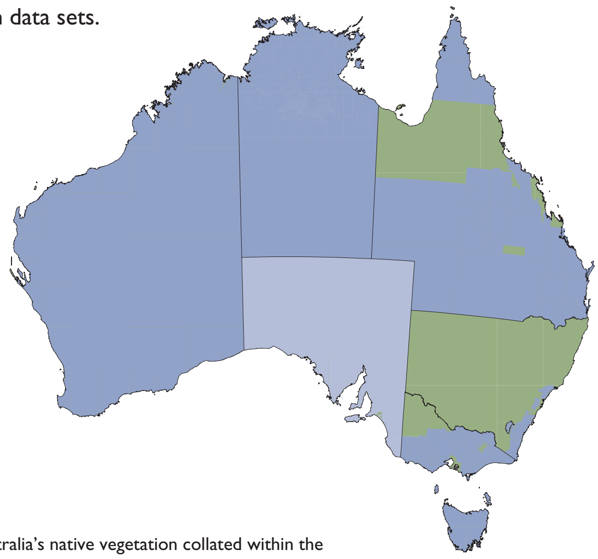
National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

- Extensive land use zone (ELZ)
- Intensive land use zone (ILZ)
- No gap: meets required scale (ELZ < 1:250 000, ILZ < 1:100 000)
- No gap: meets required scale (ELZ = 1:250 000, ILZ = 1:100 000)
- Gap: does not meet required scale (ELZ > 1:250 000, ILZ > 1:100 000)
- No data compiled in NVIS Stage1

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure 44. Scale gaps: pre-European vegetation data sets.



- No gap: meets required scale
- Gap: does not meet required scale
- No data compiled in NVIS Stage1

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Yellow Waters, Cooinda, Kakadu National Park, Northern Territory

Currency of vegetation attribute and spatial data

Gaps in the currency of the data were assessed for the present vegetation coverage. The year 1997 was specified as the nominal threshold against which to assess the currency of each vegetation data set and applies equally to attribute and spatial features of the data sets.

Currency of attribute and spatial data was assessed separately as these can be mapped and updated separately and thus are important in understanding data limitations.

Analysis of gaps in data currency assists in identifying those areas of Australia where the data may be inadequate to support up-to-date regional planning and management. The information should be further interpreted based on the application required (e.g. in areas of rapid change more recent data is required and in areas of little change data older than 1997 is acceptable).

Gaps include the following conditions:

- where field survey work for a data set was completed at least 30 years prior to 1997;
- where a spatial data set was completed at least 30 years prior to 1997; and
- where no vegetation mapping was available.

Currency of vegetation attributes

- Major gaps in the currency of the vegetation attributes relative to 1997 occur throughout Western Australia and in one data set in western South Australia reflecting data where at least some of the attributes were collected in the 1960s. Moderate gaps occur in the south-east of South Australia and the pastoral zone of South Australia, in southern central Queensland and a small area in central Australian Capital Territory. This gap is related to those data sets where at least some of the attributes were collected up to 20 years prior to 1997.
- Minor gaps occur across the Northern Territory, central and eastern South Australia, the majority of New South Wales and the Australian Capital Territory, and the north-west and East Gippsland regions of Victoria.

Currency of spatial boundaries

- Major gaps in the currency of the spatial boundaries relative to 1997 occur in a small area of western South Australia, the pastoral areas of Western Australia and western Australian Capital Territory. These gaps relate to at least some of the line work of these data sets being mapped up to 30 years prior to 1997.
- Moderate gaps occur in the intensive land use zone of Western Australia, most of the Northern Territory and large areas in central and north-eastern South Australia. These gaps relate to at least some of the line work of these data sets being mapped up to 20 years prior to 1997.
- Minor gaps occur in central and south-east South Australia, central and south-east Queensland, most of New South Wales with the exception of the eastern seaboard and adjacent slopes of the Great Dividing Range, the eastern half of the Australian Capital Territory, and north-west and Gippsland regions of Victoria.

Vegetation classification

National Vegetation Information System information hierarchy

Six levels of vegetation classification were defined within the National Vegetation Information System information hierarchy (NLWRA 2000a). Level V was specified as the target for compiling native vegetation data into the National Vegetation Information System.

A visual appraisal was conducted of the native vegetation descriptions within the map units of each data set, comparing the Level V descriptions with the requirement for meeting a Level V description. Each data set was allocated one of eight classes of gap where:

- major gaps refer to either no data provided or no useful data being included at Level V; and
- moderate and minor gaps refer to differing degrees of information that is missing relative to the required standard for Level V.

This information is provided as a guide variation occurs in the gaps assigned within a data set. Table 46 shows the type of gap in the level of vegetation detail available relative to the Level V requirements and the relative number of vegetation data sets in each of the gap classes. Table 47 lists the number of data sets and the level of the hierarchy to which they were assigned in the National Vegetation Information System.

The majority of data sets compiled (66%) have minor or no gaps at level V. Of concern is the 20% of data with moderate to major and major gaps. These data would require further mapping or possibly further effort by custodians to compile information to Level V. Sixty-one percent of present vegetation data and 68% of pre-European data have been mapped to Level V and VI.

Table 46. Type and extent of gaps found in the National Vegetation Information System Level V classification.

Type of gap	Total number of data sets
Major gap	7
Moderate to major gap	13
Minor to moderate gap	15
Minor gap	2
Nil gap	67

Table 47. Number of data sets and level of vegetation classification compiled into the National Vegetation Information System.

Number of data sets compliant to Levels	Present	Pre-European
I – II	0	1
I – III	19	8
I – IV	6	3
I – V	10	8
I – VI	31	17

Major classification gaps in the present vegetation data (Figure 45) occur in Western Australia and over most of eastern New South Wales. Moderate gaps occur over western New South Wales and scattered throughout the Australian Capital Territory. Minor gaps occur in Tasmania. No gaps are found in Northern Territory, Queensland, South Australia, Victoria and small areas of the Australian Capital Territory.

Major classification gaps in the pre-European vegetation data (Figure 46) occur in Western Australia and South Australia. Moderate to major gaps occur in the central and south eastern forests data sets in New South Wales. Minor gaps occur in Tasmania. No gaps are found in Northern Territory, Queensland and Victoria.

Consistency in the vegetation classification

Within jurisdictions

Throughout the process of data compilation, checking and validation, the data in the National Vegetation Information System were continually improved.

- A low degree of classification consistency was observed between data sets in the classification of Levels I–III in New South Wales, the Australian Capital Territory and Western Australia.
- A moderate to high degree of classification consistency between data sets for Levels I–III was observed in Tasmania.
- The highest degree of consistency between data sets for Levels I–III were observed in those States and Territories that began the process of developing uniform/unique vegetation descriptions for all their data sets either prior to or during the National Vegetation Information System Stage I project. These include Queensland, Victoria, South Australia and the Northern Territory.

Between jurisdictions

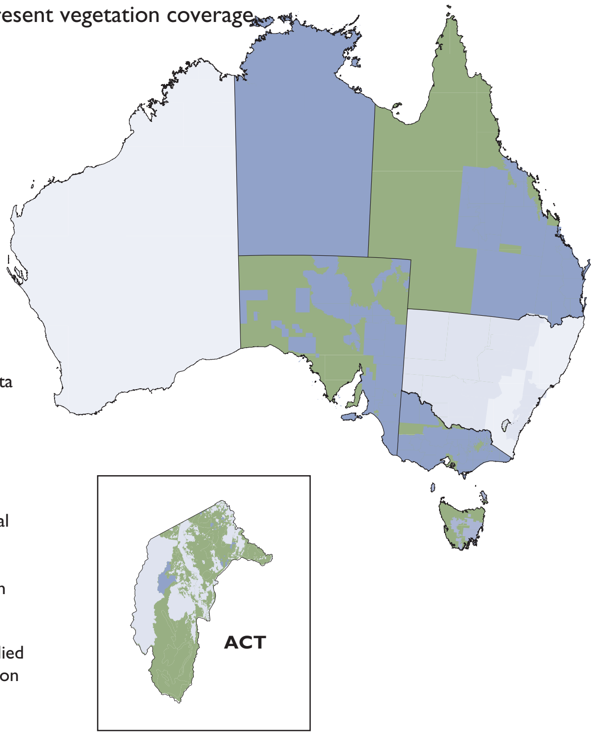
Major classification inconsistencies were observed along the Western Australia and Northern Territory border. Some of these problems appear to be related to differences in assigning a consistent definition of dominance to the upper stratum where Western Australia assigned dominance using the Beard and Webb (1974) method while the Northern Territory assigned dominance using the Walker and Hopkins (1990) method.

At regional to national scales, other less obvious edge matching problems were observed between all jurisdictions.

Resolution of these issues should be achieved if the relevant States and Territories and the Commonwealth agree on a set of rules within

Figure 45. Gaps in the National Vegetation Information System information hierarchy relative to National Vegetation Information System Level V in the present vegetation coverage.

- No gap
- Minor gap
- Moderate gap
- Major gap
- No data compiled in NVIS Stage 1



Source:

National Land and Water Resources Audit 2001.

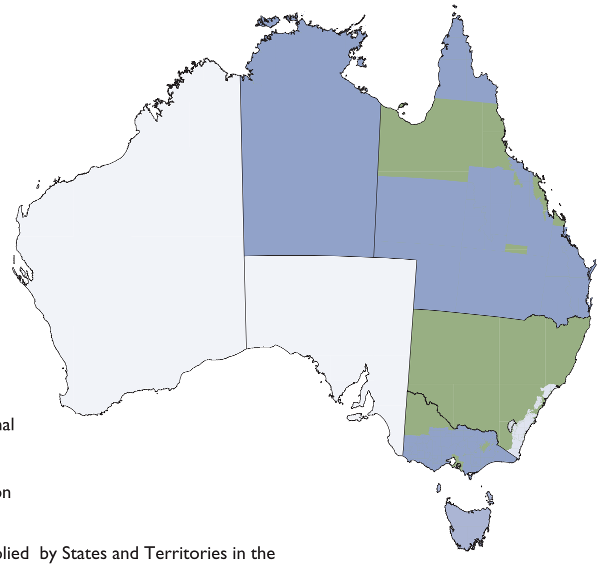
Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Note that hierarchy levels are derived from information supplied by States and Territories in the National Vegetation Information System compiler plus a visual interpretation of all data sets.

Figure 46. Gaps in the National Vegetation Information System information hierarchy relative to National Vegetation Information System Level V in the pre-European vegetation coverage.

- No gap
- Minor gap
- Moderate gap
- Major gap
- No data compiled in NVIS Stage 1



Source:

National Land and Water Resources Audit 2001.

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These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Note that hierarchy levels are derived from information supplied by States and Territories in the National Vegetation Information System compiler plus a visual interpretation of all data sets.

the National Vegetation Information System framework to achieve equivalency between the attributes used in the data that meet at borders.

Some of these issues relate to scale and detail of the mapping available, and hence cannot be resolved by seeking equivalency of attributes. The inconsistencies in some instances can only be resolved by additional information and in some cases new survey data will need to be collected. In other instances adjustments will need to be made to the line work of some data sets.

Reliability of survey and mapping methods

The reliability of survey and mapping methods assists users in determining the applications for which a data set may be used (Figure 47).

Data sets with the lowest reliability (major gaps) included those developed using a combination of minimum and/or limited and/or full site-based surveys. In the present coverage, these occur over most of New South Wales, eastern Australian Capital Territory, and south-east and central Tasmania.

Data sets with moderate reliability (moderate gaps) included those that were developed using a combination of minimum and/or limited and/or full site-based surveys combined with aerial photos and satellite imagery or aerial photos as the interpolation/extrapolation base for mapping. In the present coverage these occur throughout the Northern Territory, patches of New South Wales and a small area in central western South Australia.

Moderate to high reliability (minor gaps) include those data sets that used a combination of limited site-based field survey combined with aerial photos and satellite imagery, or aerial photos as the interpolation/extrapolation base for mapping. In the present coverage these occur scattered through south-east, central and northern South Australia, the central coast of New South Wales, and central and south-eastern Queensland.

Highest reliability (no gaps) included those data sets that used aerial photos or a combination of aerial photos and satellite imagery as the interpolation/extrapolation base for mapping in combination with full site-based surveys. In the present coverage these occur scattered across the Top End of the Northern Territory, scattered patches in central and southern South Australia, two areas in central and south-eastern New South Wales and all data set in Victoria.

Figure 47. Present National Vegetation Information System vegetation mapping methods.

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

In the pre-European vegetation coverage areas of least reliability (major gaps) occur throughout South Australia and Tasmania. Areas of moderate reliability (moderate gaps) occur throughout the Northern Territory. Areas of highest reliability (no gaps) occur in Queensland and Victoria, in south-eastern New South Wales and numerous data sets that are scattered in northern Northern Territory.

Summary of gaps in classification level and scale

Present vegetation

Data sets were ranked relative to the National Vegetation Information System threshold for classification detail (i.e. National Vegetation Information System level V) and scale of mapping of the intensive land use zone (i.e. 1:100 000 scale) and extensive land use zone (i.e. 1:250 000 scale).

In the intensive land use zone (Figure 48):

- Queensland, Victoria and South Australia were ranked above the National Vegetation Information System threshold.
- Small areas in the Northern Territory and Australian Capital Territory were ranked as either equal to or better than the National Vegetation Information System threshold for classification detail and scale of mapping.
- Five of the eight State and Territories (Australian Capital Territory, New South Wales, Northern Territory, Tasmania and Western Australia) had either most or all of their data sets ranked below the National Vegetation Information System benchmark.

In the extensive land use zone (Figure 49):

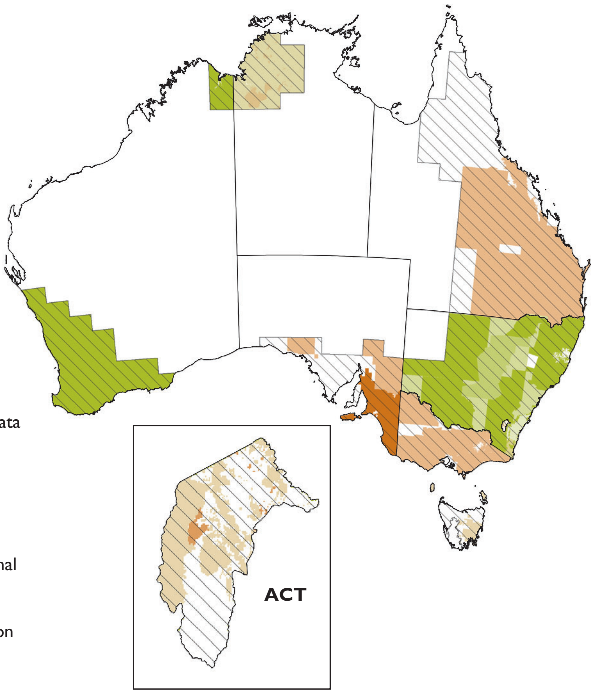
- Data sets in the Top End of the Northern Territory were ranked as better than the National Vegetation Information System threshold for classification detail and scale of mapping.
- Four of the six States and Territories (New South Wales, Northern Territory, Tasmania and Western Australia) had either most or all of their present datasets ranked below the National Vegetation Information System benchmark.

Figure 48. Present classes in the intensive land use zone ranked by classification detail and scale relative to the National Vegetation Information System benchmark.

Ranking schema

Scale	Best NVIS level III	IV	V	VI
< 1:100 000	6	5	2	1
1:100 000	8	7	4	3
> 1:100 000	12	11	10	9

Ranking ranges from 1 (above the benchmark) through to 12 (below the benchmark). A score of 4 equals the NVIS benchmark.



Source:

Graetz et al. 1995.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

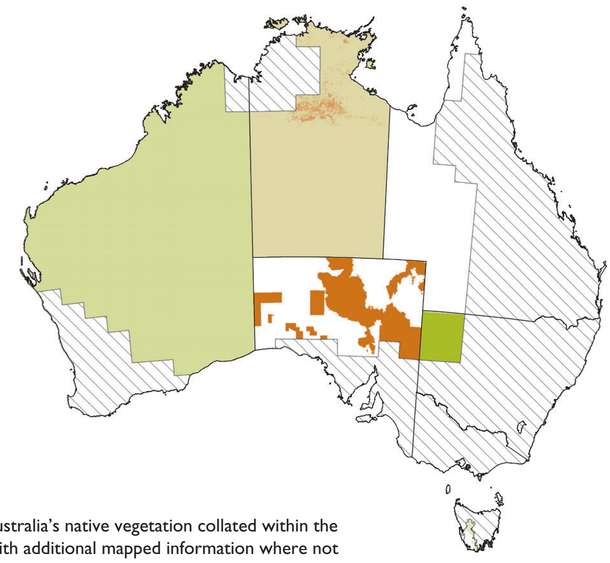
These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure 49. Present classes in the extensive land use zone ranked by classification detail and scale relative to the National Vegetation Information System benchmark.

Ranking schema

Scale	Best NVIS level III	IV	V	VI
< 1:100 000	6	5	2	1
1:100 000	8	7	4	3
> 1:100 000	12	11	10	9

Ranking ranges from 1 (above the benchmark) through to 12 (below the benchmark). A score of 4 equals the NVIS benchmark.



Source:

Graetz et al. 1995.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Pre-European vegetation

Data sets were ranked relative to the National Vegetation Information System threshold for classification detail (i.e. Level V) and scale of mapping the intensive land use zone and extensive land use zone (i.e. 1:1 000 000 scale).

Gaps in the pre-European vegetation (Figure 50):

- Queensland and Victoria were ranked above the National Vegetation Information System threshold.
- Small areas in the Northern Territory were ranked as either equal to or better than the National Vegetation Information System threshold for classification detail and scale of mapping.
- Four of the eight State and Territories (Australian Capital Territory, New South Wales, Northern Territory, Tasmania and Western Australia) had either most or all of their present data sets ranked below the National Vegetation Information System benchmark.
- South Australia was not ranked because the pre-European coverage was compliant with only Level II.

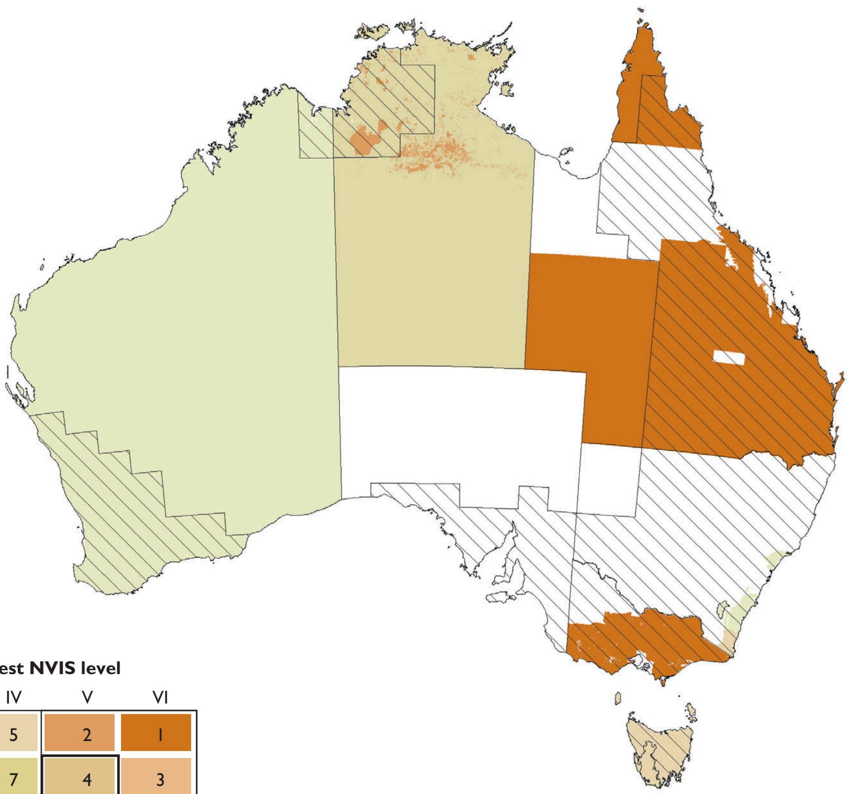
Summary of gaps in the currency of attributes and spatial boundaries

The nominal threshold of 1997 has not been met by most data sets for attributes or spatial boundaries. A comparison between the vegetation attributes and the spatial boundaries shows varying degrees of currency.

The least current vegetation data sets (i.e. major gap—thirty-year old data) are found in the extensive land use zone of the present coverage of Western Australia and a small area of central western South Australia. Moderate (twenty-year old data) to minor (ten-year old data) gaps were observed over much of South Australia and Northern Territory and small areas of Queensland.

This becomes an issue where the native vegetation of a region is known to be undergoing significant change and/or degradation (e.g. through thinning and/or clearing).

Figure 50. Pre-European data ranked by classification detail and scale relative to the National Vegetation Information System benchmark.



Scale	**Best NVIS level** III	IV	V	VI
< 1:100 000	6	5	2	1
1:100 000	8	7	4	3
> 1:100 000	12	11	10	9

Ranking ranges from 1 (above the benchmark) through to 12 (below the benchmark). A score of 4 equals the NVIS benchmark.

Source:

Graetz et al. 1995.

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the National Vegetation Information System. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

WAYS FORWARD

Blowhole Valley, Tasmania

Managing Australia's native vegetation and natural resources and providing the information to underpin this management

Australian Native Vegetation Assessment 2001, in collaboration with Commonwealth, State and Territory agencies, has collated, from wide ranging and disparate data sets the best available information on native vegetation and compared current and estimated extent of native vegetation prior to European settlement.

It is underpinned by a standardised, Australia-wide framework developed for collating and reporting vegetation type and extent. This is, in itself, a major achievement, providing both a benchmark and an information system that will facilitate regular updates of information and assessment of change and trends in the extent of native vegetation.

Applications of the information system and the assessment will inform governments and the community about the role of native vegetation in natural resource management and biodiversity planning and have the capacity to contribute directly to initiatives such as:

- international, national, State and Territory, and regional reporting obligations (e.g. nature conservation, desertification, greenhouse and State of Environment reporting);
- vegetation-specific reporting requirements such as that required under the Australia and New Zealand Environment Conservation Council National Framework for the Management and Monitoring of Australia's Native Vegetation and State of the Environment reporting;
- the regional planning process under the National Action Plan for Salinity and Water Quality and Natural Heritage Trust;
- developing nature conservation priorities and programs, with extent of native vegetation being the best available measure of terrestrial biodiversity and habitat; and
- benchmarking, collating data and interpreting it as the basis for monitoring and reporting change in theextent of native vegetation.

Most importantly natural resource managers at a range of levels will have access to contiguous and up to date information on Australia's native vegetation. This is essential for a range of activities including:

- developing natural resources plans and strategies across the landscape;
- setting priorities for revegetation; and
- assessing impacts of proposed clearing and other land use development activities.

VEGETATION MANAGEMENT IN AUSTRALIA

Native vegetation management in Australia

A report containing information on the major Government natural resource management institutions, programs and legislation affecting the use of native vegetation in each of the Commonwealth, States and Territories jurisdictions was developed as part of the National Framework for the Management and Monitoring of Australia's Native Vegetation (1999). The report can be used as a reference tool for more detailed investigation into vegetation management in Australia and links are provided to related internet on-line information and contacts.

This report is available at www.ea.gov.au

Compendium of vegetation management in Australia—a summary of national level vegetation related initiatives

A more detailed report on national strategies has been published, a Compendium of Vegetation Management in Australia including national strategies, guidelines and initiatives that have an impact on vegetation management and monitoring and covers reporting mechanisms and international obligations in relation to native and exotic vegetation management. In addition, there are a number of strategies and principles dealing with sustainability issues that affect vegetation management.

This report is available at www.affa.gov.au

Determining the effectiveness of vegetation management programs measures and methodologies—literature review

A literature review surveyed current knowledge of the biological, physical and socio-economic processes occurring in many land, water, conservation and agricultural improvement projects so that useful indicators linking actions to final outcomes could be identified more easily. The review includes research on salinity, soil conservation, water quality, biodiversity, wood production, crop yields, infrastructure damage and carbon sequestration. It also encompasses the success or otherwise of programs directed at changing people's behaviour in relation to conservation programs and suggests areas in need of further research.

The report was initiated as part of a consultancy concerned with measures and methodologies to determine the effectiveness of vegetation management programs and was funded by Bushcare and the Rural Industries Research and Development Corporation Joint Venture Agroforestry Program.

This report is available at www.rirdc.gov.au

National Vegetation Information System: supporting natural resource management

The National Vegetation Information System, by compiling data and making available information on Australia's native vegetation provides key information to support a range of natural resource management decisions and activities and a basis for native vegetation management. Some opportunities include:

- Developing an understanding of the significance of woody and herbaceous perennials in managing nutrient and sediment movement, and catchment hydrology (using National Vegetation Information System in conjunction with land use mapping data).
- Developing an understanding of the role of existing native vegetation in maintaining water balance in groundwater flow systems—essential if we are to develop integrated salinity control strategies that take the water use characteristics of the various vegetation covers, crops and soil types in a groundwater flow system into account. Intersection of the native vegetation data set with the Audit's land use, groundwater flow systems and soil property data sets provides much of the information required for this analysis—certainly within the margin of error of our understanding of salinity processes. More precise analysis would require spatial information on land use practice which is not available at this time.
- Developing an understanding of the opportunities for multi-objective landscape repair, using broadscale re-establishment of native vegetation to improve water balance and nature conservation. Using the above data in conjunction with pre-European modeled vegetation cover to estimate water use characteristics of re-vegetated landscapes and define types of vegetation required to replicate natural cover.
- Developing an integrated and catchment-based approach to management of forest resources (using National Forest Inventory data in conjunction with National Vegetation Information System and a common attribute framework).
- Developing improved understanding on the role of vegetation in landscape function, to assist natural resource and biodiversity planning and management.
- Refining the National Carbon Accounting System (using spatial coverage of native vegetation in conjunction with the Australian Greenhouse Office Landsat imagery and various allometric equations for differing vegetation types to calculate woody biomass).

There will be a range of other applications of the National Vegetation Information System at scales from Australia-wide to regional. Many of these applications are yet to be defined. Now the information set and the data that underpins it are readily available, it is expected that researchers and resource managers will develop and promote a suite of additional applications.

Native Vegetation Information: continuing to build the information base

Any information set is only useful if it is maintained and enhanced to keep pace with information technology developments and meet changing needs. Given the wide-ranging applications for up to date information on vegetation it is imperative that the National Vegetation Information System continues to be enhanced and improved.

The Audit and its Commonwealth, State and Territory government partners recognise that benefits for the National Vegetation Information System guidelines will be maximised by taking Australia-wide and comparable approaches to the collection, management and application of vegetation data. Significant resources have been provided to assist this process and the Commonwealth, States and Territories are working towards a collaborative model for future development. The long-term ideal is a distributed system where data and information resides within States and Territories as well as the Commonwealth.

Improvement requires activities on:

1. **Australia-wide coordination** providing institutional and collaborative arrangements for sharing methods, developing and managing initiatives and making progress on guidelines and data management activities—Environment Australia has agreed to take on this role.
2. **Partnerships** allowing a continued Australia-wide approach underpinned by a distributed information system—all States and Territories have agreed to continue progressing in partnership with Commonwealth agencies towards this goal.
3. **Data management** needs planned and secure funding for data management activities, so that data collections are routinely updated, data quality is improved and data access is enhanced—this requires action on all fronts from all partners to the initiative.
4. **Information delivery** needs to be timely and relevant to support management decisions—continued attention by all partners is essential so that client information needs are met.
5. **Strategic investment**—collecting data on key gaps and to meet vegetation and broader natural resource management priorities, as identified by users of the information products—requires action on all fronts from all partners to the initiative.
6. **Stocktake and evaluation**—evaluating progress, incorporating new methods of vegetation mapping and data analysis, undertaking future assessments at a maximum of five-yearly intervals based on the National Vegetation Information System 2000 baseline and ensuring relevance to broader natural resource management activities.

Rumex vesicarius, Flinders Ranges, South Australia

Australia wide coordination

Environment Australia and Agriculture, Fisheries and Forestry – Australia are establishing a national approach to coordination of vegetation information. Environment Australia has taken on the role of coordinator of the National Vegetation Information System Stage I and its products. This coordination role will include working closely with vegetation data custodians in the States and Territories and across the Commonwealth to build on the work undertaken through the Audit. It will also include development of an operational plan to improve the functionality and benefits to the custodians of the National Vegetation Information System and undertake obligations specified under the Australian Spatial Data Infrastructure for a national sponsor. The Audit is undertaking a hand-over of the Australian Native Vegetation Assessment 2001 to Environment Australia.

Meeting the objectives of continued Australia-wide native vegetation information management will require the following issues to be addressed:

- continued data sharing and data **access** across agencies at all levels of government and community, and building access to additional data sets such as the National Forest Inventory;
- review and scheduled **updating** of the National Vegetation Information System to ensure client-relevant products are delivered in a timely manner;
- **data and information management**—including attention to metadata, standards, definitions for vegetation groups and classes such as remnant vegetation—incorporating data reliability information and data archiving;

Australian Spatial Data Infrastructure

The Australian Spatial Data Infrastructure is a national initiative led by the Australian and New Zealand Land Information Council to provide improved access to spatial data and information. The Australian Spatial Data Infrastructure aims to ensure that data users will be able to acquire consistent data sets to meet their requirements, even though the data might be collected and maintained by different authorities. The identification of a national coordinator and data custodians who rigorously manage their data holdings are primary requirements for any fundamental data set to be accredited as being Australian Spatial Data Infrastructure compliant.

Implementation of the Australian Spatial Data Infrastructure requires a solid infrastructure based on policy and administrative arrangements, technical standards and a way to make spatial data accessible to the community. The long-term aim of the Australian Spatial Data Infrastructure is to set up a distributed network of databases, managed by individual government and industry custodians.

The National Vegetation Information System provides the basis for the Australian Spatial Data Infrastructure vision of a fully distributed data system across Australia to be developed. This system has key advantages in that custodians in States and Territories maintain, update and make available their data holdings in a seamless, Australia-wide and consistent manner.

The National Vegetation Information System provides the necessary framework. Commitment from all partners is needed to put quality data management structures in place so that the system can become a reality and information products based on the National Vegetation Information System are rapidly delivered and made accessible to the community.

- **data coordination** to monitor and review vegetation data management activities and ensure that data sets are time-stamped and electronically posted by States and Territories in a timely manner and in accordance with the Australian Spatial Data Infrastructure distributed data model;
- **collaboration** with a broad spectrum of clients to provide native vegetation information products (including the derivation of new products to support activities such as catchment management, salinity control or landscape and biodiversity planning);
- **facilitation** of technical training and skills development for native vegetation data collection practitioners; and
- **advocacy** that scopes and promotes initiatives to build on the National Vegetation Information System and delivers through continuing investment funded from the Natural Heritage Trust.

Partnerships

The fostering of close partnerships between States, Territories, the Commonwealth and other stakeholders in vegetation information will be a critical factor for the success of the National Vegetation Information System. The development and coordination of native vegetation information activities across agencies and jurisdictions requires high level guidance by a national collaborative committee on vegetation information matters.

The Commonwealth, States and Territories are currently convening such a committee, to be known as the Executive Steering Committee for Australian Vegetation Information, which will act as a collaborative, national forum for vegetation information. The development of this committee will provide the basis for collaborative and inclusive arrangements for both vegetation data providers and users. It will also provide the basis for an ongoing partnership in the delivery of information required for natural resource decision making.

As key contributors in collecting and providing vegetation information, States and Territories have key roles in vegetation information and data management. State and Territory activities may include:

- **Coordination—**programs are funded in such a way that all participating groups are aware of the data needs and competing priorities.
- **Innovation** that contributes to the refinement and review of the vegetation framework and guidelines.

- **Guidelines** that work across all agency data custodians within a jurisdiction to adopt and include National Vegetation Information System guidelines for all new vegetation mapping and collation activities. In some cases this will be in addition to the State system, while in others there will be a migration to the National Vegetation Information System as the core operating system for that jurisdiction.
- **Information technology** that improves data base systems so that a distributed system can operate Australia wide. This will ensure vegetation information is readily updated and easily transferred to or stored within the National Vegetation Information System database and made readily available at minimum cost to a range of clients within and outside the particular State or Territory.
- **Training and development** that supports improvement of expertise in vegetation mapping and vegetation management.
- **Supporting regional activities** and recognising that regional and State and Territory agencies have a need for more substantial levels of information both in terms of detail and spatial accuracy and such data sets will encompass local variations to deal with historical biases or uses of the data. Using regionally collected data and the National Vegetation Information System may improve services for regional community groups and natural resource management planning.
- **Updating coverage** so that arrangements are in place for regular updating of native vegetation extent data. New data sets such as the Australian Greenhouse Office Landsat coverage and State and Territory clearing registers will expedite and ensure efficiencies in these activities. Regular updating on the Australian Natural Resources Atlas will follow data updates and be facilitated through the national coordinator.

Development of native vegetation activities will be a key to vegetation information activities being undertaken across agencies. It will be overseen by a national collaborative committee on vegetation information matters—the Executive Steering Committee for Australian Vegetation Information—that will act as a collaborative, national forum for vegetation information.

Development of this committee will provide the basis for collaborative and inclusive arrangements for both vegetation data providers and users. It will also provide the basis for an ongoing partnership in the delivery of information required for natural resource decision making.

STATE AND TERRITORY VEGETATION MAPPING INITIATIVES

In the last decade there has been a groundswell of improving data collection programs and improvements in land management programs across Australia. Some of the vegetation mapping initiatives are highlighted.

New South Wales. Instituted a major native vegetation mapping program and a series of other programs to try to develop a better understanding of what is happening to native vegetation. The vegetation mapping program is being implemented across a number of regions using a standard set of guidelines for the collection and mapping of vegetation. The *Native Vegetation Conservation Act 1997* (NSW) is the result of the New South Wales Government's native vegetation reform program.

South Australia. A program of systematic surveys across the State was developed and implemented in 1971 to provide a baseline inventory of the State's flora and fauna. The program is known as the Biological Survey of South Australia, overseen by the Biological Survey Coordinating Committee, an interdepartmental State government committee.

It is estimated that at the current rate it will take more than another decade to complete surveying and mapping the vegetation for South Australia. The work is dependent on the availability of resources. Currently the vegetation survey component for the intensive zone is near complete, however, the mapping component is incomplete for large areas. No program exists to complete the work for the intensive zone. In the extensive zone, survey and mapping of the Sandy Deserts, Gawler Ranges and Nullarbor are programmed for the next five years with other areas yet to be prioritised.

In conjunction with the biological survey and vegetation mapping program, a complementary program exists to map pre-European vegetation in the intensive zone. In the next three years the south-eastern region (from the South East to Murray Mallee and Midnorth) will be complete, while the northern Mid North, Eyre and Yorke Peninsula is not programmed.

Australian Capital Territory. Future vegetation mapping and data management effort will be focused on five areas of need. It will include:

- identification of data sets that as yet have not been incorporated into the National Vegetation Information System;
- enhancement of existing vegetation data sets to address attribute and spatial deficiencies—more detailed information on the lower strata of grassy woodlands and coverage of currently unmapped areas is a priority;
- mapping of vegetation types not already addressed, including exotic vegetation and secondary grasslands;
- development of vegetation survey standards to define methodology and attributes that need to be routinely recorded, including those additional to National Vegetation Information System requirements (e.g. fire fuel loads);
- development of a vegetation database to provide a coordinated and accessible information management system; and
- development of vegetation information products that are at a scale and contain the information detail needed for local natural resource planning, management and reporting.

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Summary
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Distributed data and information systems—a key part of continued cooperative action

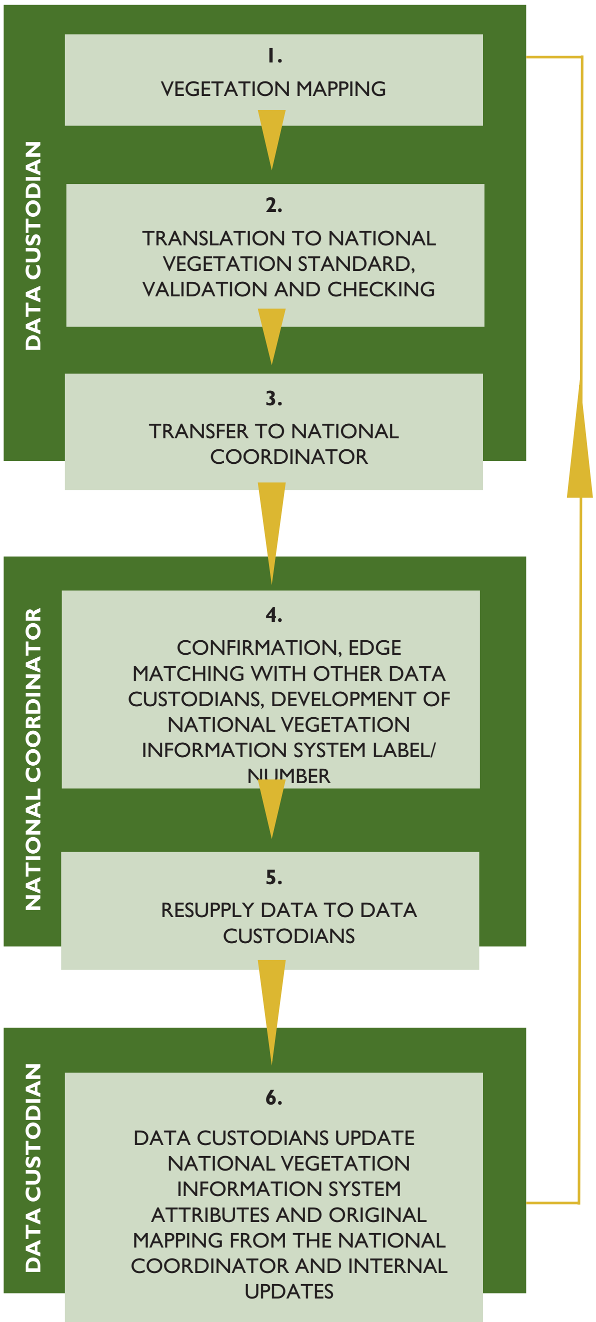
Information products derived from the National Vegetation Information System are available through the Australian Natural Resources Atlas. This provides consistent information about native vegetation in Australia at a variety of scales. While recognising the long-term benefits of a distributed system, the Audit has to date only collated existing information into a centralised database. This has facilitated validation and data checking against the guidelines and across data sets and administrative boundaries.

Centralised systems are difficult to maintain since data continue to be collected and updated by data custodians and it quickly becomes out of date. Further development of the National Vegetation Information System is being coordinated by Environment Australia and the Bureau of Rural Sciences and it is imperative that the States and Territories work closely with Commonwealth agencies to develop processes to ensure users have direct access to the most up to date data from custodians.

In a distributed system virtually all data quality control rests with the data custodians. The national coordinator's role will be to work across borders with groups of data custodians to ensure that descriptions and maps of the vegetation are consistent.

Figure 51 outlines the responsibilities of data custodians and the national coordinator. It demonstrates the need for quality assured updates from the data custodians and the progressive development of unique vegetation-type labels for each level in the information hierarchy across Australia. These labels will define an agreed list of vegetation types in Australia which can be allocated directly to new data entering the information system.

Figure 51. Responsibilities of data custodians and the national coordinator.



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Low open forest. *Eucalyptus pauciflora*, Brindabella Ranges, Australian Capital Territory

Success of this process is dependent on:

- an ongoing partnership between data custodians and the national coordinator;
- data custodians updating their original mapping using the National Vegetation Information System hierarchy; and
- development of a program of agreed public releases of national, State and Territory data and information products as continued updates on current Audit outputs.

Continued attention to information technology is essential, including:

- **Upgrading system architecture** in Environment Australia, the Bureau of Rural Sciences and all States and Territories, so that it keeps abreast of information technology improvements and maximises the utility and functionality of the information system.
- **Maintaining the software platform** by continued software development, especially for producing information products to meet client needs.
- **Supporting National Vegetation Information System sites** using a parallel information system in those States and Territories that have adopted the national Vegetation Information System architecture, and transfer protocols for agencies with non-National Vegetation Information System but National Vegetation Information System-compatible information system architecture.

Appendix 11 provides detail on the posssible stages in the development of a distributed system for Australia's vegetation information.

Information delivery—meeting client needs

Only a sample of information products produced from the National Vegetation Information System has been detailed in this report. To encourage further use and application, data and information will be readily accessible from the Australian Natural Resources Atlas and the Data Library. In time, through application of the distributed system approach, all data and information will also be available through State and Territory access systems.

As management of natural resources becomes more sophisticated and we gain a more encompassing understanding of natural resource processes, our need for information changes.

A key role for all partners is to ensure products derived from the National Vegetation Information System meet client needs and emerging policy requirements. Regular review of client needs and feedback mechanisms will be important to ensure that National Vegetation Information System remains relevant and responsive.

Strategic investment—identifying and addressing priority knowledge and information gaps

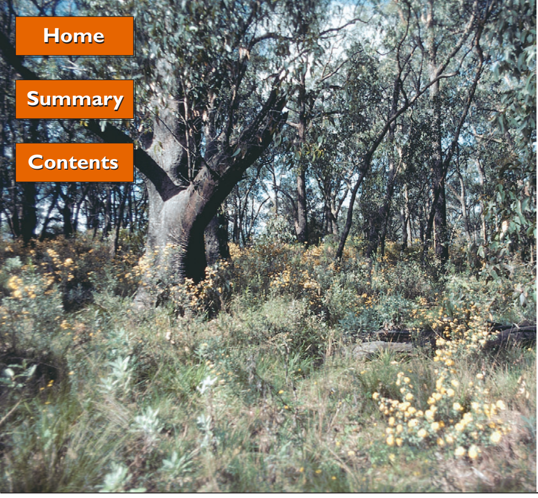
Australian Native Vegetation Resources Assessment 2001 has been designed and implemented in full recognition that many issues and information needs could not be covered within available timeframes and resources.

The work has focused on setting in place a vegetation data structure for Australia and compiling the best available data into this structure. No new mapping was undertaken and not all existing mapping could be compiled. Marine, estuarine and fine-scale riparian vegetation mapping and data for the External Territories were also excluded due to limited time and resources.

Substantial progress has been made in assessing and reporting on Australian forests and woodlands through initiatives including the Regional Forest Agreements and the National Forest Inventory. Much of the Regional Forest Agreement information has been incorporated into the National Vegetation Information System. Remaining information and other inputs into the National Forest Inventory will be incorporated and made available to the public.

Australia requires high quality data and information on native vegetation type and extent across a range of vegetation types. Priorities include:

- **defining native vegetation**, ecological dominance and modified native vegetation;
- mapping type and extent, describing and understanding use and management for **grasslands**;
- collating information, undertaking further mapping of type and extent and developing revegetation priorities for Australia's **riparian areas**;
- **mapping remnants** (particularly open woodlands and small mosaic wood lots such as areas of Crown lands and roads) not incorporated in existing native vegetation mapping because they are fragmented within an agricultural landscape. Management recommendations for Australia's remnant vegetation as part of off-reserve landscape management is an imperative and provides a framework on which revegetation initiatives can be established;
- complementing the terrestrial data compilation with **marine and estuarine vegetation** data; and
- mapping, assessing and reporting on **changes and trends in native vegetation** extent, structure and floristics; weed and feral animal invasion and other attributes of **condition** considered a priority in vegetation management.



Open forest (*Eucalyptus obliqua*) in Mount Lofty National Park, South Australia

Stocktake and evaluation—ensuring continued client relevance

Ongoing evaluation and periodic review of progress in native vegetation information is critical. Key issues to address at that time include:

- **Progress in data management:** assessing progress with the National Vegetation Information System, including all aspects of data upgrading, data management, standards, data distribution and access.
- **Utility of information:** assessing progress made over the five-year period in the updating of the National Vegetation Information System information products to meet client needs, especially at local, regional and catchment management scales.
- **Integration:** assessing progress and further opportunities for links between data sets such as land use, exotic vegetation, the National Forest Inventory and the National Vegetation Information System.
- **Extension:** determining the extent to which the National Vegetation Information System has been used for capacity building by local, regional and catchment management groups (e.g. compilations of an Australia-wide clearing register as an additional component of the National Vegetation Information System framework to display extent and type of vegetation cleared).
- **Compliance:** assessing the extent to which National Vegetation Information System standards and protocols have been applied to vegetation mapping and data storage and transfer Australia wide, and if not, to determining improvements needed.
- **Program impact:** assessing the application of the National Vegetation Information System to support decisions made in re-establishment and management of native vegetation.
- **Gap analysis:** undertake an inventory of knowledge and information gaps as input to the setting of research and information collection priorities.

GAP ANALYSIS

The Audit has identified a number of gaps in information and data coverage (see *Knowledge, data and information gaps* section):

- Thematic (information and knowledge) gaps including in grasslands, non-forested vegetation, definition of native and pre-European vegetation, riparian/riverine, wetlands, coastal and marine vegetation, native vegetation condition (changes in vegetation extent, structure and composition), weeds, environmental and landscape information, scale of capture in response to management requirements, site survey, links to land use/ catchment/landscape issues;
- Spatial (scale and geographic coverage) gaps;
- Currency (date) of mapping;
- Vegetation classification level gaps including in the National Vegetation Information System information hierarchy and consistency in the vegetation classification; and
- Reliability of survey and mapping methods.

Information on gaps provide a comprehensive overview of the status of knowledge of Australia's vegetation. The systematic collection of this information can be used in understanding the information that exists about our native vegetation and in prioritising further work including:

- building knowledge and information gap priorities into the next Native Vegetation Assessment;
- working with the Commonwealth, States and Territories, local government, and other organisations to improve knowledge;
- promoting and using the Australian Spatial Data Directory and Australian and New Zealand Land Information Council metadata standards for identifying and documentation of existing vegetation data leading to a better knowledge of vegetation data held by custodians around Australia;
- creating links between National Vegetation Information System and research and development programs, in particular the Land and Water Australia program on native vegetation; and
- implementing the standards and protocols for the Australian Spatial Data Infrastructure for native vegetation.

Australia needs an ongoing commitment to data collection, research, extension and innovation if we are to continue to adapt and improve the way we manage and use our natural resources. These needs must be prioritised based on a range of user requirements and not all gaps in the information have the same priority or need to be filled.

Gaps can be filled through a range of initiatives that ensure compatability with the vegetation information in the National Vegetation Information System.

Establishment of priorities for the further commitment of Natural Heritage Trust funds to continue the development of the National Vegetation Information System will be based on gap analysis results.

THE NEXT PRIORITY

Managing native vegetation based on condition assessment

Australia's Native Vegetation Resources Assessment 2001 provides the framework for ongoing assessments, monitoring and reporting of the status of native vegetation and its condition.

Condition is a value judgement with attributes differing widely depending on the end use of the vegetation (e.g. nature conservation, forestry production, carbon accounting, catchment water balance).

Progress and impediments

Limited progress has been made on the assessment of native vegetation condition across Australia. Condition assessment and monitoring is a developing science with continuing debate on methods and even the definition of condition. One approach suggests that vegetation condition values should consist of a matrix based on a core set of attributes with supplementary attributes to meet particular user needs, outlined in a draft framework (Environment Australia 2001).

Time and the substantial negotiations required to develop agreement on such a condition assessment process was beyond the Audit's immediate scope and resources. A review of requirements for condition information and prioritising requirements would enable the limited resources available for this activity to be better focused.

Suggested first step: a clearing register for Australia

Assessment of native vegetation condition requires a yearly inventory of clearing by vegetation type. The Australian Greenhouse Office Landsat data set will provide a good first assessment of vegetation change by providing a time series of woody vegetation loss over time. When linked with the National Vegetation Information System, information on the type of native vegetation lost and impacts can be assessed.

In some States and Territories, systems for collating finer scale information on clearing already exist (linked also to clearing permits). These more accurate information sets could replace those derived from analysis of the Australian Greenhouse Office clearing register and linked to the Native Vegetation Information System.

Work on compiling Australia-wide assessments of clearing as a first approximation for condition information can proceed immediately. Once this basic information is being routinely collated, emphasis can be given to research and development proposals for measuring attributes of condition for existing vegetation. This would include measuring the impacts of other factors that affect vegetation condition such as animal pests, climatic events, diseases, fire, grazing, insect pests, introduction of exotic biota, mining operations, plant pests, river regulation, salinisation and soil acidification.

Australia's rangelands—a special case

For Australia's rangelands, discussions on vegetation condition and associated issues (e.g. biodiversity assessment) are comparatively advanced. The Audit, with its State and Northern Territory partners, have developed the basis for a nested set of condition assessments—using the NOAA AVHRR data for Australia-wide analysis of vegetation vigour at a landscape scale, Landsat data for property and paddock scale assessment, and quadrant and photo point data for site monitoring. This system for monitoring vegetation condition can be put in place and routinely continued as part of the Australian Collaborative Rangelands Information System.

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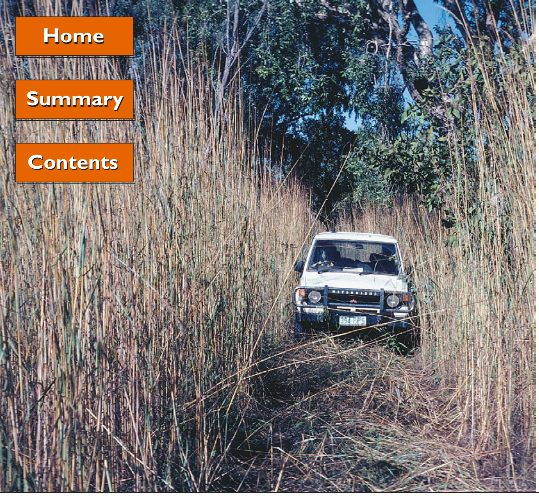

Keep River National Park, Northern Territory

MEETING AUDIT OBJECTIVES

Substantial progress has been made in compiling a framework for monitoring and assessing Australia's native vegetation. Access to the information collated is provided through the Australian Natural Resources Atlas and the Data Library. Information is available at various scales and levels of detail that support broad planning activities and increase community understanding of the needs of native vegetation.

Audit objective 1. Providing a clear understanding of the status of and changes in, the nation's land, vegetation and water resources and implications for their sustainable use

- Compiled very large amounts of native vegetation data, based on standardised Australia-wide vegetation attributes to provide a clear understanding of native vegetation extent and type.
- Included not only present (circa 1997) but also pre-European extent and type where available.
- Compiled the native vegetation data at a range of scales and levels of detail.
- Identified gaps in available data which have restricted the coverage and level of assessment possible.

Audit objective 3. Developing a national information system of compatible and readily accessible resource data

- Undertaken in partnership with States and Territories and coordinated through the Audit and Commonwealth agencies.
- Gained Australia-wide agreement on guidelines and a system to translate disparate vegetation data sets into a compatible information structure.
- Gained Australia-wide agreement, across all jurisdictions, to make native vegetation data readily accessible to the broader community.
- Gained commitment in the States and Territories to compile native vegetation data so that it is compatible with National Vegetation Information System guidelines.
- Identified the need to work towards an efficient database structure for continuing access and updating of vegetation data sets.
- Gained Australia-wide agreement on aggregate vegetation classes for broad grouping and map representation of the diversity of Australian native vegetation.
- Compiled sample information products using the National Vegetation Information System.
- Loaded the National Vegetation Information System data products onto the Australian Natural Resources Atlas and into the Audit's Data Library so that the community and government alike have ready access to information on Australia's native vegetation.

Kosciusko Alps, New South Wales

Audit objective 4. Producing national land, vegetation and water—surface and groundwater—assessments as integrated components of the Audit

- Provided data that can now be applied as a key input into the regional plans under the National Action Plan for Salinity and Water Quality. Pre-European data is particularly relevant, providing the basis for assessing optimum levels of water balance and the change that has followed the introduction of other land covers as part of land use.
- Provided spatially referenced native vegetation information that will underpin and inform condition assessment as part of analysis of Australia-wide climate variation and vegetation response based on AVHRR and assessment based on interpretation of Landsat imagery to input into rangelands monitoring proposals.
- Compiled a fundamental data set that has been used as part of the Audit's integrated assessments of river and catchment health.
- Developed a fundamental data set that has been used as an input in the Audit's assessment of biodiversity.

Audit objective 5. Ensuring integration with, and collaboration between, other relevant initiatives

- This report and the National Vegetation Information System was developed in collaboration with all States, Territories and Commonwealth agencies in native vegetation mapping and data management.
- Provides information on the extent and type of vegetation remaining as context for development of revegetation strategies and priorities (e.g. programs under the Natural Heritage Trust).
- The National Vegetation Information System is a framework which identifies a system of compatible vegetation information across Australia as one of the key inputs into best practice arrangements for vegetation management and monitoring in the Australia and New Zealand Environmental Conservation Council, the National Framework for the Management and Monitoring of Australia's Vegetation (ANZECC 2000).
- The major vegetation subgroups are an input for the Threatened Species Scientific Committee as a tool to assist the assessment of threatened ecological communities for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).
- The National Vegetation Information System is being used by the Australian Greenhouse Office to add further precision in the National Carbon Accounting System.

- As part of the National Action Plan for Salinity and Water Quality, the native vegetation information system is being used to help identify vegetation types at risk from increases in the extent of dryland salinity.
- Environment Australia is using the information to assist with implementing the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) and guiding funding priorities for the Bushcare program.

Audit objective 6. Providing a framework for monitoring Australia's land and water resources in an ongoing and structured way

- Worked in partnership with State, Territory and Commonwealth agencies.
- Provided the data framework and information technology basis for monitoring in a structured and comparable manner across Australia.
- Supported the development of long-term arrangements with coordinators and data custodians for updating and continued development of the National Vegetation Information System.
- Supported the National Vegetation Information System Stage II activities being funded under the Natural Heritage Trust, coordinated by the Bureau of Rural Sciences, Agriculture, Fisheries and Forestry – Australia.

APPENDIX 1. AREA OF NATIVE VEGETATION IN BIOREGIONS

Avicennia marina, St Kilda Beach, near Adelaide, South Australia

Bioregion name	Bioregion code	Bioregion number	Cleared	Rainforest and vine thickets	Eucalypt tall open forests	Eucalypt open forests	Eucalypt low open forests	Eucalypt woodlands
Murray Darling Depression	MDD	1	7 450 212	–	–	42 452	77 616	185 268
Naracoorte Coastal Plain	NCP	2	1 948 364	–	12	46 652	1 308	146 048
Victorian Volcanic Plain	VVP	3	1 998 844	–	656	34 392	40	49 616
South East Coastal Plain	SCP	4	1 339 960	8	14 864	109 444	928	65 112
South Eastern Highlands	SEH	5	3 697 800	27 752	1 148 516	1 961 064	7 964	1 362 052
Australian Alps	AA	6	30 848	2 436	113 436	253 528	1 956	278 240
NSW South Western Slopes	NSS	7	5 715 272	–	120	199 268	–	427 880
Riverina	RIV	8	4 580 904	–	–	401 260	–	538 584
Flinders	FLI	9	88 832	1 164	11 864	197 328	9 468	4 184
South East Corner	SEC	10	416 236	19 772	474 212	1 206 428	536	427 164
Ben Lomond	BEL	11	82 328	22 780	87 368	394 268	–	36 016
Tasmanian Northern Midlands	TNM	12	229 220	–	1 652	60 636	60	57 772
Tasmanian South East	TSE	13	274 648	1 392	67 232	329 552	532	213 096
Tasmanian West	TWE	14	6 452	451 476	30 236	195 640	340	896
Tasmanian Southern Ranges	TSR	15	46 204	65 544	241 096	261 436	208	21 396
Tasmanian Central Highlands	TCH	16	5 376	99 740	53 028	186 960	–	124 884
Darling Riverine Plains	DRP	17	3 428 472	–	189 488	628 232	432 392	1 065 016
Mulga Lands	ML	18	3 307 320	–	–	450 764	166 032	2 537 512
Simpson Strzelecki Dunefields	SSD	19	5 480	–	–	–	200 340	43 848
Sydney Basin	SB	20	1 142 868	19 092	79 608	895 856	48 092	867 232
Channel Country	CHC	21	16 308	–	–	–	41 048	536 036
Brigalow Belt North	BBN	22	6 430 308	84 724	20	228 272	–	4 012 420
Nandewar	NAN	23	1 748 584	68	–	347 660	–	192 720
Cobar Peneplain	CP	24	820 516	–	–	36 896	13 316	2 323 452
Broken Hill Complex	BHC	25	2 420	–	–	–	109 756	89 672
New England Tableland	NET	26	1 774 852	5 320	–	889 004	–	139 896
NSW North Coast	NNC	27	2 220 440	227 732	1 160	3 042 412	–	135 852
Central Ranges	CR	28	–	–	–	–	–	–
Finke	FIN	29	10 724	–	–	–	–	10 084
Stony Plains	STP	30	–	–	–	–	–	846 344
Gawler	GAW	31	10 500	–	–	–	–	90 940
Great Victoria Desert	GVD	32	20 080	–	–	–	–	8 940
Nullarbor	NUL	33	3 372	–	–	–	–	1 092
Hampton	HAM	34	1 600	–	–	–	–	–
Eyre Yorke Block	EYB	35	3 953 288	–	–	44	–	242 472
Flinders Lofty Block	FLB	36	1 300 556	–	–	20 768	1 676	186 304
Kanmantoo	KAN	37	534 948	–	–	5 924	–	61 540
Mount Isa Inlier	MII	38	8 264	–	–	–	–	188 400
Gulf Plains	GUP	39	36 568	5 604	–	–	–	6 544 104

– Indicates that this major vegetation group does not exist in a particular jurisdiction or that the scale and type of mapping

Acacia forests and woodlands	Callitris forests and woodlands	Casuarina forests and woodlands	Melaleuca forests and woodlands	Other forests and woodlands	Eucalyptus open woodlands	Tropical eucalypt woodlands/grasslands	Acacia open woodlands	Mallee woodlands and shrublands
2 924	390 164	2 855 320	48	164 348	33 020	–	–	5 138 312
36	–	328	4 552	104	5 092	–	–	161 060
180	–	–	4	708	1 020	–	–	1 932
1 008	–	–	548	35 464	1 056	–	–	–
24 604	7 084	3 628	–	1 028	250 612	–	–	3 248
132	–	–	–	108	15 516	–	–	128
1 312	130 036	14 284	–	–	380 988	–	–	21 512
95 092	121 556	130 800	–	66 316	97 168	–	36	54 344
56	116	14 660	–	4 648	252	–	–	–
16 648	13 152	1 600	608	42 548	7 876	–	–	2 444
348	–	4	–	–	6 484	–	–	–
76	–	116	–	–	23 932	–	–	–
1 736	–	832	–	104	71 400	–	–	–
–	–	–	–	548	–	–	–	–
228	–	–	–	17 096	824	–	–	–
28	–	–	–	5 456	7 252	–	–	–
504 616	43 360	125 292	–	28 728	803 712	–	8 672	14 228
4 467 348	68 456	895 916	–	48 568	1 318 196	–	1 235 312	–
28 168	1 208	–	–	1 304 712	253 924	–	1 602 832	1 030 740
–	3 560	4 680	772	–	222 628	–	–	34 272
886 348	–	–	–	2 592 980	553 456	–	1 636 712	184 296
1 058 060	312	25 568	128 148	2 800	983 580	–	10 760	–
–	6 644	56	–	–	180 644	–	–	99 976
156 980	1 382 560	146 968	–	768	459 872	–	–	286 952
3 300	39 044	523 724	–	–	3 636	–	29 772	5 664
–	6 460	–	–	–	181 660	–	–	–
–	–	–	–	–	227 100	–	–	–
1 969 900	–	–	–	–	–	–	–	256 952
30 304	–	–	–	286 092	64 044	–	186 160	4 820
998 968	–	32	–	192 228	–	–	405 764	–
17 676	–	1 748	–	38 832	–	–	39 020	1 262 820
5 620 464	–	777 156	–	38 424	690 868	–	1 102 600	5 720 340
222 648	–	229 784	–	–	488 652	–	55 460	1 510 320
–	–	–	–	–	–	–	–	784 948
4	32	84	–	208	–	–	–	1 625 904
474 008	100 696	139 584	–	29 844	37 124	–	165 668	501 532
–	292	576	64	3 884	19 120	–	–	174 684
82 988	–	–	–	667 788	1 291 756	300	204 596	–
774 856	176	–	5 165 908	2 366 452	448 256	675 100	–	–

compiled has not captured this major vegetation group; areas are in hectares

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Bioregion name	Bioregion code	Bioregion number	Low closed forests and closed shrublands	Acacia shrublands	Other shrublands	Heath	Tussock grasslands
Murray Darling Depression	MDD	1	6 280	842 152	495 852	263 040	119 456
Naracoorte Coastal Plain	NCP	2	16 644	12 724	76 764	45 388	7 760
Victorian Volcanic Plain	VVP	3	4 484	–	852	36	4 512
South East Coastal Plain	SCP	4	19 736	928	9 336	9 248	1 028
South Eastern Highlands	SEH	5	5 424	44	8 424	13 500	102 032
Australian Alps	AA	6	–	–	2 140	1 188	53 180
NSW South Western Slopes	NSS	7	1 516	–	1 636	1 760	234 164
Riverina	RIV	8	364 328	7 208	216 828	–	334 748
Flinders	FLI	9	41 332	24	16 796	116 592	6 596
South East Corner	SEC	10	18 536	2 608	7 064	17 172	2 840
Ben Lomond	BEL	11	1 488	80	10 312	3 468	6 024
Tasmanian Northern Midlands	TNM	12	124	504	5 900	16	7 344
Tasmanian South East	TSE	13	8 504	568	4 224	4 896	19 508
Tasmanian West	TWE	14	106 876	–	10 796	2 932	196
Tasmanian Southern Ranges	TSR	15	27 360	52	3 572	10 596	13 396
Tasmanian Central Highlands	TCH	16	20 728	108	5 388	43 252	54 972
Darling Riverine Plains	DRP	17	–	50 020	170 056	–	268 584
Mulga Lands	ML	18	–	8 136 064	9 296	–	845 948
Simpson Strzelecki Dunefields	SSD	19	–	2 693 212	144 316	–	980 848
Sydney Basin	SB	20	248	–	3 124	100 836	84 080
Channel Country	CHC	21	–	4 262 148	243 084	–	7 096 256
Brigalow Belt North	BBN	22	1 348	1 240	17 196	440	270 928
Nandewar	NAN	23	–	–	–	–	972
Cobar Peneplain	CP	24	–	862 628	128	–	9 436
Broken Hill Complex	BHC	25	–	1 492 756	266 480	–	15 444
New England Tableland	NET	26	–	–	–	–	100
NSW North Coast	NNC	27	–	–	–	332	1 824
Central Ranges	CR	28	–	2 689 104	–	–	182 540
Finke	FIN	29	–	1 728 036	116	–	562 940
Stony Plains	STP	30	–	898 580	334 304	–	1 865 792
Gawler	GAW	31	–	7 392 400	108 128	11 496	742 232
Great Victoria Desert	GVD	32	–	3 407 548	1 054 616	82 128	844 736
Nullarbor	NUL	33	–	700	90 308	100	185 280
Hampton	HAM	34	–	–	–	–	–
Eyre Yorke Block	EYB	35	–	82 404	133 300	–	6 740
Flinders Lofty Block	FLB	36	–	688 612	250 100	16	1 145 536
Kanmantoo	KAN	37	304	96	6 796	176	8
Mount Isa Inlier	MII	38	–	12 316	181 736	–	598 880
Gulf Plains	GUP	39	–	3 296	101 108	–	4 634 216

– Indicates that this major vegetation group does not exist in a particular jurisdiction or that the scale and type of mapping

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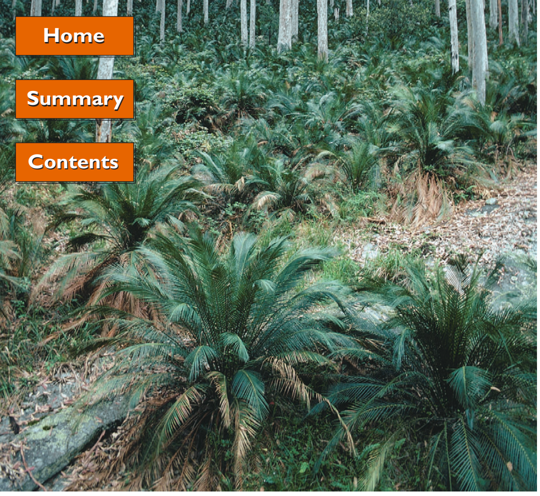


Macrozamia communis, *Eucalyptus maculata*, near Batemans Bay, New South Wales

Hummock grasslands	Grassland group	Chenopod group	Mangrove group	No data	Total area of bioregion	Native vegetation area	Percent remaining native vegetation	Percent cleared native vegetation
168	238 312	1 272 404	171 788	–	19 749 136	12 298 924	62	38
–	26 068	19 496	23 488	–	2 541 888	593 524	23	77
–	872	9 320	54 724	–	2 162 192	163 348	8	92
–	22 156	37 200	29 012	–	1 697 036	357 076	21	79
–	15 628	25 256	77 784	–	8 743 444	5 045 644	58	42
–	22 692	13 532	3 816	–	792 876	762 028	96	4
–	1 458 192	17 276	68 680	–	8 673 896	2 958 624	34	66
–	650 020	1 810 048	120 232	–	9 589 472	5 008 568	52	48
–	5 684	392	8 436	–	528 424	439 592	83	17
–	3 244	3 644	16 972	–	2 701 304	2 285 068	85	15
–	6 012	–	608	–	657 588	575 260	87	13
–	23 872	260	3 940	–	415 424	186 204	45	55
–	88 436	1 784	9 836	–	1 098 280	823 632	75	25
–	674 928	–	70 292	–	1 551 608	1 545 156	100	0
–	54 260	–	14 800	–	778 068	731 864	94	6
–	87 312	8	73 260	–	767 752	762 376	99	1
–	1 588 816	1 141 540	160 928	–	10 652 152	7 223 680	68	32
265 376	265 904	1 268 552	8 220	4 712	25 299 496	21 992 176	87	13
18 945 476	32 804	811 980	1 316 368	21 372	29 417 628	29 412 148	100	0
–	24 228	27 880	73 876	–	3 632 932	2 490 064	69	31
2 980 412	217 640	7 166 636	20 048	42 012	28 475 420	28 459 112	100	0
520	27 072	53 000	215 840	–	13 552 556	7 122 248	53	47
–	109 448	–	11 952	–	2 698 724	950 140	35	65
–	811 976	27 204	10 588	–	7 350 240	6 529 724	89	11
64	6 424	3 113 228	1 456	–	5 702 840	5 700 420	100	0
–	316	8	6 464	–	3 004 080	1 229 228	41	59
–	4	10 936	57 592	–	5 925 384	3 704 944	63	37
4 364 188	376	641 528	1 848	11 668	10 118 104	10 118 104	100	0
3 286 568	–	1 198 596	148	10 948	7 379 580	7 368 856	100	0
223 348	31 940	7 589 580	31 960	896	13 419 736	13 419 736	100	0
–	148	1 335 520	1 309 444	–	12 360 904	12 350 404	100	0
21 498 132	–	719 464	280 364	9 612	41 875 472	41 855 392	100	0
123 676	–	16 798 944	11 260	12	19 721 608	19 718 236	100	0
–	–	297 276	3 692	328	1 087 844	1 086 244	100	0
16	12	30 464	3 748	–	6 078 720	2 125 432	35	65
115 488	640	1 965 344	2 596	–	7 126 092	5 825 536	82	18
–	292	1 248	728	–	810 680	275 732	34	66
3 409 308	–	636	9 804	7 272	6 664 044	6 655 780	100	0
236 712	172 380	14 112	760 252	612	21 939 712	21 903 144	100	0

compiled has not captured this major vegetation group; areas are in hectares

Bioregion name	Bioregion code	Bioregion number	Cleared	Rainforest and vine thickets	Eucalypt tall open forests	Eucalypt open forests	Eucalypt low open forests	Eucalypt woodlands
Cape York Peninsula	CYP	40	49 960	387 064	–	199 092	11 088	6 650 812
Mitchell Grass Downs	MGD	41	1 167 240	–	–	–	–	610 392
Wet Tropics	WT	42	475 544	850 152	–	376 612	–	59 392
Central Mackay Coast	CMC	43	446 088	177 368	–	325 576	–	366 572
Einasleigh Uplands	EIU	44	220 244	80 516	–	395 048	–	6 524 036
Desert Uplands	DEU	45	811 564	12	–	43 252	–	2 188 676
Gulf Fall and Uplands	GFU	46	3 388	–	–	–	–	4 692 960
MacDonnell Ranges	MAC	47	32 996	–	–	–	–	–
Burt Plain	BRT	48	–	–	–	–	–	–
Tanami	TAN	49	–	–	–	–	–	16
Sturt Plateau	STU	50	142 244	–	–	–	–	3 929 488
Ord Victoria Plain	OVP	51	228	–	–	–	–	1 902 992
Victoria Bonaparte	VB	52	27 488	3 240	–	93 312	7 044	203 008
Gascoyne	GAS	53	4	–	–	–	–	4 584
Carnarvon	CAR	54	22 996	–	–	–	–	14 004
Central Kimberley	CK	55	32	–	–	–	–	2 548
Coolgardie	COO	56	221 992	–	–	–	–	6 482 928
Esperance Plains	ESP	57	1 402 020	–	–	684	5 088	52 056
Dampierland	DL	58	47 664	–	–	–	–	7 744
Gibson Desert	GD	59	40	–	–	–	–	–
Great Sandy Desert	GSD	60	2 084	–	–	–	–	4 752
Jarrah Forest	JF	61	1 959 380	–	2 928	1 817 300	99 756	504 260
Warren	WAR	62	166 224	–	231 372	207 900	13 100	50 916
Little Sandy Desert	LSD	63	4	–	–	–	–	4 200
Mallee	MAL	64	3 389 464	–	–	–	4 492	587 132
Murchison	MUR	65	8	–	–	–	–	168 744
Northern Kimberley	NK	66	77 392	1 628	–	–	–	736
Geraldton Sandplains	GS	67	1 921 976	–	–	–	–	13 020
Pilbara	PIL	68	34 416	–	–	–	–	150 424
Swan Coastal Plain	SWA	69	915 752	–	–	5 548	28 188	109 092
Avon Wheatbelt	AW	70	8 132 108	–	4	720	–	525 408
Yalgoo	YAL	71	90 340	–	–	–	–	150 772
Gulf Coastal	GUC	72	17 220	156	–	–	–	514 208
Daly Basin	DAB	73	166 604	–	–	417 884	–	65 184
South Eastern Queensland	SEQ	74	3 376 096	214 568	38 160	1 679 876	–	304 572
Pine Creek	PCK	75	42 672	6 060	–	168 364	–	6 072
Brigalow Belt South	BBS	76	14 948 992	120 612	17 796	302 244	–	6 611 544
Central Arnhem	CA	77	1 644	–	–	1 148 348	–	27 252
Victorian Midlands	VM	78	2 704 748	–	69 756	122 372	9 912	691 112
Darwin Coastal	DAC	79	85 368	6 964	–	1 157 372	–	4 300
Tasmanian Northern Slopes	TNS	80	226 864	47 824	76 884	250 376	–	5 636
Arnhem Coast	ARC	81	56 312	–	–	1 864 636	–	15 356
Arnhem Plateau	ARP	**82**	1 396	70 948	–	182 264	–	1 052 168
Tiwi Cobourg	TIW	**83**	21 468	4 860	–	815 112	–	1 892
Davenport Murchison Ranges	DMR	**84**	–	–	–	–	–	21 052
King	KIN	**85**	111 288	16 788	61 448	48 960	–	1 184

– Indicates that this major vegetation group does not exist in a particular jurisdiction or that the scale and type of mapping

Acacia forests and woodlands	Callitris forests and woodlands	Casuarina forests and woodlands	Melaleuca forests and woodlands	Other forests and woodlands	Eucalyptus open woodlands	Tropical eucalypt woodlands/grasslands	Acacia open woodlands	Mallee woodlands and shrublands
84 676	–	492	1 544 684	287 712	262 424	1 382 816	168	–
1 250 236	192	–	46 624	251 176	2 555 016	–	2 318 060	840
–	–	–	14 736	900	8 260	–	–	–
296	–	92	17 404	1 820	–	–	–	–
285 840	12	–	69 812	154 252	3 739 416	44	9 168	–
674 752	1 264	1 528	10 580	32 252	2 712 872	–	26 232	–
374 692	–	–	271 644	721 168	5 540 880	17 276	–	–
–	–	–	–	–	22 088	–	201 408	181 100
–	–	–	–	–	235 700	–	1 655 672	639 444
–	–	–	–	–	1 338 900	–	27 640	156 016
2 504 440	–	–	272 376	215 348	690 504	–	–	–
33 664	–	–	4 484	363 164	2 029 928	832	–	–
492	–	–	403 304	25 788	523 880	4 678 368	–	–
9 255 076	–	–	–	–	–	–	74 400	–
1 540 044	–	–	–	–	–	–	–	–
–	–	–	–	–	–	3 611 108	–	–
81 060	–	27 720	–	–	1 669 188	–	–	152 800
–	–	–	628	–	6 840	–	–	1 171 352
–	–	–	–	–	–	136	–	–
1 107 672	–	–	–	–	–	–	–	–
–	–	–	–	–	349 048	–	46 164	35 960
4	–	184	50 308	1 008	–	–	–	2 932
–	–	–	65 032	17 064	–	–	–	–
663 124	–	–	–	–	–	–	–	–
–	–	116	4	–	896 404	–	–	2 152 520
16 892 060	–	20 012	–	–	124 384	–	230 144	–
–	–	–	–	–	–	7 919 652	–	–
3 344	–	30 728	–	2 252	26 692	–	–	14 092
1 993 476	–	1 188	–	–	–	–	18 384	–
–	–	–	2 428	276 416	16 028	–	–	1 304
4	–	6 836	532	952	36 588	–	–	87 024
893 896	–	–	–	–	–	–	–	–
224	–	–	154 536	1 321 852	389 304	36	–	–
1 004	–	–	31 188	7 320	1 540	1 399 776	–	–
652	48	26 952	50 412	90 292	2 340	–	–	–
728	–	–	129 104	4	92	2 463 920	–	–
978 812	455 324	76 304	488	26 184	1 288 300	–	57 392	426 748
1 636	–	–	76 372	188 528	228	1 996 836	–	–
1 420	724	–	–	300	33 892	–	–	28 056
–	–	–	254 548	64	120	408 476	–	–
124	–	–	–	168	104	–	–	–
–	–	–	253 520	36	7 652	845 524	–	–
180	–	–	12 448	–	979 532	656	–	–
–	–	–	13 556	–	–	22 340	–	–
–	–	–	–	68	3 811 560	–	127 276	1 110 656
232	–	–	–	11 428	660	–	–	–

compiled has not captured this major vegetation group; areas are in hectares

Bioregion name	Bioregion code	Bioregion number	Low closed forests and closed shrublands	Acacia shrublands	Other shrublands	Heath	Tussock grasslands
Cape York Peninsula	CYP	40	–	–	378 244	–	526 072
Mitchell Grass Downs	MGD	41	–	726 764	991 072	–	21 415 168
Wet Tropics	WT	42	–	–	–	–	162 068
Central Mackay Coast	CMC	43	43 240	–	2 124	–	9 340
Einasleigh Uplands	EIU	44	–	44	–	–	347 080
Desert Uplands	DEU	45	–	30 340	23 948	–	342 924
Gulf Fall and Uplands	GFU	46	–	–	–	–	200 684
MacDonnell Ranges	MAC	47	–	1 543 236	–	–	3 576
Burt Plain	BRT	48	–	3 244 880	–	–	36 140
Tanami	TAN	49	–	560 560	92 748	–	293 128
Sturt Plateau	STU	50	–	199 872	–	–	91 144
Ord Victoria Plain	OVP	51	–	103 908	–	976	3 390 252
Victoria Bonaparte	VB	52	–	11 880	–	–	631 032
Gascoyne	GAS	53	–	5 752 440	666 940	–	1 264
Carnarvon	CAR	54	–	3 301 404	878 728	–	78 020
Central Kimberley	CK	55	–	8 268	–	–	654 604
Coolgardie	COO	56	45 592	1 213 768	1 074 632	272 016	–
Esperance Plains	ESP	57	2 532	2 052	159 388	45 484	112
Dampierland	DL	58	–	5 678 128	–	24 484	1 685 416
Gibson Desert	GD	59	–	511 764	–	–	–
Great Sandy Desert	GSD	60	–	901 824	60 016	148 892	14 312
Jarrah Forest	JF	61	308	3 132	24 764	3 136	16
Warren	WAR	62	32	17 184	28 988	13 100	–
Little Sandy Desert	LSD	63	–	86 776	–	14 484	–
Mallee	MAL	64	2 668	1 348	53 316	196 164	4
Murchison	MUR	65	–	2 616 752	419 288	–	–
Northern Kimberley	NK	66	–	9 772	–	–	71 764
Geraldton Sandplains	GS	67	51 160	188 388	651 980	950 984	–
Pilbara	PIL	68	–	377 104	4 668	88	1 266 180
Swan Coastal Plain	SWA	69	500	62 184	1 436	77 744	–
Avon Wheatbelt	AW	70	52 176	271 356	216 184	31 916	–
Yalgoo	YAL	71	4 012	2 507 800	44 288	2 764	–
Gulf Coastal	GUC	72	–	–	–	–	46 756
Daly Basin	DAB	73	–	–	–	–	–
South Eastern Queensland	SEQ	74	–	–	7 836	19 928	592
Pine Creek	PCK	75	–	–	–	–	104
Brigalow Belt South	BBS	76	–	22 484	8 644	26 256	265 892
Central Arnhem	CA	77	–	–	–	–	–
Victorian Midlands	VM	78	8 180	–	23 972	14 132	1 648
Darwin Coastal	DAC	79	–	–	72 064	–	6 420
Tasmanian Northern Slopes	TNS	80	3 564	–	496	420	344
Arnhem Coast	ARC	81	–	–	4	–	–
Arnhem Plateau	ARP	82	–	–	–	–	–
Tiwi Cobourg	TIW	83	–	17 908	–	–	–
Davenport Murchison Ranges	DMR	84	–	186 624	–	–	46 348
King	KIN	85	15 788	–	19 476	14 520	688

– Indicates that this major vegetation group does not exist in a particular jurisdiction or that the scale and type of mapping

Hummock grasslands	Grassland group	Chenopod group	Mangrove group	No data	Total area of bioregion	Native vegetation area	Percent remaining native vegetation	Percent cleared native vegetation
–	74 872	20 572	256 072	–	12 116 820	12 066 860	100	0
885 160	109 612	1 145 688	40 296	132	33 513 668	32 346 428	97	3
–	220	25 336	11 060	–	1 984 280	1 508 736	76	24
–	5 216	7 996	39 184	–	1 442 316	996 228	69	31
–	2 068	1 908	22 556	–	11 852 044	11 631 800	98	2
80 984	22 608	17 680	10 552	–	7 032 020	6 220 456	88	12
–	–	16 420	8 704	36	11 847 852	11 844 464	100	0
1 900 088	–	45 000	24	–	3 929 516	3 896 520	99	1
1 567 560	–	–	108	–	7 379 504	7 379 504	100	0
23 149 996	164 408	137 736	68 568	7 540	25 997 256	25 997 256	100	0
1 798 240	–	13 560	356	–	9 857 572	9 715 328	99	1
4 513 840	45 404	42 272	108 520	196	12 540 660	12 540 432	100	0
149 488	3 480	201 008	300 476	5 872	7 269 160	7 241 672	100	0
1 262 828	12 560	794 620	250 616	–	18 075 332	18 075 328	100	0
1 834 284	2 872	319 936	384 644	–	8 376 932	8 353 936	100	0
3 391 684	–	–	6 880	388	7 675 512	7 675 480	100	0
307 992	–	618 560	744 052	–	12 912 300	12 690 308	98	2
–	460	232	57 716	–	2 906 644	1 504 624	52	48
713 460	–	332	214 004	–	8 371 368	8 323 704	99	1
13 546 780	216 076	163 548	82 780	–	15 628 660	15 628 620	100	0
36 382 328	17 976	562 692	998 872	–	39 524 920	39 522 836	100	0
–	14 384	–	24 168	–	4 507 968	2 548 588	57	43
–	26 020	–	7 256	–	844 188	677 964	80	20
10 030 500	88	65 484	225 316	–	11 089 976	11 089 972	100	0
–	364	5 516	105 308	–	7 394 820	4 005 356	54	46
4 260 096	–	2 637 224	751 756	–	28 120 468	28 120 460	100	0
135 464	–	–	171 416	832	8 388 656	8 311 264	99	1
88 340	–	10 240	13 792	–	3 966 988	2 045 012	52	48
13 424 080	283 796	95 920	203 220	–	17 852 944	17 818 528	100	0
–	708	516	14 556	–	1 512 400	596 648	39	61
–	–	103 800	51 580	–	9 517 188	1 385 080	15	85
235 488	–	222 280	102 720	–	4 254 360	4 164 020	98	2
–	–	222 560	20 844	–	2 687 696	2 670 476	99	1
–	–	–	1 800	–	2 092 300	1 925 696	92	8
–	11 668	13 516	106 220	–	5 943 728	2 567 632	43	57
–	25 828	–	8 840	–	2 851 788	2 809 116	99	1
1 972	1 265 308	5 788	19 656	–	26 926 740	11 977 748	44	56
–	–	18 132	2 628	–	3 461 604	3 459 960	100	0
–	17 348	19 712	35 100	–	3 782 384	1 077 636	28	72
–	621 756	121 976	61 620	–	2 801 048	2 715 680	97	3
–	4 448	–	6 228	–	623 480	396 616	64	36
–	105 992	113 740	37 268	–	3 300 040	3 243 728	98	2
–	3 656	–	2 688	–	2 305 936	2 304 540	100	0
–	2 612	22 888	73 796	–	996 432	974 964	98	2
500 452	–	572	572	–	5 805 180	5 805 180	100	0
–	122 476	316	728	–	425 980	314 692	74	26

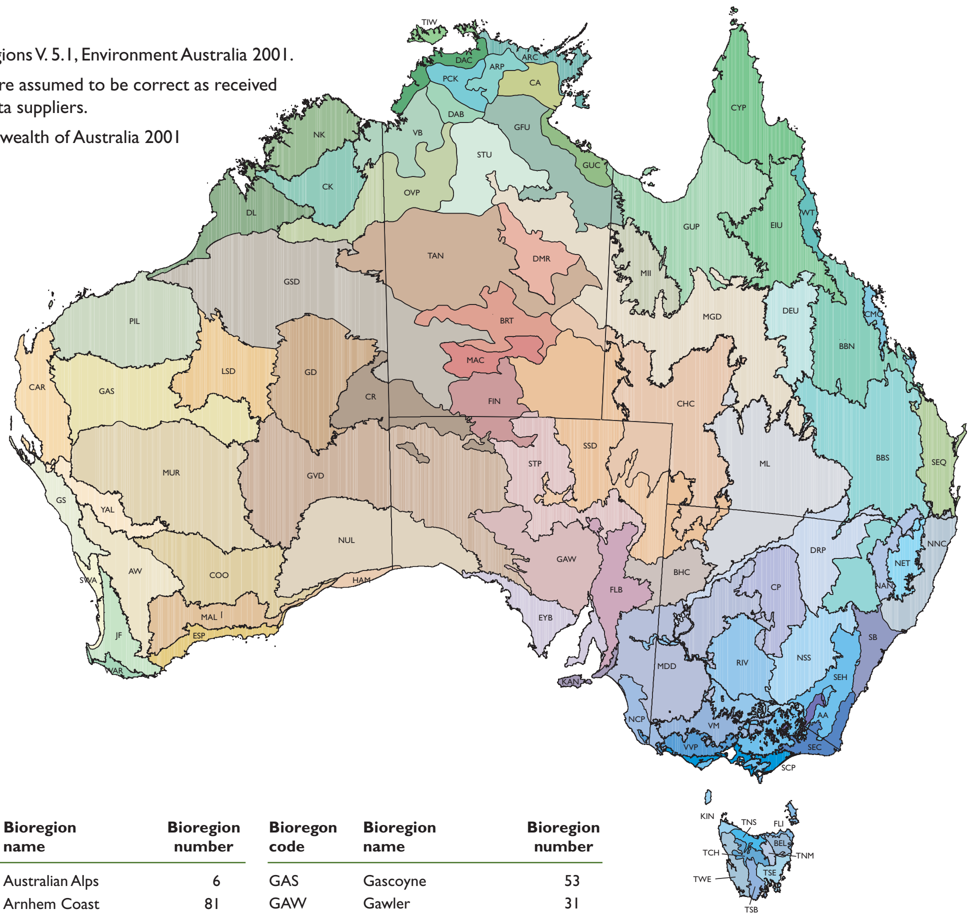
compiled has not captured this major vegetation group; areas are in hectares

APPENDIX 2. BIOREGIONS OF AUSTRALIA (VERSION 5.1)

Source:

IBRA Bioregions V. 5.1, Environment Australia 2001.

Data used are assumed to be correct as received from the data suppliers.

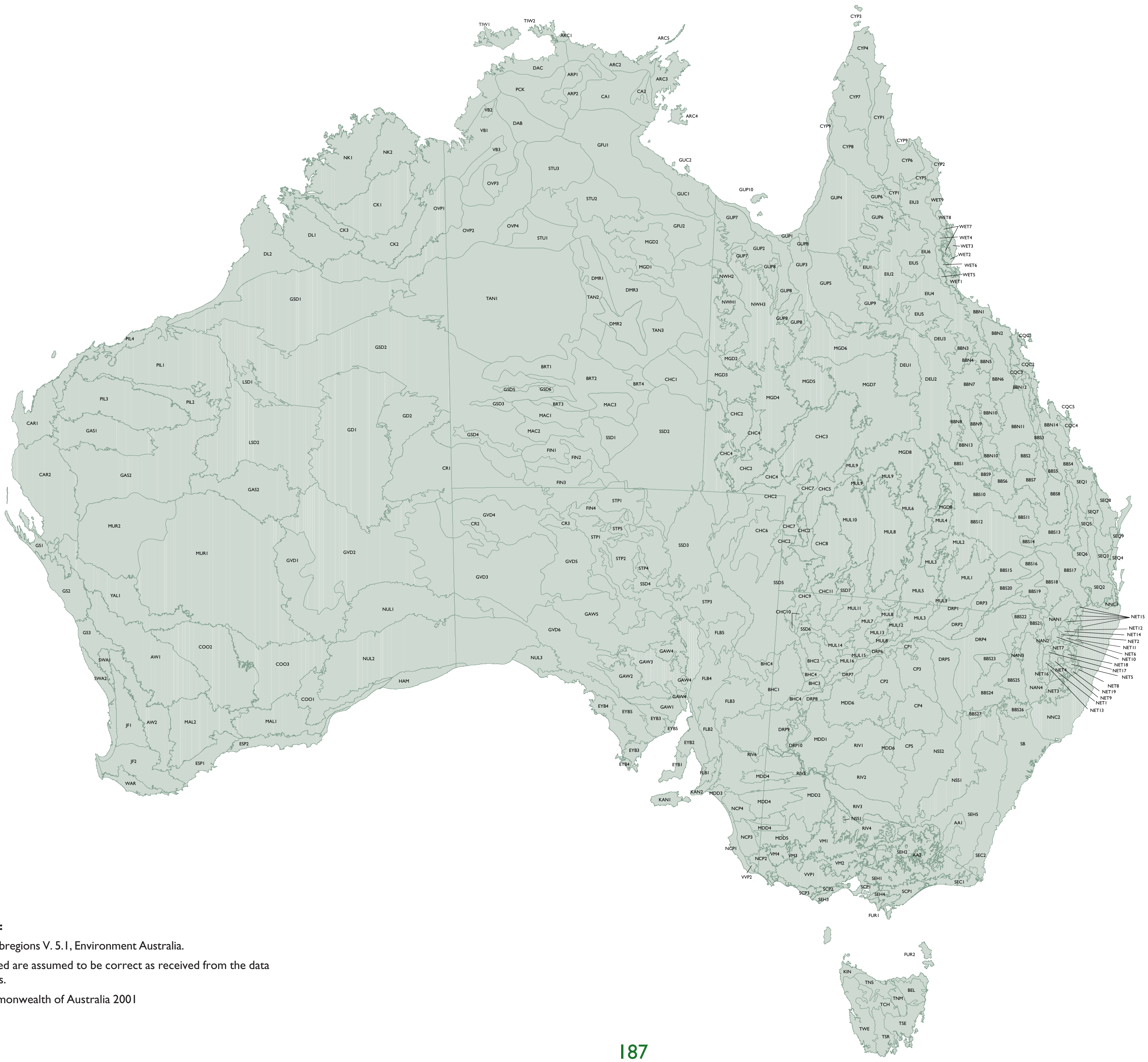


Bioregon code	Bioregion name	Bioregion number
AA	Australian Alps	6
ARC	Arnhem Coast	81
ARP	Arnhem Plateau	82
AW	Avon Wheatbelt	70
BBN	Brigalow Belt North	22
BBS	Brigalow Belt South	76
BEL	Ben Lomond	11
BHC	Broken Hill Complex	25
BRT	Burt Plain	48
CA	Central Arnhem	77
CAR	Carnarvon	54
CHC	Channel Country	21
CK	Central Kimberley	55
CMC	Central Mackay Coast	43
COO	Coolgardie	56
CP	Cobar Peneplain	24
CR	Central Ranges	28
CYP	Cape York Peninsula	40
DAB	Daly Basin	73
DAC	Darwin Coastal	79
DEU	Desert Uplands	45
DL	Dampierland	58
DMR	Davenport Murchison Ranges	84
DRP	Darling Riverine Plains	17
EIU	Einasleigh Uplands	44
ESP	Esperance Plains	57
EYB	Eyre Yorke Block	35
FIN	Finke	29
FLB	Flinders Lofty Block	36
FLI	Flinders	9

Bioregon code	Bioregion name	Bioregion number
GAS	Gascoyne	53
GAW	Gawler	31
GD	Gibson Desert	59
GFU	Gulf Fall and Uplands	46
GS	Geraldton Sandplains	67
GSD	Great Sandy Desert	60
GUC	Gulf Coastal	72
GUP	Gulf Plains	39
GVD	Great Victoria Desert	32
HAM	Hampton	34
JF	Jarrah Forest	61
KAN	Kanmantoo	37
KIN	King	85
LSD	Little Sandy Desert	63
MAC	MacDonnell Ranges	47
MAL	Mallee	64
MDD	Murray Darling Depression	1
MGD	Mitchell Grass Downs	41
MII	Mount Isa Inlier	38
ML	Mulga Lands	18
MUR	Murchison	65
NAN	Nandewar	23
NCP	Naracoorte Coastal Plain	2
NET	New England Tableland	26
NK	Northern Kimberley	66
NNC	NSW North Coast	27
NSS	NSW South Western Slopes	7
NUL	Nullarbor	33
OVP	Ord Victoria Plain	51
PCK	Pine Creek	75
PIL	Pilbara	68

Bioregon code	Bioregion name	Bioregion number
RIV	Riverina	8
SB	Sydney Basin	20
SCP	South East Coastal Plain	4
SEC	South East Corner	10
SEH	South Eastern Highlands	5
SEQ	South Eastern Queensland	74
SSD	Simpson Strzelecki Dunefields	19
STP	Stony Plains	30
STU	Sturt Plateau	50
SWA	Swan Coastal Plain	69
TAN	Tanami	49
TCH	Tasmanian Central Highlands	16
TIW	Tiwi Cobourg	83
TNM	Tasmanian Northern Midlands	12
TNS	Tasmanian Northern Slopes	80
TSE	Tasmanian South East	13
TSR	Tasmanian Southern Ranges	15
TWE	Tasmanian West	14
VB	Victoria Bonaparte	52
VM	Victorian Midlands	78
VVP	Victorian Volcanic Plain	3
WAR	Warren	62
WT	Wet Tropics	42
YAL	Yalgoo	71

APPENDIX 3. IBRA 5 SUBREGIONS OF AUSTRALIA (VERSION 5.1)



Source:

IBRA Subregions V. 5.1, Environment Australia.

Data used are assumed to be correct as received from the data suppliers.

Australian Alps

AA1	New South Wales Alps
AA2	Victorian Alps

Arnhem Coast

ARC1	Arnhem Coast P1
ARC2	Arnhem Coast P2
ARC3	Arnhem Coast P3
ARC4	Arnhem Coast P4 Groote
ARC5	Arnhem Coast P5 Wessels

Arnhem Plateau

ARP1	Arnhem Plateau P1
ARP2	Arnhem Plateau P2

Avon Wheatbelt

AW1	Avon Wheatbelt 1
AW2	Avon Wheatbelt 2

Brigalow Belt North

BBN1	Townsville Plains
BBN2	Bogie River Hills
BBN3	Cape River Hills
BBN4	Beucazon Hills
BBN5	Wyarra Hills
BBN6	Northern Bowen Basin
BBN7	Belyando Downs
BBN8	Upper Belyando Floodout
BBN9	Anakie Inlier
BBN10	Basalt Downs
BBN11	Isaac - Comet Downs
BBN12	Nebo - Connors Ranges
BBN13	South Drummond Basin
BBN14	Marlborough Plains

Brigalow Belt South

BBS1	Claude River Downs
BBS2	Woorabinda
BBS3	Boomer Range
BBS4	Mount Morgan Ranges
BBS5	Callide Creek Downs
BBS6	Arcadia
BBS7	Dawson River Downs
BBS8	Banana - Auburn Ranges
BBS9	Buckland Basalts
BBS10	Carnarvon Ranges
BBS11	Taroom Downs
BBS12	Southern Downs
BBS13	Barakula
BBS14	Dulacca Downs
BBS15	Weribone High
BBS16	Tara Downs
BBS17	Eastern Darling Downs
BBS18	Inglewood Sandstones
BBS19	Moonie R. - Commoron Creek
BBS20	Moonie - Barwon Interfluve
BBS21	Northern Basalts
BBS22	Northern Outwash
BBS23	Pilliga Outwash
BBS24	Pilliga
BBS25	Liverpool Plains
BBS26	Liverpool Range
BBS27	Talbragar Valley

Legend continued on next page

IBRA 5 subregions

Broken Hill Complex
BHC1 Barrier Range
BHC2 Mootwingee Downs
BHC3 Scopes Range
BHC4 Barrier Range Outwash

Burt Plain
BRT1 Burt Plain P1
BRT2 Burt Plain P2
BRT3 Burt Plain P3
BRT4 Burt Plain P4

Central Arnhem
CA1 Central Arnhem P1
CA2 Central Arnhem P2

Carnarvon
CAR1 Cape Range
CAR2 Wooramel

Channel country
CHC1 Toko Plains
CHC2 Sturt Stony Desert
CHC3 Goneaway Tablelands
CHC4 Diamantina-Eyre
CHC5 Cooper Plains
CHC6 Coongie
CHC7 Lake Pure
CHC8 Noccundra Slopes
CHC9 Tibooburra Downs
CHC10 Core Ranges
CHC11 Bulloo

Central Kimberley
CK1 Pentecost
CK2 Hart
CK3 Mount Eliza

Coolgardie
COO1 Mardabilla
COO2 Southern Cross
COO3 Eastern Goldfield

Cobar Peneplain
CP1 Boorindal Plains
CP2 Barnato Downs
CP3 Canbelego Downs
CP4 Nymagee-Rankins Springs
CP5 Lachlan Plains

Central Mackay Coast
CQC1 Whitsunday
CQC2 Proserpine - Sarina Lowlands
CQC3 Clarke - Connors Ranges
CQC4 Byfield
CQC5 Manifold

Central Ranges
CR1 Mann-Musgrave Block
CR2 Wataru
CR3 Everard Block

Cape York Peninsula
CYP1 Coen - Yamba Inlier
CYP2 Starke Coastal Lowlands
CYP3 Cape York - Torres Strait
CYP4 Jardine - Pascoe Sandstones
CYP5 Battle Camp Sandstones
CYP6 Laura Lowlands
CYP7 Weipa Plateau
CYP8 (Northern) Holroyd Plain
CYP9 Coastal Plains

Daly Basin
DAB Daly Basin

Darwin Coastal
DAC Darwin Coastal

Desert Uplands
DEU1 Prairie - Torrens Creeks Alluvials
DEU2 Alice Tableland
DEU3 Cape-Campaspe Plains

Dampierland
DL1 Fitzroy Trough
DL2 Pindanland

Davenport Murchison Ranges
DMR1 Davenport Murchison Range P1
DMR2 Davenport Murchison Range P2
DMR3 Davenport Murchison Range P3

Darling Riverine Plains
DRP1 Culgoa-Bokhara
DRP2 Narran-Lightning Ridge
DRP3 Warrambool-Moonie
DRP4 Castlereagh-Barwon
DRP5 Bogan-Macquarie
DRP6 Louth Plains
DRP7 Wilcannia Plains
DRP8 Menindee
DRP9 Great Darling Anabranch
DRP10 Pooncarie-Darling

Einasleigh Uplands
EIU1 Georgetown - Croydon
EIU2 Kidston
EIU3 Hodgkinson Basin
EIU4 Broken River
EIU5 Undara - Toomba Basalts
EIU6 Herberton - Wairuna

Esperance Plains
ESP1 Fitzgerald
ESP2 Recherche

Eyre Yorke Block
EYB1 Southern Yorke
EYB2 St Vincent
EYB3 Eyre Hills
EYB4 Talia
EYB5 Eyre Mallee

Finke
FIN1 Finke P1
FIN2 Finke P2
FIN3 Tieyon
FIN4 Pedirka

Flinders Lofty Block
FLB1 Mount Lofty Ranges
FLB2 Broughton
FLB3 Olary Spur
FLB4 Southern Flinders
FLB5 Northern Flinders

Flinders
FUR1 Wilsons Promontory
FUR2 Flinders

Gasgoyne
GAS1 Ashburton
GAS2 Carnegie
GAS3 Augustus

Gawler
GAW1 Myall Plains
GAW2 Gawler Volcanics
GAW3 Gawler Lakes
GAW4 Arcoona Plateau
GAW5 Kingoonya

Gibson Desert
GD1 Lateritic Plain
GD2 Dune Field

Gulf Fall and Uplands
GFU1 McArthur - South Nicholson Basins
GFU2 Gulf Fall and Uplands P2

Geraldton Sandplains
GS1 Edel
GS2 Geraldton Hills
GS3 Leseur Sandplain

Great Sandy Desert
GSD1 McLarty
GSD2 Mackay
GSD3 Great Sandy Desert P3
GSD4 Great Sandy Desert P4
GSD5 Great Sandy Desert P5
GSD6 Great Sandy Desert P6

Gulf Coastal
GUC1 Gulf Coastal P1
GUC2 Gulf Coastal P2 Pellews

Gulf Plains
GUP1 Karumba Plains
GUP2 Armraynald Plains
GUP3 Woondoola Plains
GUP4 Mitchell - Gilbert Fans
GUP5 Claraville Plains
GUP6 Holroyd Plain - Red Plateau
GUP7 Doomadgee Plains
GUP8 Donors Plateau
GUP9 Gilberton Plateau
GUP10 Wellesley Islands

Great Victoria Desert
GVD1 Shield
GVD2 Central
GVD3 Maralinga
GVD4 Kintore
GVD5 Tallaringa
GVD6 Yellabinna

Hampton
HAM Hampton

Jarrah Forrest
JF1 Northern Jarrah Forest
JF2 Southern Jarrah Forest

Kanmantoo
KAN1 Kangaroo Island
KAN2 Fleurieu

Little Sandy Desert
LSD1 Rudall
LSD2 Trainor

MacDonnell Ranges
MAC1 MacDonnell Ranges P1
MAC2 MacDonnell Ranges P2
MAC3 MacDonnell Ranges P3

Mallee
MAL1 Eastern Mallee
MAL2 Western Mallee

Murray Darling Depression
MDD1 South Olary Plain
MDD2 Murray Mallee
MDD3 Murray Lakes and Coorong
MDD4 Lowan Mallee
MDD5 Wimmera
MDD6 Darling Depression

Mitchell Grass Downs
MGD1 Mitchell Grass Downs P1
MGD2 Barkly Tableland
MGD3 Georgina Limestone
MGD4 Southwestern Downs
MGD5 Kynuna Plateau
MGD6 Northern Downs
MGD7 Central Downs
MGD8 Southern Wooded Downs

Mulga Lands
MUL1 West Balonne Plains
MUL2 Eastern Mulga Plains
MUL3 Nebine Plains
MUL4 North Eastern Plains
MUL5 Warrego River Plains
MUL6 Langlo Plains
MUL7 Cuttaburra-Paroo
MUL8 West Warrego
MUL9 Northern Uplands
MUL10 West Bulloo
MUL11 Urisino Sandplains
MUL12 Warrego Sands
MUL13 Kerribree Basin
MUL14 White Cliffs Plateau
MUL15 Paroo Overflow
MUL16 Paroo-Darling Sands

Murchison
MUR1 Eastern Murchison
MUR2 Western Murchison

Nandewar
NAN1 Northern Complex
NAN2 Inverell Basalts
NAN3 Kaputar
NAN4 Peel

Naracoorte Coastal Plain
NCP1 Bridgewater
NCP2 Glenelg Plain
NCP3 Lucindale
NCP4 Tintinara

New England Tableland
NET1 Bundarra Downs
NET2 Beardy River Hills
NET3 Walcha Plateau
NET4 Armidale Plateau
NET5 Wongwibinda Plateau
NET6 Deepwater Downs
NET7 Glenn Innes-Guyra Basalts
NET8 Ebor Basalts
NET9 Moredun Volcanics
NET10 Severn River Volcanics
NET11 Northeast Forest Lands
NET12 Tenterfield Plateau
NET13 Yarrowyck-Kentucky Downs
NET14 Binghi Plateau
NET15 Stanthorpe Plateau
NET16 Eastern Nandewars
NET17 Tingha Plateau
NET18 Nightcap
NET19 Round Mountain

Northern Kimberley
NK1 Mitchell
NK2 Berkeley

NSW North Coast
NNC1 Scenic Rim
NNC2 NSW North Coast 2

NSW South Western Slopes
NSS1 Upper Slopes
NSS2 Lower Slopes

Nullabor
NUL1 Carlisle
NUL2 Nullabor Plain
NUL3 Yalata

Mount Isa Inlier
NWH1 Southwestern Plateaus & Floodouts
NWH2 Thorntonia
NWH3 Mount Isa Inlier

Ord Victoria Plain
OVP1 Ord
OVP2 South Kimberley Interzone
OVP3 Ord-Victoria Plains P3
OVP4 Ord-Victoria Plains P4

Pine Creek
PCK Pine Creek

Pilbara
PIL1 Chichester
PIL2 Fortescue
PIL3 Hamersley
PIL4 Roebourne

Riverina
RIV1 Lachlan
RIV2 Murrumbidgee
RIV3 Murray Fans
RIV4 Victorian Riverina
RIV5 Robinvale Plains
RIV6 Murray Scroll Belt

Sydney Basin
SB Sydney Basin

South East Coastal Plain
SCP1 Gippsland Plain
SCP2 Otway Plain
SCP3 Warrnambool Plain

South East Corner
SEC1 East Gippsland Lowlands
SEC2 South East Coastal Ranges

South Eastern Highlands
SEH1 Highlands-Southern Fall
SEH2 Highlands-Northern Fall
SEH3 Otway Ranges
SEH4 Strzelecki Ranges
SEH5 South Eastern Highlands

South Eastern Queensland
SEQ1 Burnett - Curtis Hills and Ranges
SEQ2 Moreton Basin
SEQ3 Southeast Hills and Ranges
SEQ4 Southern Coastal Lowlands
SEQ5 Brisbane - Barambah Volcanics
SEQ6 South Burnett
SEQ7 Gympie Block
SEQ8 Burnett - Curtis Coastal Lowlands
SEQ9 Great Sandy

Simpson-Strzelecki Dunefields
SSD1 Simpson-Strzelecki Dunefields P1
SSD2 Simpson Desert
SSD3 Dieri
SSD4 Warriner
SSD5 Strzelecki Desert
SSD6 Central Depression
SSD7 Bulloo Dunefields

Stony Plains
STP1 Breakaways
STP2 Oodnadatta
STP3 Murnpeowie
STP4 Peake-Dennison Inlier
STP5 Macumba

Sturt Plateau
STU1 Sturt Plateau P1
STU2 Sturt Plateau P2
STU3 Sturt Plateau P3

Swan Coastal Plain
SWA1 Dandarragan Plateau
SWA2 Perth

Tanami
TAN1 Tanami P1
TAN2 Tanami P2
TAN3 Tanami P3

Tasmania (bioregions only)
BEL Ben Lomond
KIN King
TCH Tasmanian Central Highlands
TMI Tasmanian Northern Midlands
TNS Tasmanian Northern Slopes
TSE Tasmanian South East
TSR Tasmanian Southern Ranges
TWE Tasmanian West

Tiwi Coburg
TIW1 Tiwi-Cobourg P1
TIW2 Tiwi-Cobourg P2

Victoria Bonaparte
VB1 Victoria Bonaparte P1
VB2 Victoria Bonaparte P2
VB3 Victoria Bonaparte P3

Victorian Midlands
VM1 Goldfields
VM2 Central Victorian Uplands
VM3 Greater Grampians
VM4 Dundas Tablelands

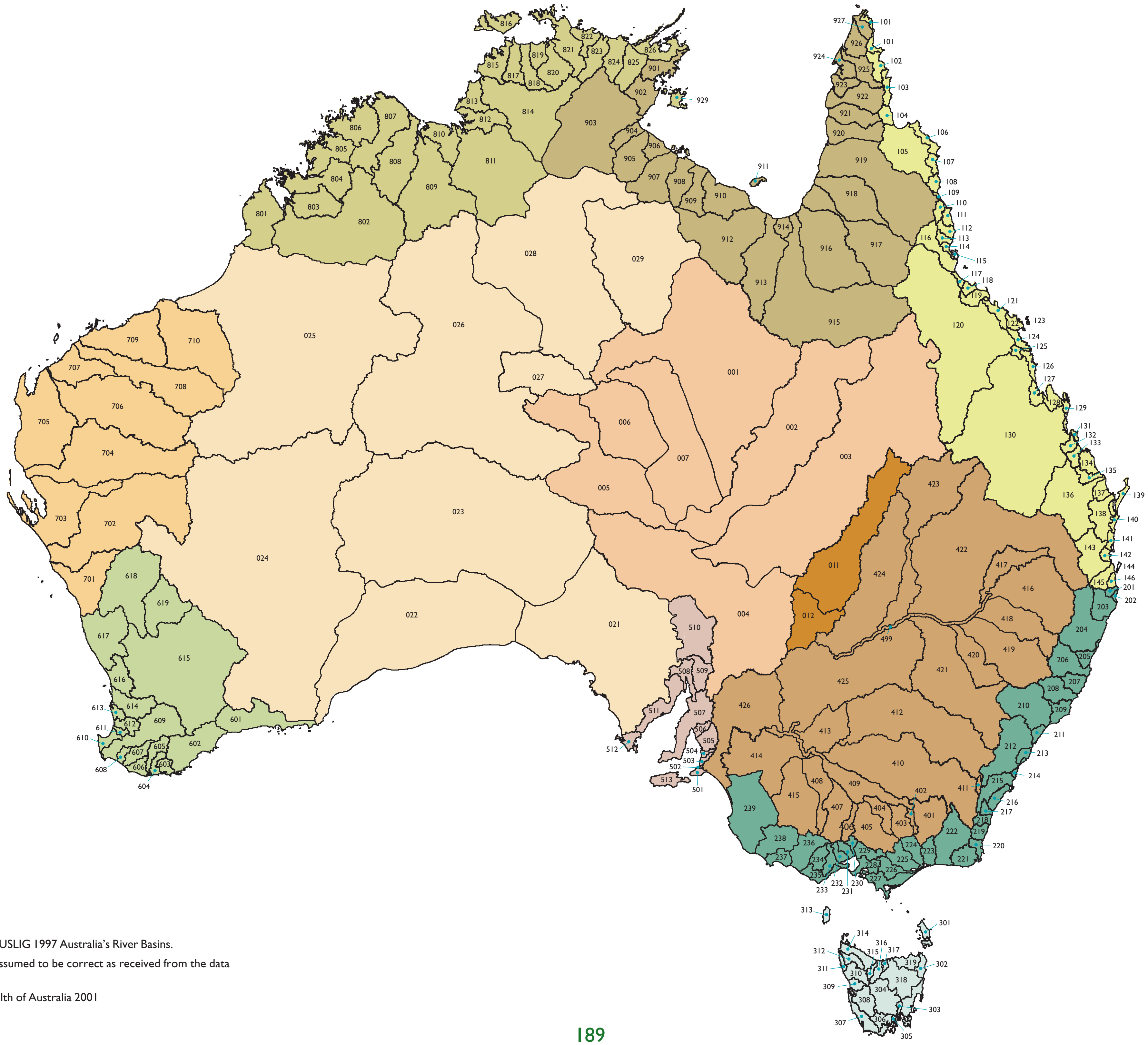
Victorian Volcanic Plain
VVP1 Victorian Volcanic Plain
VVP2 Mount Gambier

Warren
WAR Warren

Wet Tropics
WET1 Herbert
WET2 Tully
WET3 Innisfail
WET4 Atherton
WET5 Paluma - Seaview
WET6 Kirrama - Hinchinbrook
WET7 Bellenden Ker - Lamb
WET8 Macalister
WET9 Daintree - Bloomfield

Yalgoo
YAL Yalgoo

APPENDIX 4. RIVER BASINS OF AUSTRALIA



Source:

Derived from AUSLIG 1997 Australia's River Basins.

Data used are assumed to be correct as received from the data suppliers.

River basins

1. North-East Coast Drainage Division

101 Jacky Jacky Creek
102 Olive – Pascoe Rivers
103 Lockhart River
104 Stewart River
105 Normanby River
106 Jeannie River
107 Endeavour River
108 Daintree River
109 Mossman River
110 Barron River
111 Mulgrave – Russell River
112 Johnstone River
113 Tully River
114 Murray River (Qld)
115 Hinchinbrook Island
116 Herbert River
117 Black River
118 Ross River
119 Haughton River
120 Burdekin River
121 Don River
122 Proserpine River
123 Whitsunday Island
124 O'Connell River
125 Pioneer River
126 Plane Creek
127 Styx River
128 Shoalwater Creek
129 Water Park Creek
130 Fitzroy River (Qld)
131 Curtis Island
132 Calliope River
133 Boyne River
134 Baffle Creek
135 Kolan River
136 Burnett River
137 Burrum River
138 Mary River (Qld)
139 Fraser Island
140 Noosa River
141 Maroochy River
142 Pine River
143 Brisbane River
144 Stradbroke Island
145 Logan – Albert Rivers
146 South Coast

2. South-East Coast Drainage Division

201 Tweed River
202 Brunswick River
203 Richmond River
204 Clarence River
205 Bellinger River
206 Macleay River
207 Hastings River
208 Manning River
209 Karuah River
210 Hunter River
211 Macquarie – Tuggerah Lakes
212 Hawkesbury River
213 Sydney Coast – Georges River
214 Wollongong Coast
215 Shoalhaven River
216 Clyde River – Jervis Bay
217 Moruya River
218 Tuross River
219 Bega River
220 Towamba River
221 East Gippsland
222 Snowy River
223 Tambo River
224 Mitchell River
225 Thomson River
226 Latrobe River
227 South Gippsland
228 Bunyip River
229 Yarra River
230 Maribyrnong River
231 Werribee River
232 Moorabool River
233 Barwon River
234 Lake Corangamite
235 Otway Coast
236 Hopkins River
237 Portland Coast
238 Glenelg River
239 Millicent Coast

3. Tasmania Drainage Division

301 Flinders – Cape Barren Islands
302 East Coast
303 Coal River
304 Derwent River
305 Kingston Coast
306 Huon River
307 South-West Coast
308 Gordon River
309 King – Henty Rivers
310 Pieman River
311 Sandy Cape Coast
312 Arthur River
313 King Island
314 Smithton – Burnie Coast
315 Forth River
316 Mersey River
317 Rubicon River
318 Tamar River
319 Piper – Ringarooma Rivers

4. Murray–Darling Drainage Division

401 Upper Murray River
402 Kiewa River
403 Ovens River
404 Broken River
405 Goulburn River
406 Campaspe River
407 Loddon River
408 Avoca River
409 Murray – Riverina
410 Murrumbidgee River
411 Lake George
412 Lachlan River
413 Benanee
414 Mallee
415 Wimmera – Avon Rivers
416 Border Rivers
417 Moonie River
418 Gwydir River
419 Namoi River
420 Castlereagh River
421 Macquarie – Bogan Rivers
422 Condamine – Culgoa Rivers
423 Warrego River
424 Paroo River
425 Darling River
426 Lower Murray River
499 Barwon Darling Management Area

5. South Australian Gulf Drainage Division

501 Fleurieu Peninsula
502 Myponga River
503 Onkaparinga River
504 Torrens River
505 Gawler River
506 Wakefield River
507 Broughton River
508 Mambray Coast
509 Willochra Creek
510 Lake Torrens
511 Spencer Gulf
512 Eyre Peninsula
513 Kangaroo Island

6. South-West Coast Drainage Division

601 Esperance Coast
602 Albany Coast
603 Denmark River
604 Kent River
605 Frankland River
606 Shannon River
607 Warren River
608 Donnelly River
609 Blackwood River
610 Busselton Coast
611 Preston River
612 Collie River
613 Harvey River
614 Murray River (WA)
615 Avon River
616 Swan Coast
617 Moore – Hill Rivers
618 Yarra Yarra Lakes
619 Ninghan

7. Indian Ocean Drainage Division

701 Greenough River
702 Murchison River
703 Wooramel River
704 Gascoyne River
705 Lyndon – Minilya Rivers
706 Ashburton River
707 Onslow Coast
708 Fortescue River
709 Port Hedland Coast
710 De Grey River

8. Timor Sea Drainage Division

801 Cape Leveque Coast
802 Fitzroy River (WA)
803 Lennard River
804 Isdell River
805 Prince Regent River
806 King Edward River
807 Drysdale River
808 Pentecost River
809 Ord River
810 Keep River
811 Victoria River
812 Fitzmaurice River
813 Moyle River
814 Daly River
815 Finniss River
816 Bathurst and Melville Islands
817 Adelaide River
818 Mary River (WA)
819 Wildman River
820 South Alligator River
821 East Alligator River
822 Goomadeer River
823 Liverpool River
824 Blyth River
825 Goyder River
826 Buckingham River

9. Gulf of Carpentaria Drainage Division

901 Koolatong River
902 Walker River
903 Roper River
904 Towns River
905 Limmen Bight River
906 Rosie River
907 McArthur River
908 Robinson River
909 Calvert River
910 Settlement Creek
911 Mornington Island
912 Nicholson River
913 Leichhardt River
914 Morning Inlet
915 Flinders River
916 Norman River
917 Gilbert River
918 Staaten River
919 Mitchell River (Qld)
920 Coleman River
921 Holroyd River
922 Archer River
923 Watson River
924 Embley River
925 Wenlock River
926 Ducie River
927 Jardine River
928 Torres Strait Islands
929 Groote Eylandt

10. Lake Eyre Drainage Division

001 Georgina River
002 Diamantina River
003 Cooper Creek
004 Lake Frome
005 Finke River
006 Todd River
007 Hay River

11. Bulloo – Bancannia Drainage Division

011 Bulloo River
012 Lake Bancannia

12. Western Plateau Drainage Division

021 Gairdner
022 Nullarbor
023 Warburton
024 Salt Lake
025 Sandy Desert
026 Mackay
027 Burt
028 Wiso
029 Barkly

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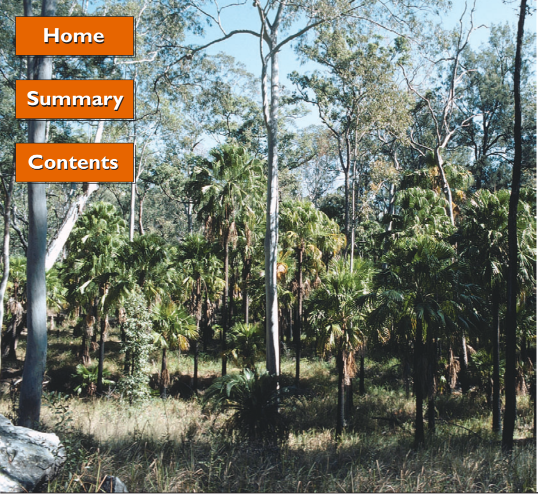

Livistona sp. in eucalypt open forest, Carnarvon Gorge National Park, Queensland

Data set level attributes

Core vegetation

DS1 Data set name
DS2 ANZLIC metadata identifier
DS3 ANZLIC metadata name
DS4 ANZLIC metadata URL
DS5 Entry level
DS6 Structural classification system
DS7 Floristic group type
DS8 Vegetation theme coverage

Positional accuracy

DS9 Positional accuracy
DS10 Positional accuracy determination
DS11 Positional accuracy measure
DS12 Positional precision

Attribute accuracy

DS13 Classification support
DS14 Sampling type
DS15 Botanical expertise
DS16 Reliability

Useable scale limits

DS17 Mapping scale
DS18 Fine scale
DS19 Broad scale

Mapping methods and sources

MM1 Mapping method number
MM2 Mapping method
MM3 Mapping expertise
MS1 Map source number
MS2 Interpretive base
MS3 Scale or resolution
MS4 Medium
MS5 Start date
MS6 End date
MS7 Map base

References

RF1 Reference number
RF2 Citation
RF3 Format
RF4 Storage location

Home
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Map unit level attributes

Core vegetation

MU1 Map unit identifier
MU2 Entry level
MU3 Spatial mix
MU4 Number of vegetation descriptions
MU5 Class
MU6 Structural formation
MU7 Broad floristic formation
MU8 Sub-formation
MU9 Association
MU10 Sub-association
MU11 Environmental description
MU12 Minor sub-associations
MU13 Source code
MU14 Source description

Vegetation description level attributes

Core vegetation

VG1 Vegetation description number
VG2 Entry level
VG3 Map unit spatial extent
VG4 Number of strata
VG5 Class
VG6 Structural formation
VG7 Broad floristic formation
VG8 Sub-formation
VG9 Association
VG10 Sub-association
VG11 Environmental description
VG12 Minor sub-associations

Source information

VG13 Source code
VG14 Source description

Structural information

STR1 Stratum number
STR2 Stratum code
STR3 Number of growth forms
STR4 Number of taxa
STR5 Cover type
STR6 Cover type derivation method
STR7 Cover minimum value
STR8 Cover maximum value
STR9 Cover median value
STR10 Cover mean value
STR11 Cover code
STR12 Height type

STR13 Height type derivation method

STR14 Height minimum value

STR15 Height maximum value

STR16 Height mean value

STR17 Height median value

STR18 Height class

STR19 Growth form code

STR20 Structural code

STR21 Broad floristic

STR22 Taxon descriptions

Growth form information

GR1 Growth form number

GR2 Dominance separator

GR3 Growth form code

GR4 Cover type

GR5 Cover type derivation method

GR6 Cover minimum value

GR7 Cover maximum value

GR8 Cover median value

GR9 Cover mean value

GR10 Cover dominance

GR11 Cover frequency

Taxon information

TX1 Taxon number

TX2 Dominance separator

TX3 Cover type

TX4 Cover type derivation method

TX5 Cover minimum value

TX6 Cover maximum value

TX7 Cover median value

TX8 Cover mean value

TX9 Cover dominance

TX10 Cover frequency

Taxon level attributes

Source information

TL1 Taxon list name

TL2 Taxon list source

TD1 Source identifier

TD2 Source code

Taxon information

TD3 Family

TD4 Genus

TD5 Species

TD6 Infraspecies rank

TD7 Infraspecies

TD8 Author

TD9 Infraspecies author

TD10 Common name

APPENDIX 6. VEGETATION DESCRIPTIONS

Example of attributes described for one vegetation description in a South Australian data set

Data set information

DS 02. ANZLIC METADATA IDENTIFIER	ANZSA1000000077
DS 03. ANZLIC METADATA NAME	Native Vegetation (Floristic) – South East
DS 04. ANZLIC METADATA URL	http://www.infoshop.sa.gov.au/asdd/ANZSA1000000077.html
DS 05. ENTRY LEVEL	Sub-association
DS 06. STRUCTURAL CLASSIFICATION SYSTEM	SA Structural Formation Table
DS 07. FLORISTIC GROUP TYPE	Indicator_biomass
DS 08. VEGETATION THEME COVERAGE	Extant only—restricted
DS 09. POSITIONAL ACCURACY	25
DS 10. POSITIONAL ACCURACY DETERMINATION	Mapped
DS 11. POSITIONAL ACCURACY MEASURE	Percentage estimate
DS 12. POSITIONAL PRECISION	Metres
DS 13. CLASSIFCATION SUPPORT	PATN dendrogram
DS 14. SAMPLING TYPE	Full vegetation sites
DS 15. BOTANICAL EXPERTISE	High
DS 16. RELIABILITY	Native vegetation data was collected in textual format as site based data through the Biological Survey of South Australia and in spatial format through the complementary mapping program. Initially the location of native vegetation mapped through the Landcover dataset program based on 1987 1:40 000 colour aerial photography. Following analysis of the field survey data, the analysis results and the field data was extrapolated to all of the polygons based on the interpretation of stereo pair colour aerial photographs. Available literature, and unpublished field notes, on native vegetation were also used to supplement the analysis and mapping. Extensive field checking was used to validate the vegetation mapping. Tilley swamp area coding and polygons were updated using 1992 1:40 000 colour aerial photography. Stoneleigh swamp – Bunbury swamp area coding and polygons were updated using 1997 1:10 000–20 000 colour aerial photography based on extensive field checking. Polygons and coding in the Gum Lagoon Swamp area were updated using 1:20 000 colour aerial photography updated 16 January 1997. Areas less than 1 ha were not mapped. Areas such as grasslands, sedgelands, low shrublands and scattered trees may not have been captured in the mapping.
DS 17. MAP PUBLICATION SCALE	50 000
DS 18. FINE SCALE	40 000
DS 19. BROAD SCALE	200 000
DS 20. START DATE ATTRIBUTE	1/01/1987
DS 21. END DATE ATTRIBUTE	31/12/1987

Reference 1

RF 02. CITATION	Regional Floristic Map
RF 03. FORMAT	Digital and hard copy
RF 04. STORAGE LOCATION	Department for Transport, Urban Planning and the Arts – Planning SA
RF 02. CITATION	SIMS – spatial information metadata system
RF 03. FORMAT	oracle database
RF 04. STORAGE LOCATION	Department of Transport, Urban Planning and the Arts

Reference 2

RF 02. CITATION	Croft T., Carruthers S., Possingham H. & Inns, B. 1999, *Biodiversity plan for the South East of South Australia*, Department for Environment, Heritage and Aboriginal Affairs.
RF 03. FORMAT	Digital
RF 04. STORAGE LOCATION	Department for Transport, Urban Planning and the Arts – Planning SA
RF 02. CITATION	Biological Survey of South Australia Vegetation Sites
RF 03. FORMAT	Digital
RF 04. STORAGE LOCATION	Department for Transport, Urban Planning and the Arts

Reference 3

RF 02. CITATION	Ground Truth Vegetation Sites
RF 03. FORMAT	Digital
RF 04. STORAGE LOCATION	Department for Transport, Urban Planning and the Arts – Planning SA

Mapping method 1

MM 02. MAPPING METHOD	Colour aerial photographic interpretation
MM 03. MAPPING EXPERTISE	High
MS 02. INTERPRETIVE BASE	True colour photography
MS 03. SCALE OR RESOLUTION	1:40 000 and 1:10 000 and 1:5000 scale
MS 04. MEDIUM	Hard copy mylar film
MS 05. START DATE SPATIAL	1/01/1987
MS 06. END DATE SPATIAL	31/12/1997
MS 07. MAP BASE	DEHAA 1:50 000 topographic series

Mapping method 2

MM 02. MAPPING METHOD	Updates – Tilley swamp area coding and polygons were updated using 1992 1:40 000 colour aerial photography. Stoneleigh swamp – Bunbury swamp area coding and polygons were updated using 1997 1:10 000–20 000 colour aerial photography based on extensive field checking. Polygons and coding in the Gum Lagoon Swamp area were updated using 1:20 000 colour aerial photography updated 16 Jan 1997.
MM 03. MAPPING EXPERTISE	High
MS 02. INTERPRETIVE BASE	Unknown
MS 03. SCALE OR RESOLUTION	Unknown
MS 04. MEDIUM	Unknown
MS 05. START DATE SPATIAL	01/01/1001
MS 06. END DATE SPATIAL	01/01/1001
MS 07. MAP BASE	Unknown

Map unit 50800010: summary information

MU 02. ENTRY LEVEL	Sub-association
MU 03. SPATIAL MIX	Mosaic unknown
MU 04. NUMBER OF VEGETATION DESCRIPTIONS	2
MU 05. LEVEL I (CLASS)	Tree mallee
MU 06. LEVEL II (STRUCTURAL FORMATION)	Open mallee forest
MU 07. LEVEL III (BROAD FLORISTIC FORMATION)	Eucalyptus open mallee forest
MU 08. LEVEL IV (SUB-FORMATION)	Eucalyptus open mallee forest/mixed unknown shrubland/mixed unknown shrubland
MU 09. LEVEL V (ASSOCIATION)	U+ *Eucalyptus diversifolia*/mallee tree/6/c;M *Xanthorrhoea caespitosa*, *Allocasuarina muelleriana* ssp. *muelleriana*/*xanthorrhoea*, shrub/–9999/Unknown;G *Hibbertia riparia*, *Lepidosperma carphoides*, *Correa reflexa* var. *reflexa*/shrub, sedge, forb/–/Unknown
MU 10. LEVEL VI (SUB-ASSOCIATION)	U1+ *Eucalyptus diversifolia*/mallee tree/6/c;M1 *Xanthorrhoea caespitosa*, *Allocasuarina muelleriana* ssp. *muelleriana*/*xanthorrhoea*, shrub/–/Unknown;G1 *Hibbertia riparia*, *Lepidosperma carphoides*, *Correa reflexa* var. *reflexa*, *Acacia spinescens*, *Astroloma hu*
MU 11. ENVIRONMENTAL DESCRIPTION	Unknown
MU 12. MINOR SUB-ASSOCIATIONS	Unknown
MU 13. SOURCE CODE	MM0010
MU 14. SOURCE DESCRIPTION	*Eucalyptus diversifolia* mallee
MU 15. DOMINANT ECOLOGICAL LAYER	U1
MU 16. VEGETATION COVER CLASSES	NN–T

Vegetation 1: summary description

VG 02. ENTRY LEVEL	Sub-association
VG 03. MAP UNIT SPATIAL EXTENT	–
VG 04. NUMBER OF STRATA	3
VG 05. LEVEL I (CLASS)	Mallee tree
VG 06. LEVEL II (STRUCTURAL FORMATION)	Open mallee forest
VG 07. LEVEL III (BROAD FLORISTIC FORMATION)	Eucalyptus open mallee forest
VG 08. LEVEL IV (SUB-FORMATION)	Eucalyptus open mallee forest/mixed unknown shrubland/ mixed unknown shrubland
VG 09. LEVEL V (ASSOCIATION)	U+ *Eucalyptus diversifolia*/mallee tree/6/c;M *Xanthorrhoea caespitosa*, *Allocasuarina muelleriana* ssp. *muelleriana*/*xanthorrhoea*, shrub/–/unknown; G *Hibbertia riparia*, *Lepidosperma carphoides*, *Correa reflexa* var. *reflexa*/shrub, sedge, forb/–/unknown
VG 10. LEVEL VI (SUB-ASSOCIATION)	U1+ Eucalyptus diversifolia/mallee tree/6/c;M1 *Xanthorrhoea caespitosa*, *Allocasuarina muelleriana* ssp. *muelleriana*/*xanthorrhoea*, shrub/–/Unknown; G1 *Hibbertia riparia*, *Lepidosperma carphoides*, *Correa reflexa* var. *reflexa*, *Acacia spinescens*, *Astroloma hu*
VG 11. ENVIRONMENTAL DESCRIPTION	Unknown
VG 12. MINOR SUB-ASSOCIATIONS	Unknown
VG 13. SOURCE CODE	MM0010
VG 14. SOURCE DESCRIPTION	*Eucalyptus diversifolia* mallee

Vegetation: stratum 1

STR 02. CODE	U1
STR 03. NUMBER OF GROWTH FORMS	1
STR 04. NUMBER OF TAXA	1
STR 05. COVER TYPE	8C
STR 06. COVER TYPE DERIVATION METHOD	Projective foliage cover estimated from classed formation category for stratum
STR 07. COVER MINIMUM VALUE	30
STR 08. COVER MAXIMUM VALUE	70
STR 09. COVER MEDIAN VALUE	–
STR 10. COVER MEAN VALUE	50
STR 11. COVER CODE	C
STR 12. HEIGHT TYPE	NA
STR 13. HEIGHT TYPE DERIVATION METHOD	Height estimated from ten individuals and averaged for all sites
STR 14. HEIGHT MINIMUM VALUE	–
STR 15. HEIGHT MAXIMUM VALUE	–
STR 16. HEIGHT MEAN VALUE	4
STR 17. HEIGHT MEDIAN VALUE	–
STR 18. HEIGHT CLASS	6
STR 19. GROWTH FORM CODE	M
STR 20. STRUCTURAL CODE	M6c
STR 21. BROAD FLORISTIC	M
STR 22. TAXON DESCRIPTIONS	*Eucalyptus diversifolia*

Vegetation 1: stratum 1: growth form 1

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	M
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	100
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	40
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 1: taxon information 1

TX 02. DOMINANCE SEPARATOR	.
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	25
TX 06. COVER MAXIMUM VALUE	50
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	38
TX 09. COVER DOMINANCE	D
TX 10. COVER FREQUENCY	A

Vegetation 1: stratum 2

STR 02. CODE	M1
STR 03. NUMBER OF GROWTH FORMS	2
STR 04. NUMBER OF TAXA	2
STR 05. COVER TYPE	Unknown
STR 06. COVER TYPE DERIVATION METHOD	Unknown
STR 07. COVER MINIMUM VALUE	–
STR 08. COVER MAXIMUM VALUE	–
STR 09. COVER MEDIAN VALUE	–
STR 10. COVER MEAN VALUE	–
STR 11. COVER CODE	*
STR 12. HEIGHT TYPE	Unknown
STR 13. HEIGHT TYPE DERIVATION METHOD	Unknown
STR 14. HEIGHT MINIMUM VALUE	–
STR 15. HEIGHT MAXIMUM VALUE	–
STR 16. HEIGHT MEAN VALUE	–
STR 17. HEIGHT MEDIAN VALUE	–
STR 18. HEIGHT CLASS	*
STR 19. GROWTH FORM CODE	S
STR 20. STRUCTURAL CODE	S**
STR 21. BROAD FLORISTIC	x
STR 22. TAXON DESCRIPTIONS	*Xanthorrhoea caespitosa*+-*Allocasuarina muelleriana* ssp. *muelleriana*

Vegetation 1: stratum 2: growth form 1

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	X
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	100
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	40
GR 10. DOMINANCE	unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 2: taxon information 1

TX 02. DOMINANCE SEPARATOR	.
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	D
TX 10. COVER FREQUENCY	A

Vegetation 1: stratum 2: growth form 2

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	S
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	100
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	40
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 2: taxon information 2

TX 02. DOMINANCE SEPARATOR	+/-
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	SD
TX 10. COVER FREQUENCY	C

Vegetation 1: stratum 3

STR 02. CODE	G1
STR 03. NUMBER OF GROWTH FORMS	5
STR 04. NUMBER OF TAXA	5
STR 05. COVER TYPE	Unknown
STR 06. COVER TYPE DERIVATION METHOD	Unknown
STR 07. COVER MINIMUM VALUE	–
STR 08. COVER MAXIMUM VALUE	–
STR 09. COVER MEDIAN VALUE	–
STR 10. COVER MEAN VALUE	–
STR 11. COVER CODE	*
STR 12. HEIGHT TYPE	Unknown
STR 13. HEIGHT TYPE DERIVATION METHOD	Unknown
STR 14. HEIGHT MINIMUM VALUE	–
STR 15. HEIGHT MAXIMUM VALUE	–
STR 16. HEIGHT MEAN VALUE	–
STR 17. HEIGHT MEDIAN VALUE	–
STR 18. HEIGHT CLASS	*
STR 19. GROWTH FORM CODE	S
STR 20. STRUCTURAL CODE	S**
STR 21. BROAD FLORISTIC	x
STR 22. TAXON DESCRIPTIONS	*Hibbertia riparia, Lepidosperma carphoides – Correa reflexa* var. *reflexa*

Vegetation 1: stratum 3: growth form 1

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	S
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	100
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	40
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 3: taxon information 1

TX 02. DOMINANCE SEPARATOR	,
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	CD
TX 10. COVER FREQUENCY	A

Vegetation 1: stratum 3: growth form2

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	V
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	100
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	33
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 3: taxon information 2

TX 02. DOMINANCE SEPARATOR	,
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	CD
TX 10. COVER FREQUENCY	C

Vegetation 1: stratum 3: growth form 3

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	F
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	100
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	28
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 3: taxon information 3

TX 02. DOMINANCE SEPARATOR	-
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	SD
TX 10. COVER FREQUENCY	C

Vegetation 1: stratum 3: growth form 4

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	G
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	70
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	20
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	A

Vegetation 1: stratum 3: taxon information 4

TX 02. DOMINANCE SEPARATOR	-
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	SD
TX 10. COVER FREQUENCY	C

Vegetation 1: stratum 3: growth form 5

GR 02. DOMINANCE SEPARATOR	,
GR 03. GROWTH FORM CODE	H
GR 04. COVER TYPE	5C
GR 05. COVER TYPE DERIVATION METHOD	Canopy cover averaged from classed categories summarised with life form codes as a structural overview
GR 06. COVER MINIMUM VALUE	1
GR 07. COVER MAXIMUM VALUE	10
GR 08. COVER MEDIAN VALUE	–
GR 09. COVER MEAN VALUE	5
GR 10. DOMINANCE	Unknown
GR 11. FREQUENCY	R

Vegetation 1: stratum 3: taxon information 5

TX 02. DOMINANCE SEPARATOR	-
TX 03. COVER TYPE	9C
TX 04. COVER TYPE DERIVATION METHOD	Unknown
TX 05. COVER MINIMUM VALUE	0
TX 06. COVER MAXIMUM VALUE	1
TX 07. COVER MEDIAN VALUE	–
TX 08. COVER MEAN VALUE	1
TX 09. COVER DOMINANCE	SD
TX 10. COVER FREQUENCY	C

APPENDIX 7. NVIS CLASSIFICATION INFORMATION

Phragmites australis, Eucalyptus camaldulensis, River Murray, Calperum, South Australia

National Vegetation Information System structural formation nomenclature

Cover characteristics			
	Foliage cover*	70–100	30–70
	Crown cover**	> 80	50–80
	Percent cover***	> 80	50–80
Growth form	**Height range**	**Structural formation classes**	
Tree	< 10, 10–30, > 30	closed forest	open forest
Tree mallee	< 3, < 10 (3–10)	closed mallee forest	open mallee forest
Shrub	< 1, 1–2, > 2	closed shrubland	shrubland
Mallee shrub	< 3, < 10 (3–10)	closed mallee shrubland	mallee shrubland
Heath shrub	< 1, 1–2, > 2	closed heathland	heathland
Chenopod shrub	< 1, 1–2, > 2	closed chenopod shrubland	chenopod shrubland
Samphire shrub	< 0.5, > 0.5	closed samphire shrubland	samphire shrubland
Hummock grass	< 2, > 2	closed hummock grassland	hummock grassland
Tussock grass	< 0.5, > 0.5	closed tussock grassland	tussock grassland
Sod grass	< 0.5, > 0.5	closed sod grassland	sod grassland
Sedge	< 0.5, > 0.5	closed sedgeland	sedgeland
Rush	< 0.5, > 0.5	closed rushland	rushland
Forb	< 0.5, > 0.5	closed forbland	forbland
Fern	< 1, 1–2, > 2	closed fernland	fernland
Moss	< 0.5	closed mossland	mossland
Lichen	< 0.5	closed lichenland	lichenland
Liverwort	< 0.5	closed liverwort land	liverwortland
Vine	< 10, 10–30, > 30	closed vineland	vineland
Palm	< 10, 10–30, > 30	closed palmland	palmland
Xanthorrhoea	< 1, 1–2, > 2	closed xanthorrhoealand	xanthorrhoealand
Cycad	< 1, 1–2, > 2	closed cycadland	cycadland
Seagrass	0–0.5, < 1	closed seagrass bed	seagrassbed

* Foliage cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is similar to the crown type of Walker and Hopkins (1990) but is applied to a stratum or plot rather than an individual crown. It is generally not directly measured in the field for the upper stratum, although it can be measured by various line interception methods for ground layer vegetation. In the data compiler (attributes STR. 11 COVER CODE) the ground cover category refers to ground foliage cover not percentage cover

** Crown cover (canopy cover) as per Walker and Hopkins (1990). The relationship between foliage cover and crown cover has come from Walker and Hopkins (1990). Although relationships between the two are dependent on factors such as season, species and species age, the crown cover category classes have been adopted as the defining measure.

*** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect methods on ground layer, or overstorey vegetative cover. That is for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover.

10–30	<10	0	0–5
20–50	0.25–20	< 0.25	0–5
20–50	0.25–20	< 0.25	0–5
Structural formation classes			
woodland	open woodland	isolated trees	isolated clumps of trees
mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees
open shrubland	sparse shrubland	Isolated shrubs	Isolated clumps of shrubs
open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs
open heath	sparse heath	isolated heath shrubs	isolated clumps of heath shrubs
open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs
open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs
open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses
open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses
open sod grassland	sparse sod grassland	isolated sod grasses	isolated clumps of sod grassland
open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges
open rushland	sparse rushland	isolated rushes	isolated clumps of rushes
open forbland	sparse forbland	isolated forbs	isolated clumps of forbs
open fernland	sparse fernland	isolated ferns	isolated clumps of ferns
open mossland	sparse mossland	isolated mosses	isolated clumps of mosses
open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens
open liverwortland	sparse liverwortland	isolated liverworts	isolated clumps of liverworts
open vineland	sparse vineland	isolated vines	isolated clumps of vines
open palmland	sparse palmland	isolated palms	isolated clumps of palms
open xanthorrhoealand	sparse xanthorrhoealand	isolated xanthorrhoeas	isolated clumps of xanthorrhoeas
open cycadland	sparse cycadland	isolated cycads	isolated clumps of cycads
open seagrassbed	sparse seagrassbed	isolated seagrasses	isolated clumps of seagrass

NVIS height classes (after Walker & Hopkins 1990)

		Growth form					
Height class	Height range (m)	Trees, vines, palms	Cycads, xanthorrhoea	Mallee, Mallee shrub	Shrubs, heath shrub, chenopod shrub, ferns, samphire	Tussock and hummock grasses, sedges, rushes, forbs	Sod grass, liverwort, lichen, moss and seagrasses
8	> 30	tall	n/a	n/a	n/a	n/a	n/a
7	10–30	–	n/a	tall	n/a	n/a	n/a
6	< 10	low	–	–	n/a	n/a	n/a
5	< 3	n/a	n/a	low	n/a	n/a	n/a
4	> 2	n/a	tall	n/a	tall	tall	n/a
3	1–2	n/a	–	n/a	–	tall	n/a
2	0.5–1	n/a	low	n/a	low	–	tall
1	< 0.5	n/a	low	n/a	low	low	–

n/a not applicable

APPENDIX 8. NATIONAL VEGETATION INFORMATION SYSTEM STAGE I DATA SETS

Data set name	Data set number	Pre-European	Present	Publication scale	Attribute start date	Attribute end date	Spatial mapping start date	Spatial mapping end date
Australian Capital Territory								
Ainslie – Majura Reserve vegetation communities	104		e	5000	1972	1972	1972	1972
Vegetation types Cotter Catchment	109		e	25000	1973	1973	1973	1973
Distribution of natural temperate grassland	102		e	25000	1997	1997	1997	1997
Murrumbidgee River Corridor Vegetation	105		e	10000	1975	1975	1975	1975
Pryor's vegetation map	110	p		250000	1939	1939	1939	1939
Vegetation of Mount Tennent – Blue Gum Creek	107		e	25000	1987	1987	1987	1987
Tidbinbilla Nature Reserve	106		e	25000	1985	1985	1985	1985
Upper Cotter Wilderness	108		e	25000	1988	1988	1988	1988
Potential wetlands below 1000 m altitude	101		e	10000	1999	1999	1999	1999
Extent and quality of remnant woodland	103		e	25000	1997	1997	1997	1997
New South Wales								
Eastern Bushlands Database	207		e	250000	1991	1993	1991	1993
Vegetation of south east Forests Region, Eden	201	p	e	100000	1998	1999	1998	1999
M305 Floristic Vegetation Mapping of MDB	205		e	25000	1978	2000	1978	2000
Royal Botanic Gardens Hawkesbury–Nepean	220		e	100000	1988	2000	1988	2000
Royal Botanic Gardens north west NSW	219		e	1000000	1994	2000	1994	2000
Hunter Remnant Vegetation (REMS)	211	p		25000	1999	2000	1999	2000
Royal Botanic Gardens Riverina Mapping	217		e	250000	1980	2000	1980	2000
Southern Comprehensive Regional Assessment	206	p	e	50000	1985	1999	1998	1999
NPWS Wheatbelt Remnant Mapping: Series 1	202		e	250000	1991	1993	1991	1993
NPWS Wheatbelt Remnant Mapping: Series 3	203		e	250000	1978	2000	1978	2000
NPWS Wheatbelt Remnant Mapping: Series 4 and 5	204		e	50000	1978	2000	1978	2000
Western Sydney – Cumberland Plain	208	p	e	100000	1999	2000	1999	2000
NPWS Wheatbelt Remnant Mapping: Series 2	222		e	250000	1987	1991	1987	1991
Northern Territory								
Vegetation Map	320	p	e	1000000	1986	1990	1984	1986
Combined coverage of vegetation units (data sets 306, 310, 318)	322	p	e	100000	1990	1993	1980	1993
Land Systems of Arnhem Land	302	p	e	250000	1990	1992	1982	1985
Land Units of Erldunda	304	p	e	100000	1998	1999	1980	1986
Vegetation/Land unit Survey of Gregory National Park	306	p	e	100000	1990	1993	1990	1993
Land Units of the Southern Gulf	308	p	e	250000	1986	1987	1968	1968
Lancewood Survey	310	p	e	100000	1991	1991	1980	1990

Data set name	Data set number	Pre-European	Present	Publication scale	Attribute start date	Attribute end date	Spatial mapping start date	Spatial mapping end date
Northern Territory (continued)								
Combined coverage of land systems (data sets 302, 308)	312	p	e	250000	1986	1992	1968	1985
Land Units of Lucy Creek	314	p	e	100000	1998	1999	1986	1995
Combined coverage of land units (data sets 324, 314, 304)	316	p	e	100000	1990	2000	1980	1995
Melaleuca Survey	318	p	e	100000	1990	1993	1980	1990
Land Units of the Victoria River Downs	324	p	e	100000	1990	2000	1990	1993
Queensland								
Brigalow Belt North (BBN)	413		e	100000	1998	1998	1995	1995
Brigalow Belt North (BBN)	412	p		100000	1998	1998	1995	1995
Brigalow Belt South (BBS)	415		e	100000	1998	1998	1995	1995
Brigalow Belt South (BBS)	414	p		100000	1998	1998	1995	1995
Blackall	402	p		100000	1997	1998	1997	1998
Blackall	401		e	100000	1998	1998	1995	1995
Central Western Qld (CWQ)	403	p		100000	1986	1988	1986	1988
Cape York Peninsula (CYP)	411	p		100000	1992	1995	1992	1995
Desert Uplands Queensland (DEU)	407	p		100000	1995	1998	1995	1998
Desert Uplands Queensland (DEU)	406		e	100000	1998	1998	1995	1995
South Central Queensland (SCQ)	405	p		100000	1976	1978	1976	1978
South Central Queensland (SCQ)	404		e	100000	1978	1978	1995	1995
South East Queensland (SEQ)	408	p		100000	1994	1998	1994	1998
South East Queensland (SEQ)	409		e	100000	1998	1998	1995	1995
South West Queensland (SWQ)	410	p		100000	1980	1982	1980	1982
South Australia								
Vegetation Map (BOOMSMA) (interim data)	501	p		2000000	1937	1972	1937	1972
Coongie	503		e	100000	1986	1987	1986	1987
Flinders Ranges	504		e	100000	1984	1999	1978	1995
Offshore Islands	507		e	50000	1966	1988	1971	2000
Kangaroo Island	517		e	50000	1989	1997	1991	1991
Mid North	502		e	50000	1992	1994	1987	1994
South Mt Lofty Ranges (interim data)	509		e	50000	1985	1985	1985	1985
Murray Mallee	505		e	50000	1990	1990	1985	1989
North Olary Plains	506		e	100000	1995	1996	1981	1987
South East	508		e	50000	1991	1997	1987	1997
South Olary Plains	510		e	100000	1991	1991	1987	1994

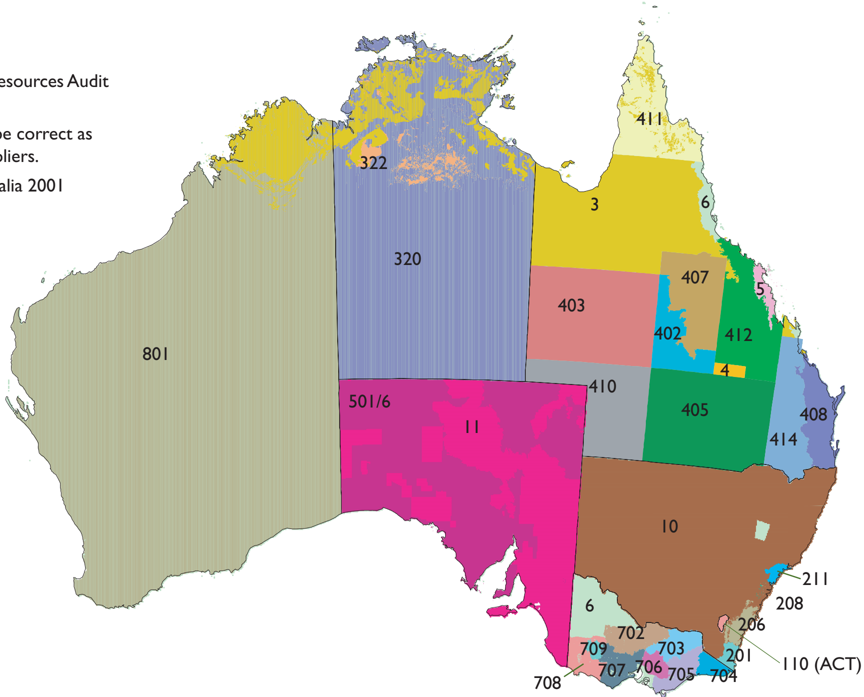
Data set name	Data set number	Pre-European	Present	Publication scale	Attribute start date	Attribute end date	Spatial mapping start date	Spatial mapping end date
South Australia (continued)								
Stony Deserts	511		e	250000	1993	1996	1978	1994
Tallaringa	512		e	100000	1988	1988	1988	1988
Unnamed Conservation Park (CP049)	513		e	250000	1972	1973	1972	1973
Western Murray Flats	514		e	50000	1992	1992	1985	1991
Yellabinna	515		e	100000	1987	1987	1987	1987
Yumbarra Conservation Park	516		e	100000	1995	1995	1995	1995
Tasmania								
Vegetation Management Strategy	601		e	25000	1996	1999	1996	1999
Reconstructed pre European vegetation (draft)	603	p		100000	1996	1999	1996	1999
World Heritage Area	602		e	25000	1996	1999	1996	1999
Victoria								
Central Highlands Regional Forest Agreement	760		e	100000	1996	1996	1996	1996
Central Highlands Regional Forest Agreement	706	p		100000	1992	2000	1992	2000
East Gippsland Regional Forest Agreement	740		e	100000	1994	1994	1994	1994
East Gippsland Regional Forest Agreement	704	p		100000	1992	2000	1992	2000
Gippsland Regional Forest Agreement	750		e	100000	1998	1998	1998	1998
Gippsland Regional Forest Agreement	705	p		100000	1992	2000	1992	2000
Goldfields	720		e	100000	1988	1988	1988	1988
Goldfields	702	p		100000	1992	2000	1992	2000
Grampians	770		e	100000	1998	1998	1998	1998
Grampians	709	p		100000	1992	2000	1992	2000
Mallee	710		e	100000	1996	1996	1996	1996
Midlands/Otways (West Regional Forest Agreement)	780		e	100000	1998	1998	1998	1998
Midlands/Otways (West Regional Forest Agreement)	707	p		100000	1992	2000	1992	2000
North East Regional Forest Agreement	730		e	100000	1997	1997	1997	1997
North East Regional Forest Agreement	703	p		100000	1992	2000	1992	2000
Portland/Wimmera (West Regional Forest Agreement)	790		e	100000	1999	1999	1999	1999
Portland/Wimmera (West Regional Forest Agreement)	708	p		100000	1992	2000	1992	2000
Western Australia								
Present Vegetation Present Vegetation Extent	802		e	250000	1960	1990	1960	1997
Beard Pre-European Vegetation	801	p		250000	1960	1990	1960	1997

Figure A1 Pre-European major vegetation group data set sources.

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.



Australian Capital Territory

110	Pryor's vegetation map of the ACT

New South Wales

201	Vegetation of south-east forests Region, Eden, NSW
206	Southern Comprehensive Regional Assessment, NSW
208	Western Sydney – Cumberland Plain, NSW
211	Hunter Regional Environmental Management Strategy (REMS), NSW

Northern Territory

320	Vegetation Map of the NT
322	Combined coverage of vegetation units of the NT (Vegetation/Land unit Survey of Gregory National Park, Lancewood Survey, Melaleuca Survey)

Queensland

402	Blackall, Qld (1:250 000)
403	Central Western Qld (CWQ)
405	South Central Qld (SCQ)
407	Desert Uplands Qld (DEU)
408	South East Qld (SEQ)
410	South West Qld (SWQ)
411	Cape York Peninsula Qld
412	Brigalow Belt North Qld (BBN)
414	Brigalow Belt South Qld (BBS)

Tasmania

603	Reconstructed vegetation, Tas

603

Victoria

702	Goldfields, Vic
703	North-east RFA, Vic
704	East Gippsland RFA, Vic
705	Gippsland RFA, Vic
706	Central Highlands RFA, Vic
707	Midlands/Otways (West RFA), Vic
708	Portland/Wimmera (West RFA), Vic
709	Grampians, Vic

Western Australia

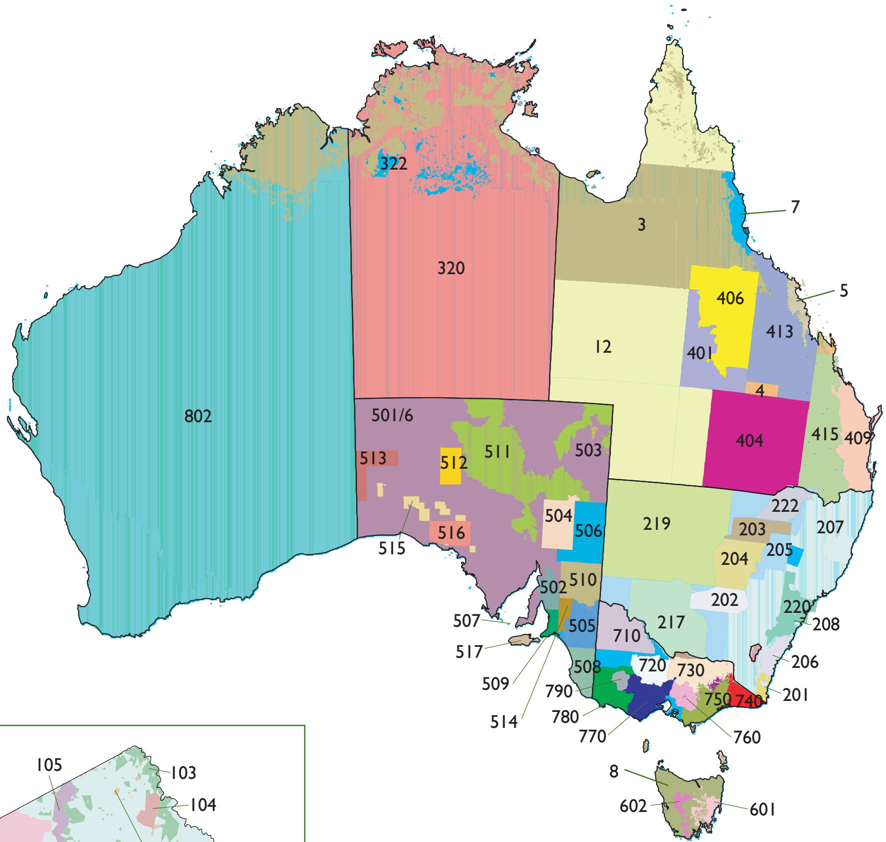
801	Pre-European Vegetation, WA

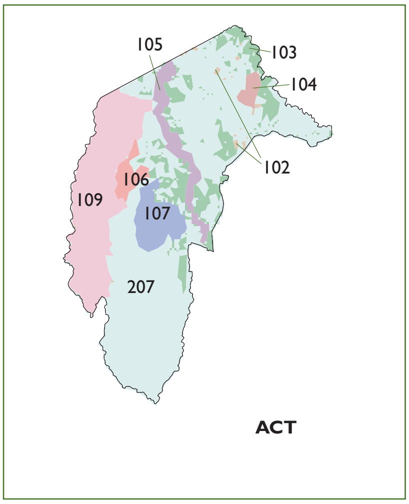
Additional data:

11	NVIS present vegetation
5	Central Queensland Coast (CQC), Queensland (1:100 000)
4	Springsure, Queensland (1:100 000)
3	The vegetation of the Australian Tropical Savannas (1 million)
501/6	Boomsma / Carnahan Natural Vegetation derived data (1:5 000 000)
10	NVIS present vegetation
6	Carnahan Natural Vegetation (1:5 000 000)

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the NVIS. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Figure A2. Present major vegetation group data set sources.





Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

These summary maps and tables provide information on Australia's native vegetation collated within the National Vegetation Information System at July 2001 and with additional mapped information where not available from the NVIS. The National Vegetation Information System will be updated continuously as vegetation mapping data becomes available from States and Territories.

Australian Capital Territory

102 Distribution of natural temperate grasslands,
103 Extent and quality of remnant woodlands
104 Ainslie – Majura Reserve vegetation communities
105 Murrumbidgee River Corridor Vegetation
106 Tidbinbilla Nature Reserve
107 Vegetation of Mount Tennent – Blue Gum Creek
109 Vegetation types Cotter Catchment

New South Wales

201 Vegetation of south-east forests Region, Eden
202 NPWS Wheatbelt Remnant Mapping (Series 1)
222 NPWS Wheatbelt Remnant Mapping (Series 2)
203 NPWS Wheatbelt Remnant Mapping (Series 3)
204 NPWS Wheatbelt Remnant Mapping (Series 4 and 5)
205 M305 Floristic Vegetation Mapping of the Murray–Darling Basin portion of New South Wales
206 Southern Comprehensive Regional Assessment
207 Eastern Bushlands Database
208 Western Sydney – Cumberland Plain
217 Royal Botanic Gardens Riverina Mapping
219 Royal Botanic Gardens north-west NSW
220 Royal Botanic Gardens Hawkesbury-Nepean (Sydney)

Northern Territory

320 Vegetation Map of the Northern Territory
322 Combined coverage of vegetation units of the Northern Territory (Vegetation/Land unit Survey of Gregory National Park, Lancewood Survey, Melaleuca Survey)

Queensland

401 Blackall, Queensland (1:250 000)
404 South Central Queensland (SCQ)
406 Desert Uplands Queensland (DEU)
409 South East Queensland (SEQ)
413 Brigalow Belt North Queensland (BBN)
415 Brigalow Belt South Queensland (BBS)

South Australia

502 Midnorth, South Australia
503 Coongie, South Australia
504 Flinders Ranges, South Australia
505 Murray Mallee, South Australia
506 North Olary Plains, South Australia
507 Offshore Islands, South Australia
508 South East, South Australia
509 South Mt Lofty Ranges, South Australia
510 South Olary Plains, South Australia
512 Unnamed Conservation Park (CP049), South Australia
513 Tallaringa, South Australia
511 Stony Deserts, South Australia
514 Western Murray Flats, South Australia
515 Yellabinna, South Australia
516 Yumbarra Conservation Park, South Australia
517 Kangaroo Island, South Australia

Tasmania

601 Vegetation Management Strategy, Tasmania
602 World Heritage Area, Tasmania

Victoria

710 Mallee, Victoria
720 Goldfields, Victoria
730 North-east RFA, Victoria
740 East Gippsland RFA, Victoria
750 Gippsland RFA, Victoria
760 Central Highlands RFA, Victoria
770 Midlands/Otways (West RFA), Victoria
780 Portland/Wimmera (West RFA), Victoria
790 Grampians, Victoria

Western Australia

802 Present Vegetation Extent, Western Australia

Additional data

3 The vegetation of the Australian Tropical Savannas (1 million)
4 Springsure, Queensland (1:100 000)
5 Central Queensland Coast (CQC), Queensland (1:100 000)
7 Carnahan Present Vegetation (1:5 000 000)
501/6 Boomsma / Carnahan Natural Vegetation derived data (1:5 000 000)
8 Kirkpatrick & Dickinson (1: 500 000)
12 NVIS pre-European vegetation

APPENDIX 9. PHASES TO THE DEVELOPMENT OF THE NATIONAL VEGETATION INFORMATION SYSTEM FRAMEWORK AND SYSTEM

Partnerships and the specification of client needs for vegetation information

The Audit's Vegetation Theme Work Plan (Cofinas et al. 1999) was developed in collaboration with State, Territory and Commonwealth agencies and was designed to specify and schedule a series of project tasks to:

- collect and construct a consistent set of core vegetation data sets;
- derive data needed to prepare theme reports;
- develop methods to analyse these data;
- produce and communicate final outputs and reports; and
- provide a forum for negotiating methods, contributions, partnerships and synergy between the Audit and other activities at regional, State and Commonwealth levels.

The products specified in the work plan were:

- a framework for the National Vegetation Information System that includes nationally consistent specifications for data attributes and standards;
- an archive of all vegetation data received and translated into the data compiler according to the specifications and standards;
- metadata meeting Australian New Zealand Land Information Council standards (page 0) and agreed page 1 attributes;
- coverage to include both present and pre-European vegetation data (map and site) where available;
- development of methods, database specifications and compilation of existing data describing vegetation condition; and
- a final report reporting on Australia's vegetation; detailing gaps in digital vegetation data; and providing recommendations of priority activities to continue the initiative in the context of programs and activities underway across Australia in vegetation management.

Vegetation attributes and databases

Environment Australia as project leader, undertook to deliver the Australian Vegetation Attributes and National Vegetation Information System databases in preparation for the data collation phase.

Subsequent pilot testing and review of these with the Bureau of Rural Sciences as project leader and States and Territories on the Vegetation Attributes (Version 4) and Data Compiler (Version 1) resulted in development of the next versions of each. These later, more refined versions were used to develop Stage I of the National Vegetation Information System.

Available reports are listed in the *References* section.

Vegetation data audit

The Bureau of Rural Sciences coordinated the development of the National Vegetation Information System metadata requirements for use in the data audit and compilation projects.

The aims of the National Vegetation Information System data audit project was to:

- collect, collate and report on metadata on vegetation data through the Australian Spatial Data Directory;
- document metadata records comprising the best available vegetation data sets including maps and site-based surveys and time-series (pre-European to present);
- provide resources to enable vegetation data sets to access through on-line data query and mapping services via the nodes of the Australian Spatial Data Directory; and
- identify the best available vegetation data sets that comply with National Vegetation Information System Vegetation attributes as a basis for gap-filling in Stage 2 of the National Vegetation Information System (spatial, temporal and attribute gaps).

The data audit and compendium of metadata records represents an advance over previous exercises that have aimed to compile a national compendium of metadata records with input from State and Territory agencies. These metadata records will be available through the State Australian Spatial Data Directory nodes <www.auslig.gov.au>.

The majority of metadata records compiled in the National Vegetation Information System metadata compendium comprise site-based data sets with 763 records, 485 of which were sourced from digital data sets. Polygon-based data sets comprised the next largest number of records with 387 records, 275 of which were sourced from digital data sets. Raster-based data sets comprised the least number of data sets documented, with only 20 records, all of which were sourced from digital data sets.

Vegetation mapping data compilation

After the completion of the pilot projects and revision of the vegetation attributes and databases, the Bureau of Rural Sciences as project leader and the States and Territories undertook to populate the National Vegetation Information System with an agreed group of data sets. The data was sourced primarily from existing digital information with some additional interpretation from hardcopy reports.

This phase of the project was complicated and resource intensive. Extensive communication was required between the Bureau of Rural Sciences and each of the States and Territories to ensure that issues such as quality control were addressed as they arose. Translation and compilation of the large volume of data in each State and Territory and its integration into the national database proved a major task and represented a significant investment in time and resources.

The time frame allowed for this activity doubled with a large proportion of validation required by the Bureau of Rural Sciences to ensure each data set complied with the attribute standards. For most agencies the translation process was complicated and time consuming. The best quality data was received from those agencies that ensured vegetation mappers who were familiar with both the vegetation attributes framework and State and Territory data sets were directly involved with the project or had statewide mapping projects developed.

The scale, line work and attributes of the original data have been retained in the National Vegetation Information System to ensure that the best available information is used to derive a range of products.

Data checking and validation

An assessment was made of the quality and completeness of the data as it was received. Since most jurisdictions were consistent in their compilation of Levels I–III, these Levels I–III were validated in accordance with the vegetation attributes framework. Data for pre-European and the current vegetation attributes were validated. Levels IV–V were not validated because many of the States and Territories had either not compiled these levels in accordance with the vegetation attributes framework or these data were missing.

During the process of validating Levels I–III, a large number of inconsistencies were observed between the map units and data sets in Level IV. Due to these inconsistencies the process of validating Level IV is not yet completed. It is expected that the observed inconsistencies can be overcome by deriving an alternate Level V using available data in Level V and other attributes in the database:

- only half the States and Territories have successfully compiled Level IV (Northern Territory, Queensland, South Australia and Victoria) in accordance with the attribute standard. These data are internally consistent within the State and Territory and can be used in this context; and
- Australian Capital Territory, New South Wales, Tasmania and Western Australia have either not entered Level IV (e.g. Australian Capital Territory, Western Australia) or have entered the same data for Level III in Level IV (e.g. New South Wales and Tasmania). Western Australia has recently resupplied data for their Level IV.

Spatial data compilation

Spatial data transfer protocols were developed in consultation with data custodians to enable efficient transfer of the data in a consistent format. To enable the spatial and attribute data to be loaded into the database data custodians were required to establish a link between these attribute types.

The spatial data compilation proved to be one of the most time and resource intensive activities in the process. This issue arose in those regions of Australia where clearing has created a plethora of very small patches within a fragmented landscape. This resulted in very large spatial data sets that challenged the best geographic information system computer systems in Canberra.

APPENDIX 10. METHODS TO DERIVE MAJOR VEGETATION GROUPS AND MAJOR VEGETATION SUBGROUPS

Mapping Australia's native vegetation at continental scales

The size and complexity of the National Vegetation Information System data sets presented a series of technical difficulties in accessing the data and interpreting it conceptually or spatially above regional scales. To provide a continental overview of native vegetation that would be discernible at broad mapping scales and that would be easy for a wide range of users to interpret was a major restriction on the level of detail that could be used.

Large scale maps of 1:40 000 000 scale which form the basis for the user interface in the Australian Natural Resources Atlas and this report necessitated the analysis be restricted to a small number of vegetation types.

The majority of the vegetation data compiled into the National Vegetation Information System has been mapped at between 1:250 000 to 1:100 000 scale. It includes some very broad-scale data, for example from the Northern Territory which was at 1:1 000 000 scale. The fine scales of mapping present a complex set of line work for representation at State and Territory and Australia-wide scales and many difficulties in ensuring continuity in map units across state borders and map sheets. Amalgamation of the spatial data for mapping units defined at association (Level V), or sometimes at subassociation (Level VI) level, into major groups for this overview of Australia's vegetation helped overcome some of these difficulties with the finer scale mapping.

Resolving classification inconsistencies

A manual assignment of the map units to the major vegetation groups was undertaken. As data collection further develops with resolution of inconsistencies in the nomenclature or description of some attributes and in the assignment of attributes at some levels, it will become possible to directly interrogate the data. This will result in minimising the risk of errors in the allocation of structural categories. Inconsistencies were addressed by checking the species present in Level IV and if need be in Level V or the State/Territory map unit descriptions.

Some vegetation community descriptors not related to structural attributes alone caused some problems (e.g. heaths proved to be problematic, with no clear definition of what communities should be included under this label). Care was taken in the development of the major vegetation groups to include not just the southern ericoid heaths but related tropical communities and other closed shrublands, particularly in South Australia. South Australia does not use heath as a descriptor in plant community definition. Advice was sought on what taxa were the best indicators of 'heath' communities in this situation.

Another major difference in nomenclature was related to jurisdictions describing similar communities at Level III as chenopod in one state and samphire in another.

Development of the major vegetation groups

Twenty-three major vegetation groups were delineated across Australia. Many of these vegetation groups are widespread and contain a large number of vegetation associations and sub-associations. Some groups such as rainforests are comparatively restricted and isolated in their occurrence.

The stratification and aggregation of the '100 plus' structural attributes (Level II) was the first step in the development of the major vegetation groups. The criteria for this stratification included:

- major structural groups recognised and commonly used in overviews and discussions on vegetation by the States/Territories and other agencies. This was determined from a review of State/Territory vegetation overviews, recognising that one of the strengths of the National Vegetation Information System is that vegetation descriptions relate to dominant vegetation, not just upper stratum descriptors;
- groupings that help overcome some of the inconsistencies in nomenclature and description of vegetation units by the jurisdictions (e.g. putting samphire and chenopods in the same group); and
- distinct environments worthy of separate discussion in vegetation analyses (e.g. rainforest, mangrove/saltmarsh communities).

This process included a review of previous Australia-wide overviews of vegetation by Australian Surveying and Land Information Group (1990) and Beadle (1981), with cognisance of the limitations of being able discern the different classes either on-screen or on hardcopy maps.

Although the major vegetation groups were developed for national and State and Territory summaries of the vegetation data, they are valuable in providing context for more detailed vegetation descriptions at regional scales.

Development of more detailed major vegetation subgroups

A further stratification of the major vegetation groups was undertaken to more clearly define the extent of and type of major ecosystems or vegetation communities at scales near 1:5 000 000.

A stratification of the data was sought which, in combination, would allow appropriate aggregation for the display of vegetation data at a range of mapping scales. For maps produced at larger scales more detail is discernible and hence a larger number of mapping units than the 23 major vegetation groups is possible.

The data were stratified into a series of logical subgroups based on either:

- the genera used as the primary descriptor of the dominant stratum—major vegetation groups, Level III and Level IV (e.g. eucalypt woodland);
- their occurrence within broad geographical regions; and
- their species composition (e.g. rainforest taxa) or where the assignment of dominant genera in the dominant stratum has been difficult but the communities are typified by a distinct suite of taxa in the Level IV and Level V data (e.g. tropical mixed species forests and woodlands).

The geographic stratification undertaken reflects broadly the major climatic determinants influencing vegetation, its structure and distribution, namely:

- *tropical* includes the wet and dry tropics (minus the semi-arid lands);
- *eastern Australia* from coastal and inland areas east of the arid land zone from Townsville south to and including Tasmania, then west to Adelaide;
- *arid and semi-arid* zone; and
- *south-west Australia* the south-western corner of Western Australia.

One of the areas in vegetation mapping where there is a large divergence of approaches by the jurisdictions is the description of eucalypt forest and woodland communities. Several States/ Territories talk about dry or wet forests but these descriptors, in isolation from the list of taxa present in each community do not convey a clear sense of what environments these forests represent. Victoria uses descriptors such as 'shrubby dry forest' that provides an immediate insight into these environments.

A proposed stratification of the occurrence of vegetation communities dominated by eucalypts was applied which greatly improves the interpretation and analysis of the data and provides a better insight into the physical environments covered by each mapping unit (Commonwealth of Australia 1997b). Mallee is a structural attribute so this category is already addressed in the data, and the arid zone catena of eucalypts is accounted for by a geographical stratification as are the monsoon forests and woodlands.

A similar stratification was undertaken for the acacia communities beyond a straight geographical split, particularly for mulga communities because of the broad range of environments in which they occur across a very large geographic area (e.g. the presence of spinifex or other notable taxa in the ground layer or shrub layer provide a cogent basis for such stratification and is readily determined from the data).

A proposed aggregation suitable for 1:5 000 000 map production, using such a schema, is presented in Table A1. The major vegetation subgroups will be available on the Australian Natural Resources Atlas.

Table A1 Proposed categorisation of the major vegetation groups by major vegetation subgroups.

Rainforest and vine thickets

- Cool temperate rainforest
- Tropical and sub-tropical rainforest, dry rainforest and vine thickets

Eucalypt tall open forests

- Eucalypt tall open forests and eucalypt forests with a dense broad leaved understorey (wet sclerophyll)

Eucalypt open forests and eucalypt low open forests

- Eucalypt forests with a shrubby understorey
- Eucalypt forests with a grassy understorey
- Eucalypt forests with a heath understorey
- Tropical eucalypt mixed species forests and woodlands

Tropical eucalypt woodlands/grasslands

- Tropical eucalypt forests and woodlands with a annual grassy understorey

Eucalypt woodlands and eucalypt open woodlands

- Eucalypt woodlands with a shrubby understorey
- Eucalypt woodlands with a grassy understorey
- Low tropical eucalypt forests and woodlands
- Tropical eucalypt mixed species forests and woodlands

Callitris forests and woodlands

- Callitris forests and woodlands

Acacia forests and woodlands

- Brigalow (*Acacia harpophylla*) forests and woodlands
- Other acacia forests and woodlands

Melaleuca forests and woodlands

- Melaleuca forests and woodlands

Other forests and woodlands

- Other forests and woodlands

Aggregation of several major vegetation group sub-components

- Alpine and subalpine woodlands, shrublands, sedgelands and herbfields

Eucalypt open woodlands

- Arid eucalypt low open woodlands with hummock grass
- Arid eucalypt low open woodlands with tussock grass

Acacia forests and woodlands, acacia open woodlands and acacia shrublands

- Mulga (*Acacia aneura*) woodlands and low open woodlands
- Mixed species arid acacia woodlands and shrublands
- Arid acacia low open woodlands and shrublands with chenopods
- Arid acacia low open woodlands and shrublands with hummock grass
- Arid acacia low open woodlands and shrublands with tussock grass
- Other low open woodlands and shrublands with tussock grass

Casuarina forests and woodlands

- Casuarina and *Allocasuarina* forests and woodlands

Mallee woodlands and shrublands

- Mallee eucalypt low open woodlands
- Mallee heath and shrublands

Table A1 Proposed categorisation of the major vegetation groups by major vegetation subgroups.

Low closed forests and closed shrublands	
	Low closed forests and tall closed shrublands
Heath	
	Heath plus banksia woodlands and shrublands
Chenopod shrubs, samphire shrubs and forblands	
	Chenopod shrublands
Other shrublands	
	Other shrublands
Hummock grasslands	
	Spinifex hummock grasslands
Tussock grasslands	
	Mitchell grass (*Astrebla*) tussock grasslands
	Blue grass (*Dichanthium*) and tall bunch grass (*Chrysopogon*) tussock grasslands
	Other tussock grasslands
Other grasslands, herblands, sedgelands and rushlands	
	Other grasslands
	Herblands, sedgelands and rushlands
Chenopod shrubs, samphire shrubs and forblands	
	Mixed chenopods, samphires and forblands
Mangroves, tidal mudflats, samphires and bare areas, claypan, sand, rock, salt lakes, lagoons, freshwater lakes	
	Mangroves, tidal mudflats and coastal samphires
	Bare areas, rock, sand, claypan, salt lakes and lagoons
	Freshwater lakes

APPENDIX 11. TECHNICAL NOTE ON DEVELOPING THE DISTRIBUTED SYSTEM

The de-centralisation of the Australian Natural Resources data library and atlas will occur in stages and be based on existing systems used by data custodians.

Stage 1. Linking Australian Spatial Data Directory nodes to data download facilities

Data custodians making available the data and products for download through their node of the Australian Spatial Data Directory. This will help ensure that the community has on-going access to the vegetation information.

Implementation issues

Many data custodians do not yet have facilities that allow direct online access to their data products.

Actions

- Audit will provide the full data set back to all nominated data custodians.
- Data custodians to make vegetation information available on-line with documentation available through their Australian Spatial Data Directory node and with Australia-wide views also available through the Audit's Australian Natural Resources Atlas.
- The Atlas and Data Library will also link to those nodes containing vegetation information to give an apparently seamless set of access points.

Stage 2. Streamlining data custodians database systems

Efficient processes and systems are required to transfer data between the National Vegetation Information System and whatever vegetation data systems are maintained by the custodians. For some States this implies an adoption of the National Vegetation Information System as their data base structure. This is already underway in several States, including South Australia. Migration to the National Vegetation Information System will enable custodians to effortlessly make available up to date data to the community, linking to all the data sets collated already across Australia.

For other States, recognising the ownership of that State to their existing data structure, the State might, at least in the short term, maintain two data structures (e.g. Queensland). In these States there will need to be a data protocol for migration of data between data systems. This is far from ideal, may lead to confusion and errors between data sets and some confusion in the community as to which data set to access. To encourage all States to migrate to a common data structure, the Commonwealth will restrict its support funding in vegetation mapping to those States displaying commitment to move to the Australia-wide system.

Implementation issues

Data custodians will need time and resources to adopt the National Vegetation Information System as their lead and preferably only database system.

Actions

- National coordinator to work with data custodians to improve database storage and translation systems. This will also form the base for continually improving the National Vegetation Information System functionality, ensuring it meets custodian needs in all States.
- Data custodians to plan for and then secure resources for adoption of the National Vegetation Information System database and translation systems.
- National Vegetation Information System database structures to be continually improved and these improvements implemented in a planned fashion Australia wide.

Stage 3. Linking spatial data servers

As standards for Open Geographic Information Systems evolve and are adopted by Australia and New Zealand Land Information Council, the Audit will implement these standards in the Australian Natural Resources Atlas. Implementation of distributed online mapping applications will commence in 2001–2002 for those States with compliant systems.

Implementation issues

- Technological. None—the Open GIS Consortium Web Map Server Interfaces Implementation Specification (April 2000) provides basic functionality to view and integrate images generated by map services available over the Internet.
- Data quality. Mapping and presentation standards for mapping vegetation data and products across Australia need to be agreed and developed by Australia and New Zealand Land Information Council.
- Institutional. Data custodians need access to these systems based on a working relationships with their Australian Spatial Data Directory lead agency, often a separate agency to the agency that is vegetation data custodian.

Actions

- Data quality. National Coordinator and Australia and New Zealand Land Information Council to facilitate further development of mapping standards with data custodians based on those developed by the Audit.
- Institutional. Data custodians to work closely with their agency responsible for the Australian Spatial Data Directory node.

Gymnoschoenus sphaerocephalus, Morton National Park, New South Wales

GLOSSARY

Arid
Those areas in Australia that receive less than 250 or 350 mm of rainfall each year in the south and north respectively.

Association
Level V in the National Vegetation Information System information hierarchy. Dominant growth form, height, cover and species (three species) for the three traditional strata (i.e. upper, mid and ground).

Attribute
In a geographic information system, an attribute is analogous to a data element or column in a database table.

Biodiversity
Variety of life forms including the different plants, animals and microorganisms, the genes they contain, and the ecosystems they form. Biodiversity is usually considered at three levels: genetic, species and ecosystem.

Bioregion (IBRA)
Based on an Interim Biogeographic Regionalisation for Australia. A complex land area composed of a cluster of interacting ecosystems that are repeated in similar form. Region descriptions seek to describe the dominant landscape scale attributes of climate, lithology, geology, landforms and vegetation. Biogeographic regions vary in size with larger regions found where areas have more subdued terrain and arid and semi-arid climates.

Biomass
The total mass (usually measured as dry weight) of all the living organisms in a given area, population, habitat, or trophic level, often expressed as kg/ha (Meagher 1991).

Broad floristic formation
Level III in the NVIS information hierarchy. The dominant growth form, cover, height and broad floristic code usually dominant land cover genus for the upper most or dominant stratum.

CAR reserve system
A system of protected areas that address comprehensiveness, adequacy and representativeness (CAR) of all its component ecosystems.

Comprehensiveness: inclusion of the full range of ecosystems recognised at an appropriate scale within and across each bioregion.

Adequacy: maintenance of the ecological viability and integrity of populations, species and communities.

Representativeness: the principle that those areas that are selected for inclusion in reserves reasonably reflect the biotic diversity of the ecosystems from which they derive.

Carbon account
See *National Carbon Accounting System*.

Carbon sequestration
The capture of carbon, particularly uptake and storage in woody biomass and soils.

Catchment
An area of land where run-off from rainfall goes into the one river system.

Class
Level I in the National Vegetation Information System information hierarchy. An upper level of the information hierarchy describing growth form and broad structure of the vegetation (Walker & Hopkins 1990).

Classification system
The systematic grouping of entities into categories based upon shared characteristics (Lund 1995).

Co-dominant
A species that is locally dominant in the sub-association.

Codes of practice
Sets of agreed guidelines adopted by rural industries and the agricultural service sector to minimise the impacts of farming operations on the environment.

Conservation
The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment.

Community
A natural aggregate of different species of organisms existing in the same environment. While species within the community interact with each other, forming food chains and other ecological systems, they do not generally interact with species in other communities (Meagher 1991).

Cover
The cover produced by the foliage of any vegetation within a defined area.

Database
A collection of interrelated information, usually stored on some form of storage system. A geographic information system database includes data about the position and attributes of geographical features that have been coded as points, lines, areas, pixels or grid cells (Burrough 1989).

Data compilation
The process of bringing data together from a range of sources for validation, analysis and reporting.

Data custodian
The organisation responsible for ensuring the accuracy, currency, storage, security and distribution of a data set. In fulfilling these responsibilities, the custodian is expected to consult with, and take into account the needs of users other than itself. The custodian may choose to delegate these functions while still retaining responsibility.

The custodian of a data set need not necessarily be the holder of the copyright, or the originator of the data, although in many cases the custodian will be both of these (ANZLIC 1996).

Data management
Maintenance and updating of data and information including access and confidentiality, conformity and quality and content.

Data set
A unique and defined data set often developed using similar methods.

Data quality
The characteristics of a data set including its source, purpose and method of collection and analysis techniques used that can be used to assess its 'quality' for a particular application.

Desirable
If information is available, attribute information should be completed.

Distributed system
A network of systems that enable data and information to be maintained by data custodians at a range of locations to a specified standard and administrative arrangements.

Dominant

A common species that is always dominant in the sub-association. It is very frequent and also has the greatest biomass. Any number of species could be dominant (e.g. 1, 2, 3, 4 or 5) depending on the association.

Dominant stratum

The stratum which, because of its physiognomy and relative continuity, dominates the rest of the community in the sense that it conditions the habitats of the other strata.

The most important or characteristic stratum of a particular vegetation type. It probably occupies the greatest 'air' space (Beadle & Costin 1952).

Dryland cropping

Cropping without irrigation.

Dryland salinity

Where water balance has been altered due to changing land use (e.g. clearing of native vegetation for broadacre farming or grazing), excess water entering the watertable mobilises salt which then rises to the land surface. Movement of water drives salinisation processes and may move the stored salt towards the soil surface or into surface water bodies.

Ecological dominance, ecologically predominant, foremost, diagnostic, indicator

Ecological dominance is defined as the species making the greatest contribution to the overall biomass of the stratum, site and vegetation type.

Ecosystem

Community of organisms (that may include people) interacting with one another. Incorporates the physical, chemical and biological processes inherent in that interaction and the environment in which they live.

Edaphic

Characteristics of soil or topography.

Endemic

A species of vegetation type restricted to a specified region or site.

Entry level

The level of detail in the input data set provided by the data custodian. It defines the level of data incorporated into the National Vegetation Information System according to the National Vegetation Information System information hierarchy.

Estuary

An inlet or river mouth that is influenced by tides from the sea and fresh water from land. The area where fresh and salt waters mix.

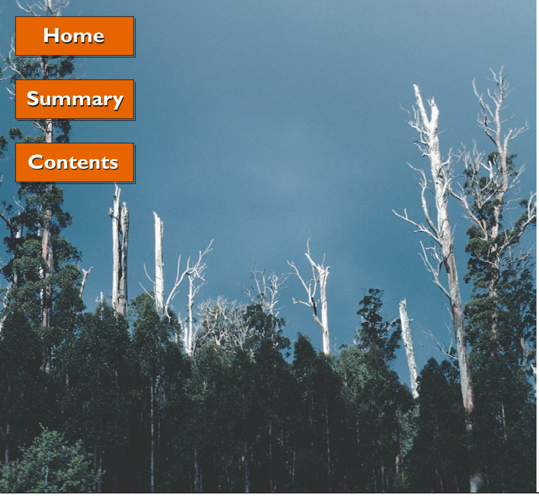
Erosion

The continuing process of landscape development as a smoothing or levelling of the earth's surface by removal of weathered material.

Natural erosion is due only to the forces of nature; accelerated erosion occurs as a result of human activities. In each case the same processes operate and the distinction is often only a matter of degree and rate.

Extensive land use zone

Areas of Australia, commonly referred to as the rangelands, where human impacts on the vegetation and land are less than other areas or contain areas not used by humans.



Stags, near Hartz Mountains, Tasmania

Family
A group of allied genera (Boland et al. 1994).

Floristics
A description of the plant species that occur in a defined area or vegetation type.

Formation
The synthetic structural unit to which are referred all climax communities exhibiting the same structural form, irrespective of floristic composition (Beadle & Costin 1952).

Fragmentation
The result of broad scale clearing of native vegetation and the small parts of that vegetation that remain often only as isolated patches.

Freehold
Tenure where land is held for life and owned by individuals or entities.

Genus
The collective name of a group of species possessing certain common characteristics by which they are distinguished from all other (Boland et al. 1994).

Geographic information system
A computer information system for processing, managing and analysing map data.

Greenhouse gas emissions
Gases including carbon dioxide, methane, nitrous oxide, carbon monoxide, oxides of nitrogen, non-methane volatile organic compounds (NMVOCs), perfluorocarbons and sulfur hexafluoride emitted from particular land uses including land clearing, the energy sector, agricultural activities and forestry.

Growth-form
Habitat of a plant, identified most precisely by the position of its perennating buds (Beadle & Costin 1952).

Height
Measurement from base to top for a given community to derive the average height for a given stratum (Fowler & Fowler 1996).

Information hierarchy
A hierarchical vegetation classification used to standardise the level of detail within a data set, and within and between jurisdictions and to provide a framework for generating outputs (e.g. map products) at various levels. The National Vegetation Information Hierarchy (Version 5) has six levels of classification.

Intensive land use zone
Areas of Australia in the agricultural zones where land is intensively used and native vegetation has been highly modified in many areas.

Jurisdiction
The jurisdiction is the name of the State/Territory or country in which the custodian of the data set is domiciled. If the custodian has offices in more than one State/Territory of Australia, the jurisdiction 'Australia' should be used (ANZLIC 1996).

Landscape condition
A value judgement related to the worth of a landscape for a particular land use. Condition is not necessarily equivalent to function. This judgement may depend on the presence of species considered important for a particular land use and may be influenced by cultural or social views or values.

Landscape function
The ability of a landscape to conserve and use scarce water and nutrients.

Leasehold
Tenure where land is occupied by individuals or entities under a lease agreement with a State or Territory government. Often conditions of the lease include the use to which the land can be allocated.

Level
The attribute groupings within the National Vegetation Information System that recognise information of similar spatial, structural or floristic detail.

Life-form
See *growth form*.

Major vegetation groups
Major structural formations (e.g. woodlands, grasslands) and floristic groups (e.g. acacias and eucalypts) that broadly group Australia's native vegetation.

Major vegetation subgroups
Major structural formations (e.g. woodlands, grasslands) and floristic groups (e.g. acacias and eucalypts) subdivided by climatic and understorey differences that broadly group Australia's native vegetation.

Mandatory attribute
An attribute that must be filled in for successful completion of core attribute information.

Map unit
A set of areas on a map used to represent a defined feature or set of features. Mapping units are described by the map legend (Burrough 1989).

Mapping methods
Information about the mapping sources and base data used to delineate the map/spatial units in a data set. Each data set may be compiled using a combination of mapping methods and sources of information.

Metadata
A written description for a data set. Metadata should conform to the Australia and New Zealand Land Information Council Metadata Guidelines (1996).

Mix
Defines the spatial mix of a map unit. Spatially mixed map units are defined as those that have a number of discrete vegetation types within one mapped boundary (i.e. they are mosaics of some kind or other).

Monitoring
Routine counting, testing or measuring environmental factors to estimate their status or condition.

Montane
Of mountains.

Mosaic
A set of vegetation descriptions describing a map unit. This accounts for the heterogeneous nature of vegetation in a continuum.

National Carbon Accounting System (NCAS)
Provides a complete accounting capability for sources and sinks of greenhouse gas emissions from Australian land-based systems. The system underpins reporting of Australia's greenhouse gas emissions for the National Greenhouse Gas Inventory and Kyoto Protocol. It also supports emissions trading discussions and provides a basis for emissions projections to assess progress towards meeting international targets.

National coordinator
A body that is responsible for the national coordination of a fundamental data set according to the Australian Spatial Data Infrastructure. Responsibilities include ensuring access to data and information, conformity and quality, content, industry engagement, avoidance of duplication and managing confidentiality requirements.

Native vegetation
Generally represents vegetation types that are indigenous to Australia and defined specifically by the purpose of the mapping undertaken. May include modified native vegetation (e.g. some weeds or modified structure).

Native plantings
Planting of native Australian plant species for a range of outcomes including farm forestry, biodiversity conservation, mitigating dryland salinity.

Native regrowth
Natural regrowth of native Australian plant species in an area that has previously been cleared.

Natural resources management
The management of natural resources (e.g. land, water and biodiversity) in an integrated fashion recognising the values of both conservation and productive use of natural resources and striving to achieve sustainability in all resource use.

Percentage cover
The cover of any vegetation converted to a percentage for a given area.

Perennial plant
Plants that live more than one year.

Pre-European/pre-clearing
Vegetation types and extent before European settlement in Australia.

Present native vegetation
Native vegetation existing in the landscape as represented by mapped data sets. The currency, scale, method of mapping affect the vegetation types represented.

Protected area
Defined by the World Conservation Union (IUCN) formerly the International Union for the Conservation of Nature. An area of land or sea specially dedicated to the protection and maintenance of biodiversity and associated cultural resources and management through legal and/or other effective means.

Rangelands
Areas of native grasslands, shrublands, woodlands, and tropical savanna woodlands that cover a large proportion (75%) of the arid and semi-arid regions of (outback) Australia.

Recharge
Rainfall that moves through the soil, beyond the roots of plants, to replenish the aquifer.

Restoration
The restoration or reconstruction of native vegetation to its former species composition and condition.

Revegetation
The planting of native species in areas that have been cleared or highly modified. The mix of species may not be the same as originally occurring in that patch of vegetation.

Resolution

The resolvability of features for a given map scale. Scale effects resolution. In a larger scale map, the resolution of features more closely matches real-world features because the extent of reduction from ground to map is less.

Map resolution may refer to a 'minimum mapping unit' or the accuracy at which a given map scale can depict the location and shape of map features (ESRI 1994, Lund 1995).

Riparian/riverine vegetation

Frequenting river banks; growing by rivers or streams.

Salinisation

The process whereby soluble salts accumulate in the soil.

Salinity

The total amount of water-soluble salts present in a soil horizon.

Scale

Map scale indicates the relation between the size of an object on a map and its size in the real world (Burrough 1989).

Sclerophyll

Species that have adapted to lengthy seasonal drought by producing tough leathery leaves to cut down moisture loss by transpiration.

Semi-arid

Lands where rainfall is too low and unreliable for crops to be grown with certainty.

Species

A group of organisms that are biologically capable of breeding and producing fertile offspring. It is the lowest normal taxonomic classification in use (Meagher 1991).

Stratum

A layer in a community produced by the occurrence at approximately the same level of an aggregation of plants of the same habit (Beadle & Costin 1952).

Structural formation

Formation classes defined by growth form and crown separation (woody plants) or foliage cover (ground stratum), and qualified by height class (Walker & Hopkins 1990). The vegetation structure for each stratum is defined by describing the vegetation in terms of the growth form, height and cover (e.g. vegetation which is shrub, less than 2 m in height, with foliage cover 10–30% is classed as 'open shrubland' under the National Vegetation Information System structural formation nomenclature).

Structure

The spatial arrangement of plants within a community (Beadle & Costin 1952).

Sub-formation

Dominant growth form, cover, height and broad floristic code usually dominant genus and family for the three traditional strata. (i.e. upper, mid and ground).

Sub-association

A subdivision of the association determined by a variation in the most important subordinate stratum of the association, without significant qualitative changes in the dominant stratum (Beadle & Costin 1952).

Subdominant

A species that occurs frequently but has a lesser biomass.

Subregion

A subdivision of a bioregion which contains distinctive geomorphic units that closely align with land capability and development potential.

Taxon

A category in the classification of living organisms. The taxa (plural of taxon) in the Linnaean system are commonly kingdom, phyllum, class, order, family, genus and species.

Threatening processes

Those limiting factors that threaten, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community.

Vegetation

All plants within a specified area. It is usually considered generally and not taxonomically.

Vegetation type

A community that has a floristically uniform structure and composition, often described by its dominant species.

Vegetation condition

The current state of ecosystems compared to what would be considered pristine or as defined by a set benchmark.

Vegetation description

Collectively, the levels described in the National Vegetation Information System information hierarchy provides a vegetation description based on a mapped unit of vegetation.

Viability

The likelihood of long-term survival of the example/population of a particular ecosystem or species.

Melaleuca cuticularis, near Cranbrook, Western Australia

REFERENCES

Accad A., Neldner V.J., Wilson B.A. & Niehus R.E. 2001, *Remnant Vegetation in Queensland: Analysis of Pre-clearing, Remnant 1997-1999 Regional Ecosystem Information*, Queensland Herbarium, Brisbane.

Australian Soil and Land Information Group (AUSLIG) 1990, *Atlas of Australian Resources. Volume 6 Vegetation*, AUSMAP, Department of Administrative Services, Canberra.

Australia and New Zealand Land Information Council (ANZLIC) 1996, *ANZLIC Guidelines: Core Metadata Elements (Version 1). Metadata for high level land and geographic data directories in Australia and New Zealand*, prepared for ANZLIC by the ANZLIC Working Group on Metadata, July 1996.

Australian New Zealand Environment and Conservation Council 2000, *National Framework for the Management and Monitoring of Australia's Native Vegetation. December 1999*, Department of Environment and Heritage, Canberra.

Barson M., Randall L.A. & Bordas, V. 2000, *Land Cover Change in Australia*, results of the collaborative Bureau of Rural Sciences – State agencies' Project on Remote Sensing of Land Cover Change, Bureau of Rural Sciences, Canberra.

Beadle N.C.W. & Costin A.B. 1952, 'Ecological Classification and nomenclature', *Proceedings of the Linnean Society of New South Wales,* vol. 77, pp. 61–82.

Beadle N.C.W 1981, *The Vegetation of Australia*, Cambridge University Press.

Beard J.S. & Webb M.J. 1974, *The vegetation survey of Western Australia : its aims, objects and methods. Great Sandy Desert. Part 1 of explanatory notes to sheet 2. Vegetation survey of Western Australia, 1:1 000 000 Vegetation Series*, University of Western Australia, Nedlands, Perth.

Beeston G.R., Hopkins A.J.M. & Shepherd D.P. 2001, *Land-use and Vegetation in Western Australia,* Project DAW27, final report, Agriculture Western Australia and the National Land and Water Resources Audit.

Benson J. 1999, *Setting the Scene. The Native Vegetation of New South Wales. A background paper of the Native Vegetation Advisory Council of New South Wales*, Background paper number 1, Native Vegetation Advisory Council NSW.

Binning C. & Young M. 1997, *Motivating People: Using Management Agreements to Conserve Remnant Vegetation. National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation*, Research Report 1.

Boland D.J., Brooker M.I.H., Chippendale G.M., Hall N., Hyland B.P.M., Johnston R.D., Kleinig D.A. & Turner J.D. 1994, *Forest Trees of Australia*, CSIRO Publishing, Collingwood, Australia.

Boulter S.L., Wilson B.A., Westrup J., Anderson E.R., Turner E.J. & Scanlon J.C. 2000, *Native vegetation management in Queensland. Background, Science and Values*, Department of Natural Resources, Queensland.

Burrough P.A. 1989, *Principles of Geographical Information Systems for Land Resources Assessment,* Monographs of Soil and Resources Survey, Clarendon Press, Oxford.

Calvert M., Simpson J. & Adsett K. 2000, *Land Use Mapping of the Fitzroy Catchment,* Fitzroy Catchment Implementation Project Final Report, Queensland Department of Natural Resources and National Land and Water Resources Audit.

Cofinas M., Thackway R., Howell C., Wood M. & Cresswell I.D. 1999, *Vegetation Cover, Condition and Use Work Plan: Theme 3*, National Land and Water Resources Audit, Canberra

Commonwealth of Australia 1997a, *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, report by the Joint ANZECC/ MCFFA National Forest Policy Statement Implementation Sub-committee, Canberra.

Commonwealth of Australia 1997b, *State/ Commonwealth Regional Forest Agreement Process World Heritage Report*, record of the World Heritage Expert Panel meetings: Western Australia, New South Wales and Queensland.

Conn B.J. (ed.) 1996, *Herbarium Information Standards and Protocols for Interchange of Data. Version 3 (HISPID3)*, National Herbarium of New South Wales, Sydney.

Cresswell I.D. & Thomas G.M. (eds) 1997, *Terrestrial and Marine Protected Areas in Australia*, Environment Australia, Biodiversity Group, Canberra.

Gunn R.H., Beattie J.A., Riddler A.M.H. & Lawrie R.A. 1988, 'Mapping', in R.H. Gunn, J.A. Beattie, R.E. Reid & R.H.M. van der Graaff (eds), *Australian Soil and Land Survey Handbook: Guidelines for Conducting Surveys*, Inkata Press, Melbourne.

Environment Australia 1999, *Proposed Site Based Attributes for the National Vegetation Information System*, National Land and Water Resources Audit, Canberra.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and development of Version 5.1*, Summary Report, Environment Australia, Canberra.

Environment Australia 2001, *Draft Framework for the assessment and monitoring of native vegetation condition*, National Land and Water Resources Audit, Canberra.

ESRI 1994, *Map Projections: Georeferencing Spatial Data,* Environmental Systems Research Institute Inc.

Floyd A.G. 1987, 'The status of rainforests in northern New South Wales. The Rainforest Legacy', *Australian National Rainforest Study,* vol. 1, Australian Heritage Commission, AGPS, Canberra.

Fowler H.W. & Fowler F.G. 1979, *The Concise Oxford Dictionary,* Oxford University Press.

Graetz R.D., Wilson M.A. & Campbell S.K 1995, *Landcover disturbance over the Australian continent : a contemporary assessment*, Biodiversity Series Paper No. 7, Department of the Environment, Sport and Territories, Canberra.

Groves R.H. 1994, *Australian Vegetation,* second edition, Cambridge University Press.

Hardy A.M. (ed.) 2001, *Terrestrial Protected Areas in Australia*, summary Statistics from the Collaborative Australian Protected Area Database, Environment Australia.

Harrison B.A. & Jupp D.L.B. 1990, *Introduction to Remotely Sensed Data*, CSIRO Publications.

King S.A. 1986, 'The conservation of Mulga in New South Wales', in P. Sattler (ed.) *The Mulga Lands*, Royal Society of Queensland.

Kirkpatrick J.B., Barker P., Brown M.J., Harris S. & Mackie R. 1995, *The reservation status of Tasmanian vascular plant communities,* Wildlife Scientific Report 95/4, PWS Hobart.

Lund H.G. 1995, *A Primer on Evaluation and Use of Natural Resource Information for Corporate Data Bases*, United States Department of Agriculture.

Meagher D. 1991, *The MacMillan Dictionary of The Australian Environment*, The MacMillan Company of Australia.

National Land and Water Resources Audit (NLWRA) 2000a, *Australian Vegetation Attributes: National Vegetation Information System Version 5.0*, National Land and Water Resources Audit Canberra.

National Land and Water Resource Audit (NLWRA) 2001a, *Australian Dryland Salinity Assessment 2000*, National Land and Water Resources Audit.

National Land and Water Resource Audit (NLWRA) 2001b, *Australian Water Resources Assessment 2000*, National Land and Water Resources Audit.

National Land and Water Resource Audit (NLWRA) 2001c, *Landscape Health in Australia*, National Land and Water Resources Audit.

National Land and Water Resource Audit (NLWRA) 2001d, *Rangelands – Tracking Changes. Australian Collaborative Rangeland Information System*, National Land and Water Resources Audit.

Parks and Wildlife Commission (no date) *Northern Territory Parks Masterplan 'Towards a Future Secured',* Parks and Wildlife Commission, Northern Territory.

Read I.G. 1994, *The Bush – A Guide to the vegetated landscapes of Australia,* University of New South Wales, Reed Books Pty Ltd.

SLATS 2000, *Landcover Change in Queensland, 1997-1999*, Department of Natural Resources, Brisbane.

Sattler P.S. & Williams R.D. (eds) 1999, *The Conservation Status of Queensland's Bioregional Ecosystems*, Environmental Protection Agency and the Queensland National Parks Association, Brisbane.

Sattler P.S. 2001, *A Vegetation Information System Management Application. Queensland Brigalow Belt Case Study*, final report, National Land and Water Resources Audit, Canberra.

Saunders D.C., Margules C. & Hill B. 1998, *Environmental indicators for national state of the environment reporting – Biodiversity*, Australia: State of the Environment (Environmental Indicator Reports), Department of the Environment, Canberra.

Shephard M. 1992,*The Simpson Desert. Natural History and Human Endeavor,* Royal Geographical Society of Australasia, Giles Publications, Adelaide.

Sinclair, Knight, Merz 2000, *Riverine Vegetation Mapping Scoping Study*, final project report National Land and Water Resources Audit, Canberra.

Specht R.L. 1970, 'Vegetation', in G.W. Leeper (ed), *Australian Environment* 4th edition, Melbourne University Press, Melbourne.

Specht R.L., Roe E.M. & Boughton V.H. 1974, 'Conservation of major plant communities in Australia and Papua New Guinea', *Australian Journal of Botany Supplement*, no. 7.

Specht R.L. & Specht A. 1999, *Australian Plant Communities. Dynamics of Structure, Growth and Biodiversity,* Oxford University Press.

Walker J. & Hopkins M.S. 1990, 'Vegetation', in R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker & M.S. Hopkins, *Australian soil and land survey. Field handbook*, 2nd edition, Melbourne, Inkata Press.

Webb L.J. 1984, 'Nature Conservation', in A. Bailey (ed.), *The Brigalow Belt of Australia*, Royal Society of Queensland.

Williams J. 2000, *Managing the Bush: Recent research findings from the EA/LWRRDC National Remnant Vegetation R&D Program*, National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation, Research Report 4/00.

Young P.A.R. & McDonald W.J.F 1987, 'The distribution, composition and status of rainforests in southern Queensland', in *The Rainforest Legacy. Australian National Rainforest Study,* vol. 1, Australian Heritage Commission, AGPS, Canberra.

Young P.A.R., Wilson B.A., McCosker J.C., Fensham R.J., Morgan G. & Taylor P.M. 1999, 'Brigalow Belt', in P.S. Sattler & R.D. Williams (eds), *The Conservation Status of Queensland's Bioregional Ecosystems,* Environmental Protection Agency, Brisbane.

Audit vegetation publications

Environment Australia 1999, *Proposed Site Based Attributes for the National Vegetation Information System*, National Land and Water Resources Audit, Canberra.

Environment Australia 2001, *Draft Framework for the assessment and monitoring of native vegetation condition*, National Land and Water Resources Audit, Canberra.

McDonald E.R. & Watt A. 2000, *Develop attributes and databases for the National Vegetation Information System (NVIS)*, final report DET5, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit 1999, *User Requirements and Technical Specification*, Version 2, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit 2000a, *Australian Vegetation Attributes: National Vegetation Information System Version 5.0*, National Land and Water Resources Audit Canberra.

National Land and Water Resources Audit 2000, *NVIS Implementation Strategy Version 2.0*, National Land and Water Resources Audit Canberra.

National Land and Water Resources Audit 2000, *NVIS Data Compiler System Specification*, Version 2. National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit 2000, *NVIS Data Compiler Version 2.0 User's Guide,* National Land and Water Resources Audit Canberra.

National Land and Water Resources Audit 2000, *NVIS Data Compiler Functional Specification Version 2.0,* National Land and Water Resources Audit Canberra.

National Land and Water Resources Audit 2000, *NVIS Database System Specification Version 2.0,* National Land and Water Resources Audit Canberra.

National Land and Water Resources Audit 2000, *NVIS Database Functional Specification Version 2.0,* National Land and Water Resources Audit Canberra.

Thackway R., Sonntag S. & Donohue R. 2001, *Compilation of National Vegetation Information System (NVIS) Vegetation 2000 data set*, final report BRR13, National Land and Water Resources Audit, Canberra.

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VEGETATION PROFILES: fact sheets of the major vegetation groups

The vegetation profiles contain summary information about the native vegetation in each of the 23 major vegetation groups across Australia. They include:

- descriptions of each group and a listing of some key species;
- distribution;
- key facts and figures;
- information on change since settlement by Europeans;
- key values; and
- some management considerations.

The information is based on the products developed from the National Vegetation Information System, other mapped vegetation information, expert advice and key references. Data sources used and the quality of the mapped information should be obtained from the *Guidelines* section of *Australian Native Vegetation Assessment 2001*.

The profiles are designed to be used as fact sheets and provide summary information and representative photographs of the vegetation groups for a wide range of users.

In summary, the major vegetation groups:

- equate to aggregations of the National Vegetation Information System Level III categories, except for group 1 (rainforest and vine thickets) and group 17 (heath), which used Level V and Level VI floristic information to delineate rainforest/heath communities;
- unify variations in nomenclature (e.g. *Eucalyptus* with *Corymbia*);
- unify anomalies in assigned ecological dominance (e.g. group 42, tropical eucalypt woodland/grassland);
- help overcome skews in data from strictly defined structural categories so that they better reflect onground conditions for certain ecosystems (e.g. not all rainforest communities may be described as closed forest);
- unify variations in assigned community descriptors. Examples are:
  - *Angophora*, *Syncarpia* and *Lophostemon* communities usually have *Eucalyptus* spp. present, or may occur in association or as part of a mosaic with eucalypt communities, so are included in eucalypt major vegetation groups;
  - samphire – chenopod classification is used inconsistently between jurisdictions;
- provide a framework to develop summary statistics at a continental scale and help unravel the complexity of the more detailed underlying information, thus facilitating its use.

Version 1

The information contained in each vegetation profile illustrates current knowledge compiled on native vegetation. Many other sources of vegetation information are available and these should be incorporated in any review and subsequent version of the fact sheets. Co-dominant and subdominant vegetation groups are not shown.

Profile maps are a guide to where particular vegetation groups occur but do not necessarily show entire distribution. This is because the scale of vegetation mapping greatly affects the types of vegetation that are shown and many mapping programs concentrate on mapping the tree components (e.g. coarse scales of mapping cannot represent small fragments of vegetation in an agricultural area or strips of vegetation along river courses and many shrublands and grasslands remain unmapped where the dominant vegetation is woody).

Information provided under key values and management considerations is very general and should be used as a guide and starting point for further investigations at more detailed levels of management.

Definition of terms:

Vegetation class
: Dominant growth form described for the vegetation, derived from the National Vegetation Information System hierarchy, Level I.

Structural formation
: Dominant growth form, cover and height described for the vegetation, derived from the National Vegetation Information System hierarchy, Level II.

Major vegetation group
: Dominant vegetation group occurring in an area from an aggregation of many vegetation types. Subdominant vegetation groups which overlap the dominant groups are not shown (e.g. the dominant vegetation in an area may be mapped as eucalypt open forest although it contains pockets of rainforest vegetation as a subdominant).

IBRA region
: From the Interim Biogeographic Regionalisation for Australia (Version 5.1). Bioregions are a complex land area composed of interacting ecosystems that are repeated. Descriptions seek to describe the dominant landscape scale attributes of climate, lithology, geology, landforms and vegetation.

Protected area
: Land dedicated to the protection and maintenance of biodiversity and associated cultural resources with management through legal and/or other effective means. Includes IUCN Classes I to VI.

RAINFOREST AND VINE THICKETS

- Closed forests characterised by dense foliage in the upper layers (> 70% cover).
- Adapted to regenerating in low light conditions.
- Not dependent on fire for successional regeneration and contain a large diversity of species.
- Rainforests occur with emergent eucalypts in certain situations (e.g. the tall open forests of Victoria and Tasmania).
- Vines, epiphytes and mosses form a conspicuous and important element of the structure in the tropical and subtropical rainforests.
- Cover a diverse range of vegetation types—from deciduous, cool temperate, southern beech forests in Tasmania dominated by only one or two canopy species, to the species-rich tropical complex mesophyll vine forests in the Wet Tropics of Queensland where no one species dominates the canopy and hundreds of species may be found. Between these two extreme types lies a series of warm temperate and subtropical forests and vine thicket communities, stretching northwards from Victoria to Cape York Peninsula. Isolated patches also occur in the Kimberley region of Western Australia.

The considerable variation in structure and species composition resulting from the range of environments from northern to southern Australia has been detailed in Specht and Specht 1999.

Rainforest and vine thickets: facts and figures

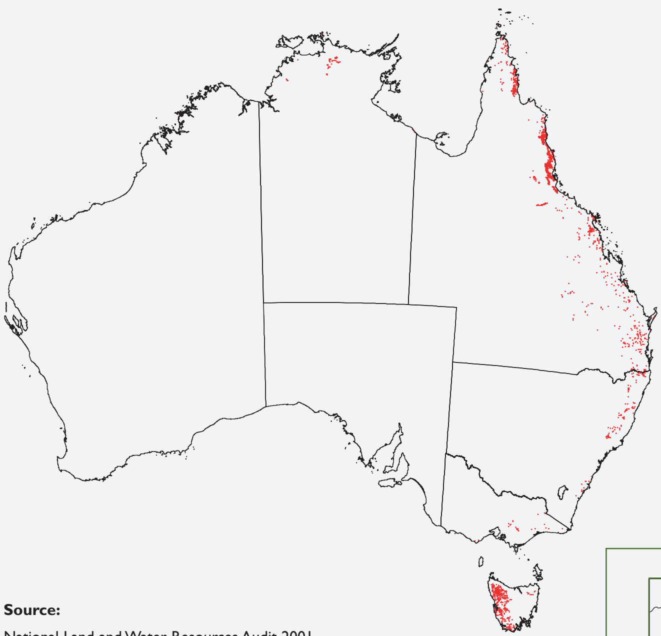
Vegetation class	Tree, shrub
Structural formation	Closed forests, low closed forests, tall closed forests, tall open forests, open forests, low open forests, tall closed shrublands, tall shrublands, tall sparse shrublands
Major vegetation group	MVG 1. Rainforest and vine thickets
Number of IBRA regions	31
Pre-European extent (km^2)	43 493
Present extent (km^2)	30 231
Area in protected area (km^2)	11 244

Murray Fagg

Rainforest (*Arthrospermum moschatum* and *Dicksonia antartica*) in Mount Field National Park, Tasmania

Geography

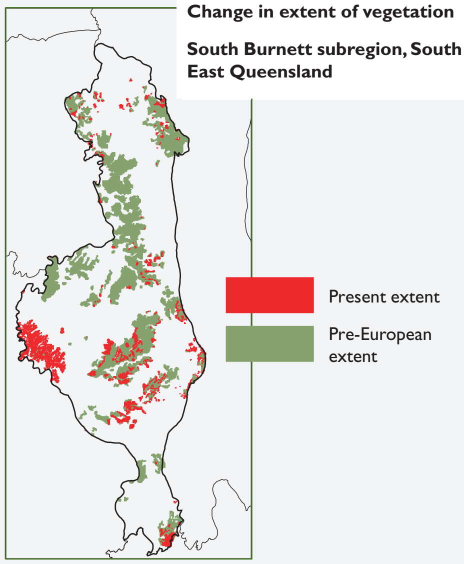
- Mostly confined to the wetter areas or climatic refuges in eastern Australia.
- Largest area is in Queensland (19 558 km^2).
- Rainforests occur mainly in areas receiving more than 1200 mm of rainfall from cool temperate to warm temperate, subtropical and tropical areas in Queensland, New South Wales, Victoria, Tasmania and small patches in north coastal Northern Territory and the Kimberley region in Western Australia.
- Rainforests are found from sea level to high altitudes, normally within 100 km of the coast.
- Semi-evergreen vine thickets of the Brigalow Belt and the monsoonal vine thickets are found on the eastern coast in the transitional zone between the coast and semi arid areas and in the seasonal tropics of northern Australia.
- Extent of the rainforests and vine thickets vary from a few hectares in sheltered gullies to mosaics covering hundreds of square kilometres often in association with wet sclerophyll forests.



Source:
National Land and Water Resources Audit 2001.
Data used are assumed to be correct as received from the data suppliers.

Mission Beach, near Tully, Queensland

Murray Fagg



Change in extent of vegetation

South Burnett subregion, South East Queensland

Maria Cofinas

Rainforest epiphytes, Queensland

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Change

- Most lowland areas have been cleared. About 30% of pre-European extent cleared across Australia, accounting for 1.4% of total clearing.
- Approximately 13 000 km^2 cleared since European settlement including rainforest communities in the coastal lowlands, floodplains and more undulating sections of the coastal ranges of eastern Australia. These were some of the first native vegetation communities to be harvested for timber, particularly along coastal rivers as these were used to gain access and transport timber out for export.
- Notable examples of the tropical and subtropical rainforests cleared for timber, dairying or agriculture are:
    - the 'Big Scrub' in northern New South Wales, reduced from an estimated 75 000 ha to just 300 ha by 1900 (Floyd 1987);
    - the Illawarra rainforests;
    - the hoop pine scrubs of south-east Queensland (Young & McDonald 1987); and
    - the tropical rainforests of the Atherton and Eungella Tablelands and coastal Wet Tropics floodplains of the Daintree, Barron, Johnstone, Tully – Murray, Herbert, Proserpine and Pioneer rivers.
- The most extensive areas of cool temperate rainforest are found in western Tasmania, particularly in the north east. Smaller areas are also found in favourable elevated sites in eastern Victoria and a few small climatic refuges along the Great Dividing Range to the MacPherson Ranges in south-east Queensland.
- Extensive areas of vine thickets, notably the softwood scrubs in the Brigalow Belt of Queensland and north-western New South Wales, substantially cleared for agriculture or grazing as part of brigalow land development.
- Other effects are evident from changes in fire regimes (e.g. upslope of intensive agriculture and inundation such as water supply and hydro-electric dams).
- The broad range of communities across Australia found within this major vegetation group masks the level of regional depletion of some rainforest and vine thicket types.
- The main threat to rainforests is the potential for regular or intense wildfires that are able to break the dense cover of foliage that is critical for preserving available moisture and which maintains a suitable local environment for regeneration and persistence of some rainforest and vine thicket species. Other threats include clearing, diseases and pests.

Tenure

Much of Australia's remaining rainforest occurs within state forests and national parks.

New South Wales:	protected areas, state forests; little on freehold land
Northern Territory:	most on freehold land; some in protected areas
Queensland:	state forests, protected areas, some freehold land and leasehold land, many isolated areas on freehold land
Tasmania:	protected areas, state forests, vacant crown land
Victoria:	mainly state forests; some in protected areas and little on freehold land
Western Australia:	mainly in Aboriginal reserves

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Key values

- Biodiversity of some of the richest and most varied plant communities in Australia
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Timber (e.g. high value cabinet timbers)
- Ancient and evolutionary significance
- Reservoirs of genetic diversity
- Ecosystem function including a role as refuges from fire and climatic change for flora and fauna
- Aesthetic values and ecotourism, including bushwalking, walkways, wilderness experiences in some more remote areas in Tasmania and Queensland, and tree-top walks

Rainforests and vine thickets attract a large interest from the wider community and tourists, possibly as a result of the cultural values associated with evergreen species.

Many icon areas remain paramount to the Australian community as examples of rainforest (e.g. Daintree, Washpool, Gordon below Franklin). In some areas the rainforests have been re-established (e.g. Wet Tropics Tree Planting Scheme).

Growth in recent ecotourism has led to a greater awareness of the need to manage these systems to allow both opportunities for ready access and protection of tourist values. Their value for indigenous people, forestry, conservation and tourism have been recognised through the recent joint Commonwealth and States data collation and review process associated with the Regional Forest Agreements (www.rfa.gov.au).

The restricted extent of rainforests and protection of associated endangered species is significant in these areas since they are either naturally geographically restricted in area or have become restricted through fragmentation of rainforest or vine thicket areas.

Management considerations

- Clearing/edge effects
- Maintenance of local hydrological conditions (e.g. stream flows)
- Wildlife corridor re-establishment between remnants
- Isolation and faunal barriers caused by roads/powerlines
- Tourist/visitor management (e.g. raised walkways)
- Fire (e.g. from surrounding land uses)
- Disease
- Weeds
- Exclusion of stock to maintain their integrity

References

Floyd A.G. 1987, 'The status of rainforests in northern New South Wales', in *The Rainforest Legacy, Australian National Rainforest Study*, vol. 1, Australian Heritage Commission, AGPS Canberra.

Specht R.L. & Specht A. 1999, *Australian Plant Communities. Dynamics of Structure, Growth and Biodiversity.* Oxford University Press.

Young P.A.R. & McDonald W.J.F 1987, 'The distribution, composition and status of rainforests in southern Queensland', in *The Rainforest Legacy, Australian National Rainforest Study*, vol. 1, Australian Heritage Commission, AGPS Canberra.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

EUCALYPT TALL OPEN FORESTS

- Stand over 30 m tall and can reach heights of 100 m.
- Most commonly contain a dense, broad leaved understorey.
- Previously described as 'wet sclerophyll forest'.
- Contain the tallest tree species in Australia and the tallest flowering plant in the world, *Eucalyptus regnans* (mountain ash), found only in Tasmania and Victoria.

Rainforest species do occur within sheltered areas and valleys of tall open forests in the eastern States. In Tasmania, there are areas where the understorey is closed by *Nothofagus cunninghamii* (AUSLIG 1990).

- Understorey varies widely from a dense rainforest layer to a series of other trees and shrubs, through to tree fern or other ferns on the ground layer, depending on soil types, climatic zoning and period since fire.

Eucalypt tall open forests: facts and figures

Vegetation class	Tree
Structural formation	Open forests, tall open forests, tall closed forests
Major vegetation group	MVG2. Eucalypt tall open forests
Number of IBRA regions	26
Pre-European extent (km^2)	44 817
Present extent (km^2)	30 129
Area protected (km^2)	8011

Murray Fagg

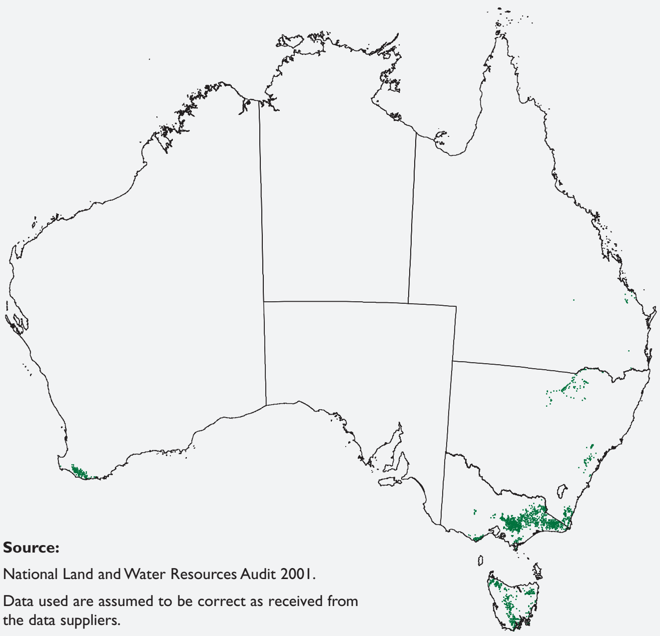
Dandenong Ranges, Victoria

Additional species

- *Eucalyptus delegatensis* subsp. *delegatensis* (alpine ash), *E. obliqua* (messmate stringybark) and *E. viminalis* subsp. *viminalis* (manna gum) in Tasmania, Victoria, Australian Capital Territory and New South Wales.
- *E. pilularis* (blackbutt), *E. saligna* (Sydney blue gum), *E. grandis* (flooded gum), *E. tereticornis* (forest red gum) with *Corymbia tessellaris* and *E. propinqua* (grey gum) in New South Wales and Queensland.
- *E. cypellocarpa* (mountain grey gum), *E. fastigata* (brown barrell), *E. radiata* (narrow-leafed peppermint) in Victoria and New South Wales.
- *E. muelleriana* (yellow stringybark), *E. elata* (river peppermint), *E. smithii* (gully gum) and *E. deanii* in New South Wales.
- *E. diversicolor* (karri) and *E. marginata* (jarrah) only found in Western Australia.
- *E. diversicolor* (karri) in association with *E. jacksonii* (red tingle), *E. guilfoylei* (yellow tingle), *E. brevistylis* (Rate's tingle), *E. calophylla* (marri) in Western Australia.

Geography

- Usually occur in temperate and subtropical climates in areas with no dry season and regular seasonal rainfall, that exceeds 1000 mm annually.
- Restricted to mainly sheltered areas of mountainous terrain in Tasmania and on the mainland from Victoria to south-east Queensland and in south western Western Australia.
- Largest area is in Victoria (16 755 km^2).



Source:
National Land and Water Resources Audit 2001.
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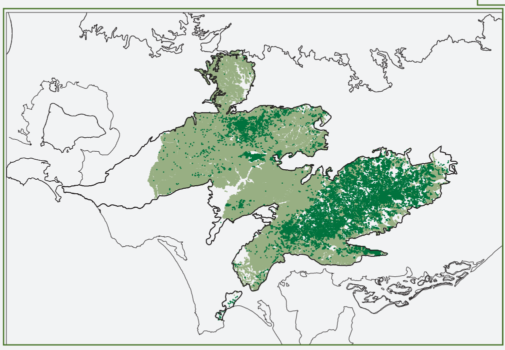
Change in extent of vegetation

Strzelecki Ranges, South East Highlands, Victoria

Present extent
Pre-European extent



Change

- Approximately 33% of pre-European extent cleared across Australia, accounting for 1.5% of total clearing.
- Approximately 15 000 km^2 cleared since European settlement for forestry (leading to changes in forest composition), agriculture and dams.
- Value of the timber has led to increased protective management. However this is often based on traditions of forest management initially developed through State forestry agencies and issues associated with understanding and managing forest areas have arisen.
- Many of these forests have the capacity to re-establish and provide multiple values for the community (e.g. regrowth karri forest around Pemberton cleared over a 100 years ago and now regenerated).
- Threats to these forests include regular or intense wildfires, unsustainable logging and clearing, and diseases and pests that may attack specific species or taxa (e.g. brown rot in the *Eucalyptus diversicolor* forests in Western Australia).

Key values

- Biodiversity that includes some of the richest and most varied plant communities in Australia
- Water catchments
- Geodiversity since they occur across a range of locations and site conditions
- Faunal remnants in their support of a wide range of vertebrate and invertebrate fauna species
- Timber
- Ecotourism, including bushwalking, walkways, wilderness experiences and tree-top walks (e.g. tree-top walk at Nornalup Western Australia, www.calm.wa.gov.au)

The public have placed a high value on the cultural and heritage values associated the stature of the larger and taller trees in these communities (e.g. Bird tree in Camden Haven, Gloucester and Diamond tree lookouts near Pemberton and Manjimup).

The value of these tall open forests for Indigenous people, forestry activities, conservation and tourism have been recognised through the recent joint Commonwealth and States data collation and review process associated with the Regional Forest Agreements (www.rfa.gov.au).

Tenure

Most of Australia's remaining tall open forests occur within state forests.

New South Wales:	central north areas on freehold land along river courses; coastal areas in state forests and protected areas
Queensland:	small patches primarily on freehold land, some in state forests
Tasmania:	state forests and protected areas
Victoria:	state forests and protected areas, some freehold land
Western Australia:	state forests and protected areas, very small areas on freehold land

Management considerations

- Clearing/edge effects
- Wildlife corridor re-establishment between remnants
- Isolation and faunal barriers caused by roads/powerlines. The establishment of public roads, which encourages access and enjoyment, can also lead to the degradation of these forests and the values that the tourists wish to see
- Tourist/visitor management
- Fire (e.g. from surrounding land uses). Fire is used as a tool in some areas (karri forest) for regenerating forests, while in other areas the intensity and frequency of fire is critical in the management of the forested areas (mountain ash and flooded gum)
- Disease management
- Weed control (e.g. aggressive weeds such as lantana)

Since forestry activities have been actively undertaken in these forest areas there has been a shift from addressing the management of the dominant forest tree species to endangered species and the management of forest systems through ecologically sustainable forest management. The integration of these management issues in the context of increasing pressures from human settlement and risks of fires has led to wide ranging and often competing public expectations of the managing authorities and agencies.

Murray Fagg

Eucalypt, Dandenong Ranges, Victoria

References

AUSLIG (Australian Surveying and Land Information Group) 1990, *Atlas of Australian Resources. Volume 6 Vegetation*, AUSMAP, Department of Administrative Services, Canberra.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

EUCALYPT OPEN FORESTS

- Vary from 10 m to 30 m reflecting the range of monsoonal, tropical, subtropical and temperate climatic conditions in which they occur.
- Generally the soil nutrient status determines the nature of the associated understorey, with the sclerophyllous shrubs on the nutrient-poor soils and the grassy (savanna) understorey on the higher nutrient soils (Specht & Specht 1999).
- Form the bulk of Australia's forested country and are the primary source for the timber industry—mainly from state forests.
- Majority dominated by a variety of eucalypts occurring in association with each other.
- Allow more light to penetrate the canopy providing scope for variability from a grass-dominated to shrub-dominated understoreys. Generally have a shrubby understorey which is low to moderate in height. In drier sites they may have a grassy understorey with scattered shrubs and/or cycads.

Eucalypt open forests: facts and figures

Vegetation class	Tree
Structural formation	Open forest, woodland, low open woodland
Major vegetation group	MVG 3. Eucalypt open forests
Major vegetation subgroups	• Eucalypt forests with a shrubby understorey • Eucalypt forests with a grassy understorey • Eucalypt forests with a heath understorey
Number of IBRA regions	50
Pre-European extent (km^2)	340 968
Present extent (km^2)	240 484
Area protected (km^2)	41 553

Murray Fagg

Eucalyptus obliqua open forest in Mount Lofty National Park, South Australia

Species

Tropical eucalypt open forests are dominated by *Eucalyptus tetrodonta, E. miniata* (Darwin woollybutt) and *E. nesophila* (Melville Island bloodwood). The woody understorey and associated species differ through the presence of *Terminalia, Buchanaia, Livistona* (palms) and *Cycas* (cycads). In some areas these forests support an understorey dominated by grasses such as species of *Triodia, Plectrachne* and *Sorghum.*

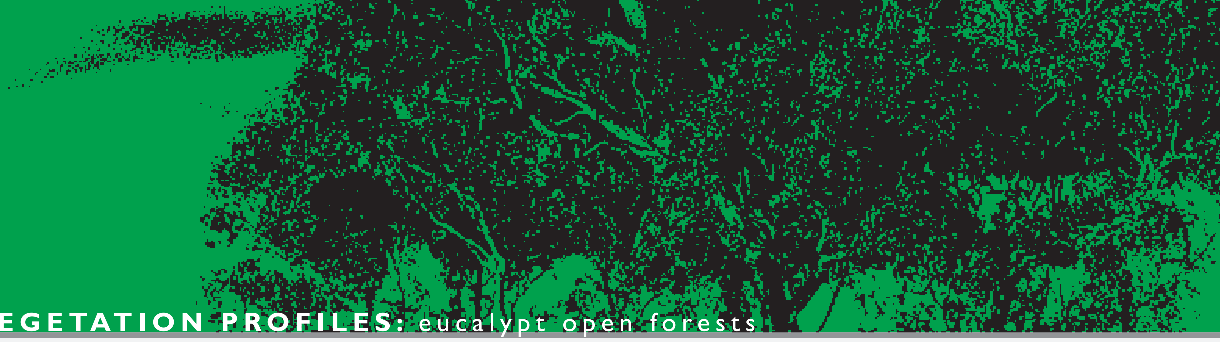
Eucalypt forests outside the tropics are often dominated by either sclerophyllous shrubs or grasses such as *Stipa* and *Danthonia* (or *Austrostipa* and *Austrodanthonia* respectively depending on their taxonomic acceptance). However they also include the world-renowned jarrah (*E. marginata*) forests in the south-west of Western Australia. These occur as pure stands and in association with wandoo, marri and tingle. In south-eastern Australia a diverse suite of eucalypt species are found, but some species may be widespread:

- *E. baxteri* (brown stringybark) and *E. obliqua* (messmate stringybark) in South Australia and Victoria;
- *E. macrorhyncha* (red stringybark) and *E. sideroxylon* (red ironbark) in Victoria and New South Wales;
- *E. crebra* (narrow leaved red ironbark) and *E. gummifera* (red bloodwood) in New South Wales;
- *E. maculata* (spotted gum), *E. intermedia* (pink bloodwood) and *E. acmenoides* in south-eastern Queensland;
- *E. camaldulensis* (river red gum) as an open forest is dominant along water courses in the Riverina in New South Wales;
- *E. microtheca* (coolabah) and *E. ochrophloia* (yapunyah) occurs along watercourses and seasonally inundated flats in the north-east of New South Wales.

Dominant species in Tasmania include *E. globulus*, *E. viminalis*, *E. obliqua*, *E. delegatensis*, *E. pauciflora*, *E. tenuiramis*, *E. pulchella*, *E. ovata*, *E. amygdalina* and *E. nitida*.

Murray Fagg

Eucalytpus delegatensis, Tasmannia lanceolata, Ben Lomond National Park, Tasmania

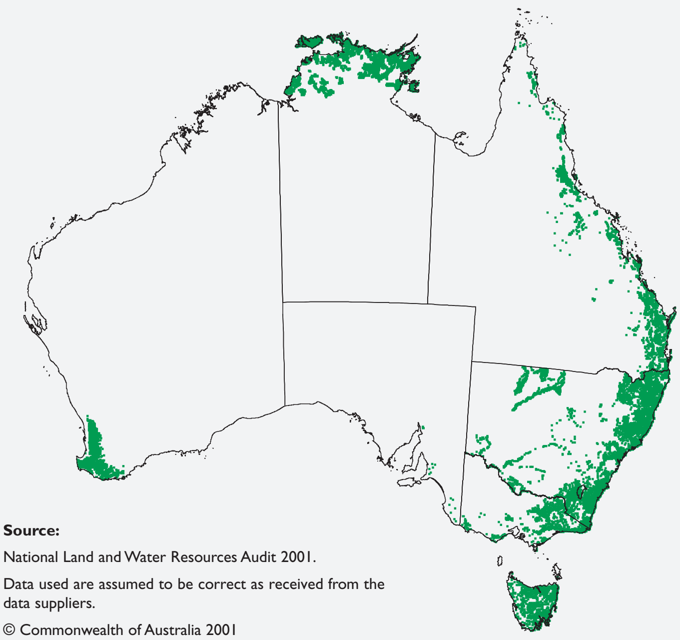


Geography

- Usually occur in monsoonal, tropical, subtropical and temperate regions of Australia and within 200 km of the coast or along major water courses.
- Occur around the edges of Australia from the Northern Territory, Queensland, through New South Wales, Victoria and Tasmania, to the southern areas of South Australia and Western Australia. There are small outliers in northern Queensland and along rivers in central and western New South Wales.
- Largest areas occur in New South Wales (90 979 km^2), the Northern Territory (58 471 km^2) and Queensland (35 150 km^2).
- Largest major vegetation group in Tasmania and the Australian Capital Territory.

Michael Ryan

Eucalyptus glaucescens flowers



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Murray Fagg

Xanthorrhoea glauca ssp. *angust, Eucalyptus sideroxylon* ssp. *sideroxylon, E. mainfera*

Change

- Approximately 30% of pre-European extent cleared accounting for 10.3% of total clearing in Australia.
- Approximately 100 000 km^2 cleared since European settlement including large areas in south-east Queensland. Only 9.5% of the pre-European extent remains of the initially small population in South Australia.
- Extensively cleared in the latter half of the nineteenth century for timber production, both for export (e.g. jarrah) and local markets (e.g. blackbutt), or cleared or ringbarked for agriculture and grazing.
- Continued loss of these communities would have occurred, had not substantial areas been set aside in crown land reserves either for timber production or, later, for nature conservation. The reservations for state forests are a good example of the foresight of resource managers at the time.
- Change may occur as a result of the activities of people that can either directly or indirectly affect the forest values, pests and diseases (e.g. the influence of *Phytophthera cinnamomi* in the *Eucalyptus marginata* forests in Western Australia and the *E. baxteri – E. obliqua* forests in Victoria), the potential for shifts in forest types resulting from logging regimes and regeneration strategies.
- Many of the northern forests have been influenced by grazing activities but remain largely uncleared, with the exception of some areas (e.g. near Darwin) that are increasingly under pressure from agriculture and urbanisation.

Tenure

A large proportion of the eucalypt open forests remain in state forests.

Australian Capital Territory :	largely in protected areas
New South Wales:	leasehold land in the western part of the State; coastal strip distribution largely in state forests, freehold land and protected areas
Northern Territory:	largely on freehold land, some in protected areas and leasehold land
Queensland:	primarily on freehold land; less in state forests, protected areas and leasehold land
South Australia:	protected areas and state forests, some small fragments on freehold land
Tasmania:	state forests and protected areas
Victoria:	protected areas and state forests, some freehold land
Western Australia:	large areas in state forests, less in protected areas, fragmented areas on freehold land

Key values

- Biodiversity including many endemic, and a wide range of flora and fauna species
- Geodiversity as a result of their wide ranging occurrence
- Faunal remnants of a wide range of vertebrate and invertebrate fauna species
- Timber (e.g. hardwoods for framing and flooring)
- Ecotourism (e.g. bushwalking, walkways) often in extensive areas of forests in Western Australia, South Australia, Tasmania and Queensland

Open forests tend to attract great interest from the wider community and tourists, possibly as a result of their proximity to settled areas as most of the southern open forest areas occur near or within a short driving distance of the major coastal city populations in Australia. This proximity has in recent years has led to additional threats to the native forest areas as forestry operations in some of the areas have been curtailed and there has been a shift to more forestry plantations and dedication of conservation areas (www.rfa.gov.au/).

Murray Fagg

Eucalyptus pauciflora open forest, Mount Ginini, Australian Capital Territory

Management considerations

- Clearing/edge effects
- Wildlife corridor re-establishment between remnants
- Isolation and faunal barriers caused by roads/powerlines
- Tourist/visitor management
- Fire regimes (protection of life and property versus management of biological values)
- Disease
- Weed control
- Feral animal control
- Forest management for multiple values

References

Specht R.L. & Specht A. 1999, *Australian Plant Communities. Dynamics of Structure, Growth and Biodiversity*, Oxford University Press.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

EUCALYPT LOW OPEN FORESTS

- Grow on less favourable sites (e.g. in extreme cold such as subalpine areas, dry areas, drainage impeded sites and steep rocky slopes).
- Can vary from 5–10 m in height.
- Eucalypt species may be the same as those occurring in the nearby more favourable sites, which support open forests. In other stands of low open forest the dominant species may include a gradation of species type and growth constraints (e.g. the snow gum, *Eucalyptus pauciflora,* in subalpine areas).
- Exhibit a variety of subforms, with understoreys ranging from low trees and shrubs to tussock grasses or, in some cases, bare ground.

Eucalypt low open forests: facts and figures

Vegetation class	Tree
Structural formation	Low open forests, low closed forests, rushland
Major vegetation group	MVG4. Eucalypt low open forests
Number of IBRA regions	28
Pre-European extent (km^2)	15 066
Present extent (km^2)	12 922
Area protected (km^2)	957

Michael Ryan

Low open eucalypt forest (*Eucalyptus maniffera*), Wee Jasper, New South Wales

Species distribution

North-west New South Wales

Eucalyptus largiflorens (black box) communities occur in seasonally inundated areas which may occur with *E. microtheca* (coolibah) and *E. camaldulensis* (river red gum).

Australian Capital Territory

A range of eucalypt species occur.

Victoria

Occurs in riparian areas with *E. camphora* and *Acacia melanoxylon* or in dry forests with a mix of eucalypt species.

Tasmania

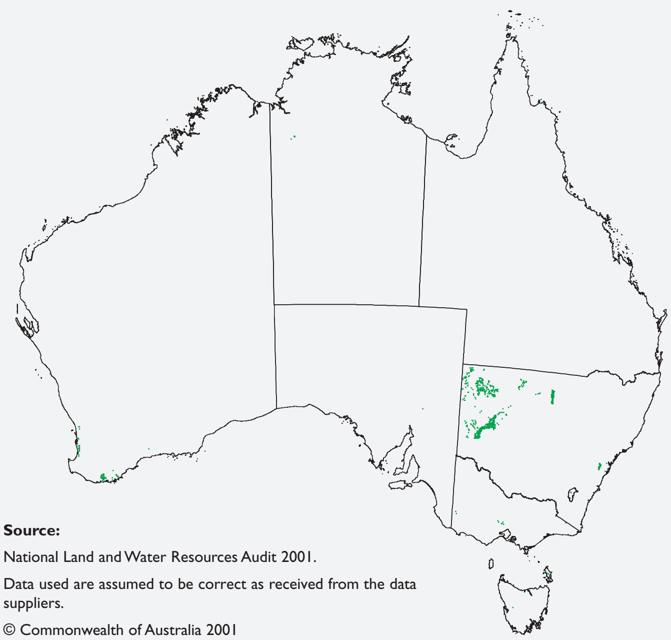
Flinders Island includes heathy and shrubby forest of *E. vernicosa* with *Nothofagus cunninghammii* shrubs, *E. viminalis*, *E. globulus* and *E. nitida.*

Western Australia

Has a range of species including *E. marginata* (jarrah), *E. cornuta* (yate), *E. lehmanni*, *E. platypus*, *E. calophylla* (marri), *E. decipens* and *E. staeri* often associated with casuarina and banksia species.

Geography

The eucalypt low open forests occur in New South Wales, Victoria, Tasmania, Western Australia and the Australian Capital Territory. The largest distribution occurs in western New South Wales.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

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Change

- Approximately 14% of pre-European extent cleared accounting for 0.2% of total clearing in Australia.
- Approximately 2000 km^2 cleared since European settlement.
- The restricted areas remaining may be relatively intact because of the extremes in site conditions that do not favour agricultural or pastoral activities.

Key values

- Biodiversity including endemic species
- Geodiversity particularly some specific environments (e.g. alpine areas)
- Faunal remnants of a wide range of vertebrate and invertebrate fauna
- Specialist values from tree and understorey species
- Ecotourism, including bushwalking, skiing, walkways and wilderness experiences in isolated areas

Key values are primarily associated with the protection of restricted ecological communities and endangered species. These become more significant in forest areas which are either geographically restricted in area or which have become restricted through fragmentation.

Management considerations

- Clearing/edge effects
- Wildlife corridors remnants
- Isolation and faunal barriers caused by roads/powerlines
- Tourist/visitor management (e.g. skiing)
- Fire (e.g. from surrounding land uses)
- Disease
- Weeds
- Feral animals

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Tenure

Low open forests are mainly found in protected areas, except in New South Wales where most are on leasehold land.

Australian Capital Territory: largely in protected areas and state forest

New South Wales: leasehold land and a small area protected in the western part of the State; coastal strip largely in protected areas

Northern Territory: in protected areas

Queensland: in protected areas

Tasmania: scattered in protected areas, state forest, crown land and freehold land

Victoria: largely in protected areas

Western Australia: scattered in freehold land, protected areas, state forest and crown land

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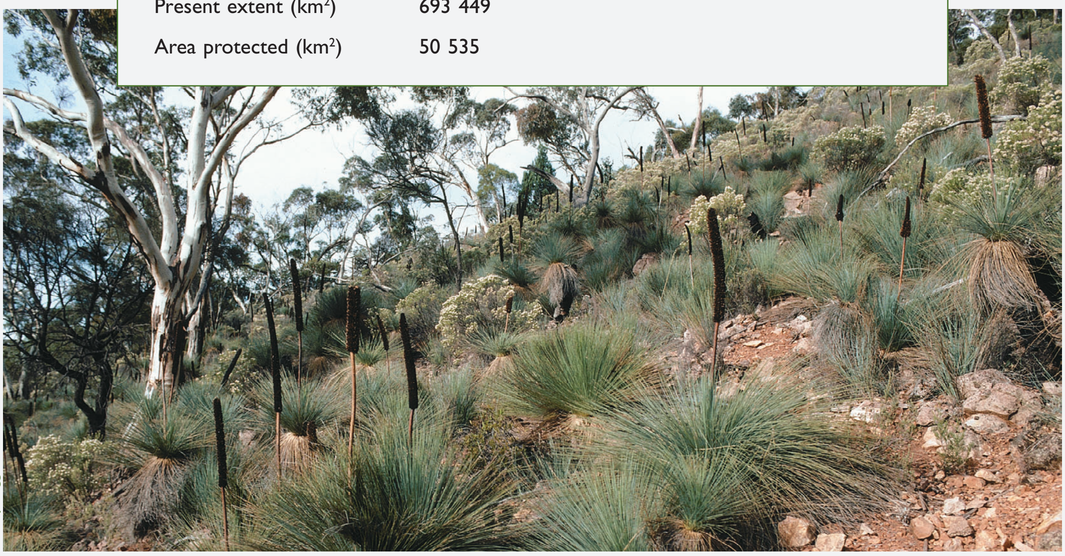
EUCALYPT WOODLANDS

- Form a transitional zone between the higher rainfall forested margins and hummock grasslands and shrublands of the arid interior.
- Include a series of communities that typify inland Australia (e.g. the poplar, white and yellow box, and ironbark woodlands of eastern Australia are included in this group).
- The complexity of the communities varies from simple communities with fewer than three dominant tree species to mixed communities with many tree species. This complexity is further increased with the wide range of shrub and grassy understoreys that may occur.
- Understoreys may vary from grasses to shrubs and in some cases have attained a parkland appearance due to frequent fire and grazing. This 'parkland' now typifies the woodlands in the eastern and southern parts of Australia and is reflected in earlier landscape paintings providing a strong sense of place for many Australians.
- Earlier accounts from explorers provide a slightly different picture of these communities—one where tall grasses were a more conspicuous component of the landscape than today.

Eucalypt woodlands: facts and figures

Vegetation class	Tree
Structural formation	Woodlands, low woodlands, tall woodlands, open woodlands, open forests
Major vegetation group	MVG 5. Eucalypt woodlands
Major vegetation subgroup	• Eucalypt woodlands with a shrubby understorey • Eucalypt woodlands with a grassy understorey • Low tropical eucalypt forests and woodlands • Tropical eucalypt mixed species forests and woodlands
Number of IBRA regions	80
Pre-European extent (km^2)	1 012 047
Present extent (km^2)	693 449
Area protected (km^2)	50 535



Murray Fagg

Eucalypt woodlands with *Xanthorrhoea quadrangulata* understorey, near Wilmington

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Major groupings

Several major groupings of eucalypt woodland are commonly recognised:

- Tropical stringybark and box woodlands with annual grass understoreys, dominated by Darwin stringybark (*E. tetrodonta*) and Darwin woollybut (*E. miniata*) (see tropical eucalypt woodlands/grasslands major vegetation group).
- Tropical stringybark woodlands with a perennial grass understorey.
- Northern ironbark and bloodwood woodlands.
- Box woodlands of the Brigalow Belt.
- Spotted gum woodlands.
- Woodlands (e.g. coolabah [*E. microtheca*] and river red gum [*E. camaldulensis*]) occurring on inland riverine flats.
- Box-ironbark woodlands of southern Queensland, New South Wales and Victoria.
- Subalpine woodlands in New South Wales, Victoria and Tasmania.
- Smooth barked and box woodlands in South Australia.
- Woodlands of the Tasmanian lowlands.
- Woodlands over hummock grasses in the arid interior.
- Wandoo, redwood, Dundas blackbutt, coral gum, salmon gum, merrit and red mallee in eastern south-west Western Australia; jarrah and wandoo in the far south-western corner.
- *E. microcarpa* and *E. ovata* also in South Australia.
- South Australia also has *E. fasciculosa* as well as *E. leucoxylon*.
- *E. odorata* in South Australia, as well as similar communitites of *E. porosa*, *E. microcarpa* box style woodlands.

The woodlands of *Eucalyptus camaldulensis* (river red gum) are the most widespread of all woodlands, as this community occurs along the majority of inland waterways and creeklines.

Woodlands with low shrubs occur in south-western Western Australia and include *Eucalyptus wandoo, E. accedens* (powderbark wandoo) and *E. salmonophloia* (salmon gum), in southern Australia (South Australia and Victoria) and *E. leucoxylon* and *E. tetrodonta* in Queensland, and *E. sieberi* and *E. macrorhyncha* and *E. sideroxylon* (red ironbark) in New South Wales.

Woodlands over tussock grasses occur in many places in the wetter parts of northern and eastern Australia, from the Kimberley region of Western Australia, to south-eastern South Australia. The woodlands in the northern monsoonal areas include some of the few deciduous species of eucalypts, including *Eucalyptus alba, E. grandifola* and *E. latifolia*. These grassy woodlands tend to be associated with heavier or more fertile soils than those with a shrubby or hummock grassland and consequently large areas of these woodlands have been cleared for agriculture. Dominant species in this subform include *E. tetrodonta* and *E. dichromophloia* in northern Australia (see tropical eucalypt woodlands/grasslands), *E. miniata* in Northern Territory, *E. polycarpa* in Queensland, *E. crebra, E. populnea* and *E. melanophloia* in areas west of the coastal ranges of Queensland and New South Wales, *E. tereticornis* in coastal valleys, and *E. albens* and *E. melliodora* on inland side of ranges in New South Wales and Victoria, with *E. microcarpa* further west. *E. viminalis* is common in the ranges from New South Wales to South Australia and Tasmania. *E. leucoxylon* and *E. camaldulensis* are major species in South Australia and Victoria.

Species distribution

Northern Territory

E. dichromophloia (a bloodwood), *E. miniata* (Darwin woollybutt), *E. tetrodonta* (Darwin stringybark) and *E. polycarpa, E. bella, E. oligantha, E. confertiflora, E. tectifica, E. patellaris, E. terminalis, E. ferruginea, E. pruinosa, E. microtheca, E. phoenicea, E. leucophloia* and *E.papuana*.

Northern Queensland

E. tetrodonta, Corymbia clarksoniana, Corymbia hylandii, E. phoenicea (scarlet gum).

Central Queensland

E. populnea (poplar or bimble box), *E. crebra* (narrow-leaved red ironbark), *E. melanophloia* (silver-leaved ironbark) and *Angophora leiocarpa*.

South-east Queensland

E. umbra (broad-leaved white mahogany), *Corymbia trachyphloia, E. crebra, E. melliodora and E. albens.*

Southern coastal New South Wales

Angophora costata and *A. floribunda.*

Murray Fagg

30km north of Cairns, Cook Highway, Queensland

New South Wales

E. microcarpa (grey box) and *E. largiflorens* (black box), *E. melanophloia, E. populnea, E. blakelyi.*

Australian Capital Territory

E. stellulata, E. rubida, E. rossii (scribbly gum), *E. polyanthemos, E. pauciflora, E. nortonii, E. melliodora, E. macrorhyncha, E. dives* (broad-leaved peppermint) and *E. blakelyi.*

Victoria

E. ovata (swamp gum), *E. obliqua, E. baxteri* (brown strngybark), *E. viminalis, E. leucoxylon* (yellow gum), *E. gonicocalyx, E. arenacea, E. melliodora, E. microcarpa, E. dives, E. rubida, E. pauciflora, E. macrorhyncha, E. cephalocarpa, E. blakelyi, E. tricarpa* and *E. albens.*

Tasmania

E. globulus, E. amygdalina (black peppermint), *E. pauciflora, E. viminalis, E. ovata, E. obliqua, E. delegatensis, E. rodwayi* and *E. subcrenulata* (Tasmanian alpine yellow gum).

South Australia

E. ovata (swamp gum), *E. odorata, E. obliqua, E. viminalis, E. leucoxylon, E. gonicocalyx, E. fasciculosa* (pink gum), *E. porosa, E. microcarpa, E. camaldulensis, E. cosmophylla, E. cladocalyx* (sugar gum), *E. baxteri, E. arenacea, E.largiflorens, E.coolabah* and *E. preiseei.*

Western Australia

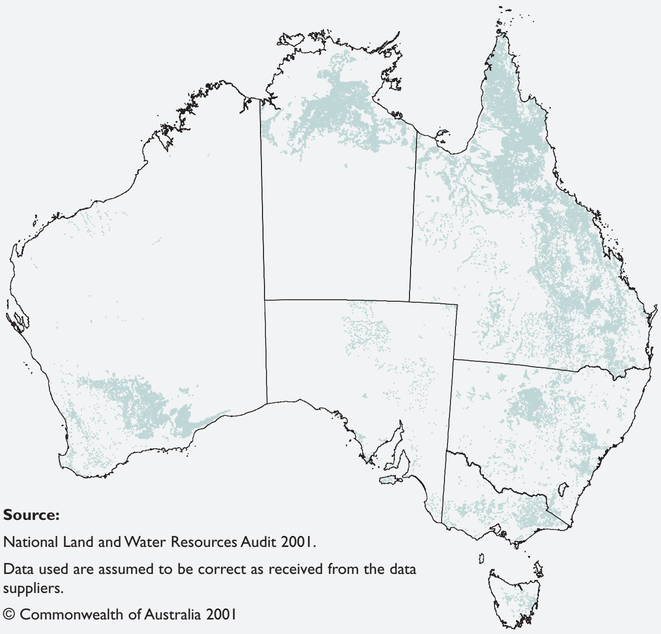
E. transcontinentalis (redwood), *E. dundasii* (Dundas blackbutt), *E. toquata, E. wandoo* and *E. calophylla* (marri).

Geography

- Found across a wide range of climatic conditions and usually on the fringes of forested areas and water courses or where soil moisture or nutrients may be limiting for tree growth.
- The large number of eucalypts and their associated species occur on a wide range of environmental gradients. These relationships have been further complicated by the impact of land use following European settlement.
- Largest distribution of woodland type in Australia and occurs in all States and Territories.
- Largest distribution is found in Queensland (367 293 km^2).
- Makes up the largest major vegetation group in Queensland and Victoria.

Diane Napier\

Erythrophleum chlorostachys and *Eucalyptus tectifica* woodland, *Sorhum intrans* grassland, Northern Territory



Source:

National Land and Water Resources Audit 2001.

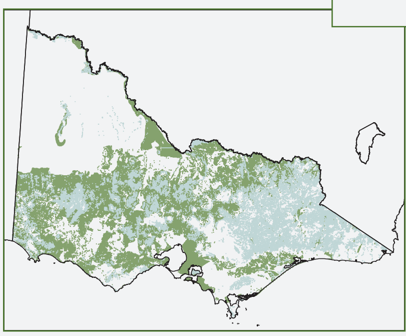
Data used are assumed to be correct as received from the data suppliers.

Change in extent of vegetation

Victoria

Pre-European extent

Present extent



Murray Fagg

Eucalypt grassy woodland, near Suggan Buggan, Victoria

Change

- Approximately 319 000 km^2 cleared since European settlement: approximately 31% of pre-European extent cleared accounting for 32.5% of total clearing in Australia.
- An important part of cereal cropping and pastoral zones. Much of the cleared areas are extensive so that the broad fabric of the landscape from a vegetation perspective has been lost.
- Removed from many cereal cropping and sheep grazing lands in the south-east and the far south-west of Australia.
- Modified by pastoral activities and altered fire regimes in many places.
- In Queensland, New South Wales and Victoria, pasture improvement and tree thinning have been extensively employed in the grassy woodlands, while the shrubby understorey of others has been removed to increase pasture growth.
- Shrubby understorey of remnants has often been removed either mechanically or by frequent fire, the native tussock grasses have been invaded by exotic species or have been subject to overgrazing, with annuals then replacing perennials. Eucalypt open woodland areas mapped as native vegetation may be highly modified, and from a condition perspective, low in nature conservation values.
- Spread of urban development has encroached on these woodlands so that some are considered to be threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), while others are under consideration for listing.
- In recognition of fire hazard and their proximity to intensive agricultural and urban areas the fire regime in these communities has been modified in the last few centuries and many of the woodlands have been invaded by aggressive introduced plant species. A good example of woodlands subject to urban pressures is the Cumberland Plain woodlands of western Sydney.
- Foremost amongst threats to this vegetation is the fragmentation of woodland areas, regular or intense wildfires, grazing or rapid changes to local sites conditions. In view of recent changes in land clearing policies in parts of Australia, there has been a recent shift away from the clearing of woodlands to the protection and management of these areas, including use of native pasture grasses. Consequently, there are issues associated with understanding and managing grazing in these woodland areas.
- Rural communities are rehabilitating and fencing off selected remnants. These stewardship activities are often spurred on by dieback, the need for dryland salinity control and a recognition that in many of the agricultural landscapes only over-mature trees remain.

Tenure

Eucalypt woodlands mainly occur on leasehold land or in state forests:

New South Wales:	leasehold land, protected areas, freehold land and some state forests
Northern Territory:	largely leasehold land, some freehold land, protected areas
Queensland:	largely leasehold and freehold land, some state forests and protected areas
South Australia:	leasehold land, freehold land, some protected areas and little in state forests
Tasmania:	state forests, protected areas and freehold land
Victoria:	state forests, protected areas and some freehold land
Western Australia:	vacant crown land, leasehold land, fragmented areas in freehold land and some state forests

Key values

The values of the woodlands for indigenous people, conservation and tourism have started to be recognised. Less than 10% remains in secure protected areas with most areas under private or leasehold management.

- Biodiversity including a variety of understorey from grasses to shrubs
- Geodiversity as a result of the range of locations and site conditions
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Ecotourism, including bushwalking, walkways and landscape features
- Water balance—much of the area affected by groundwater rise coincides with area of eucalypt woodlands

Management considerations

- Clearing/edge effects and control of dieback/loss of trees from the landscape
- Wildlife corridor between remnants
- Remnant protection and expansion
- Fire (e.g. from surrounding land uses) is used as a tool in some areas, although the understorey species can be modified by the intensity and regularity of fire regimes
- Weeds

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

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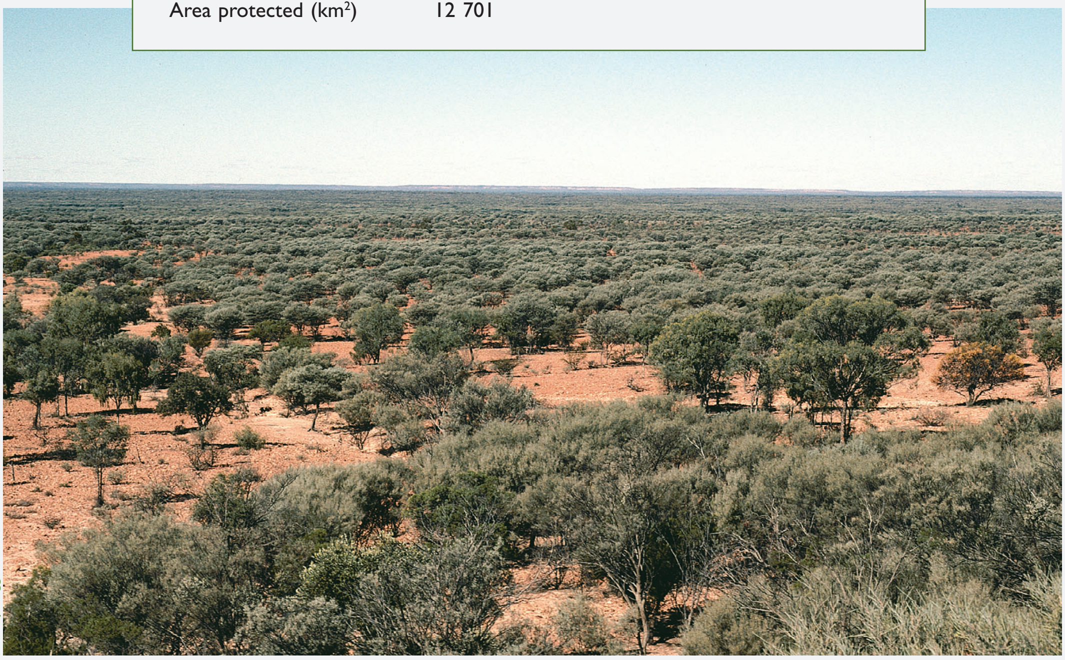
ACACIA FORESTS AND WOODLANDS

- Acacia is the most widespread tree component.
- Although the trees are stunted (often less than 10 m), in some areas they can grow to heights of 25 m.
- Dominant species include lancewood (*Acacia shirleyi*), bendee *(A. catenulata*), mulga (*A. aneura*), gidgee (*A. cambagei*) and brigalow (*A. harpophylla*). The most widespread species are mulga and brigalow.
- Dominance is controlled by climatic conditions and soil factors.
- Eucalypts occur in some places as occasional emergents.
- Understorey species are generally low shrubs or herbaceous.

Acacia forests and woodlands: facts and figures

Vegetation class	Tree
Structural formation	Open forests, low open forests, woodlands, open woodlands, low woodlands
Major vegetation group	MVG 6. Acacia forests and woodlands
Number of IBRA regions	62
Pre-European extent (km^2)	657 582
Present extent (km^2)	560 649
Area protected (km^2)	12 701



Murray Fagg

Acacia aneura woodland near Yenloora, Queensland

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Species distribution

Co-dominants include *Eucalyptus, Callitris, Casuarina* and *Terminalia.* The ground layers are generally herbaceous. Associated species include shrub species such as *Eremophila, Dodonaea*, chenopods such as *Atriplex, Maireana, Sclerolaena* and grasses such as *Triodia, Plectrachne, Aristida* and *Austrostipa.*

Northern Australia

Dominated by *A. shirleyi* with grassy understorey and *A. crassicarpa* on coastal dunes in Cape York Peninsula.

Central and central west Queensland

Dominant species are *A. cambagei* (gidgee), *A. shirleyi* with eucalypt species, *A. harpophylla* (brigalow) with casuarina, *A. catenulata* (bendee) with grassy understorey, *A. argyrodendron* with shrubland; *A. aneura* with eucalyupt species, *A. rhodophloia*, *A. rhodoxylon*, *A. crombiei*, *A. georginae*, *A. excelsa* and *A. cyperophylla* with grassy understorey.

Southern Queensland

Dominated by *A. aneura*, *A. cambagei* (gidgee), *A. harpophylla* (brigalow) with casuarina and both forb and grassy understoreys, *A. catenulata*, *A. shirleyi* with eucalypt species, *A. microsperma*, *A. rhodophloia*, *A. melvillei*, *A. rhodoxylon* with an *A. aulacocarpa* mix on coastal dunes.

Northern central and west of New South Wales

Contain *A. pendula* (myall), *A. harpophylla* (brigalow), *A. melvillei*, *A. excelsa* and *A. cambagei* (gidgee) across to South Australia with *A. salicina* with *E. camaldulensis*; *A. aneura*, *A. victoriae* and *A. stowardii* mixed overstorey with acacia and chenopod shrubs.

Victoria

Very restricted with *A. melanoxylon* (blackwood), *A. dealbata* (silver wattle), *A. mearnsii* swampy/riparian communities; *A. silvestris* mixed community; *A. pycnantha* with a sedge understorey woodland in the eastern half of the State.

Western Australia

A large area of this group covers the central area including *A. aneura*, *A. coriacea*, *A. eremaea*, *A. victoriae*, *A. ramulosa*, *A. linophylla*, *A. sclerosperma*, *A. rostellifera*, some mixed with callitris and eucalypt species.

Murray Fagg

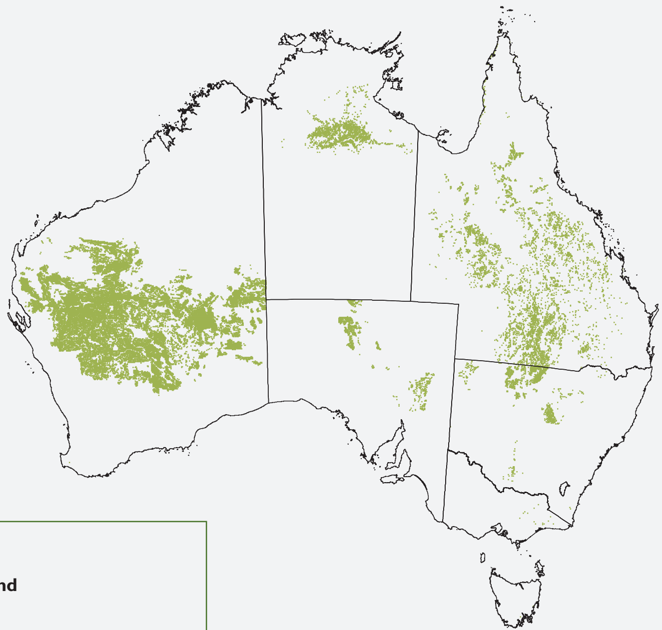
Mulga (*Acacia aneura*) woodland, 150 km west of Charleville, Queensland

Geography

- Climatic conditions are generally dry, hot summers, with cool to warm winters. Rainfall is variable although maximum falls occur in summer.
- Occur in New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria and Western Australia primarily in semi-arid regions.
- Largest areas are in Western Australia (402 223 km²).

John Neldner

Acacia shirleyi (lancewood) low woodland south of Winton Queensland



Source:

National Land and Water Resources Audit 2001.

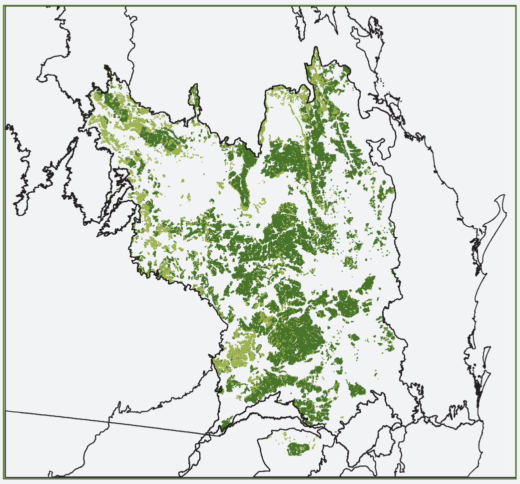
Data used are assumed to be correct as received from the data suppliers.

Change in extent of vegetation

Brigalow Belt South bioregion, Queensland

Present extent

Pre-European extent



Change

- Approximately 15% of pre-European extent cleared accounting for 9.9% of total clearing in Australia.
- Approximately 97 000 km^2 cleared since European settlement.
- Extensively cleared for agriculture (particularly the brigalow and mulga communities).
- Modified by pastoral and (in localised areas) mining activities.
- As the pastoral industry has faced restructuring in recent years, some areas have been purchased for conservation (e.g. some pastoral stations in Western Australia and Queensland). Clearing of these woodlands is continuing in Queensland (NLWRA 2001a).
- Foremost threats are changes in fire regime and over-grazing (including cattle, sheep and feral animals) (NLWRA 2001b). Recent changes in land management policies has resulted in a shift to use of native pasture grasses, restrictions on clearing and a search for more sustainable management of rangeland pastures.

Brigalow (*Acacia harpophylla*) forest, near Tambo, Queensland

Murray Fagg

Tenure

Acacia forests and woodlands mainly occur on leasehold land.

New South Wales:	leasehold and freehold land, small areas protected
Northern Territory:	leasehold land, some freehold land
Queensland:	freehold and leasehold land, some protected areas and state forests
South Australia:	leasehold land, small areas protected
Victoria:	state forests and protected areas
Western Australia:	leasehold land, crown land, reserved crown land, small areas protected

Key values

- Biodiversity
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Timber values (e.g. craft products such as sandalwood)
- Ecotourism (including bushwalking and landscapes in remote areas)

Key values are mainly associated with biodiversity and ecotourism values, ecological communities and protection of endangered species.

Management considerations

- Clearing, especially in Queensland
- Grazing pressure from both domestic stock and feral animals
- Fire regimes (recognising that some introduced grasses such as buffel grass can carry a hotter fire than native pasture grasses, thereby altering regeneration opportunities of trees and shrubs)
- Weed control (a major issue with pastoralists is the level of investment able to be made given the low profitability of the land)

References

National Land and Water Resources Audit (2001a) *Landscape health in Australia*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (2001b) *Rangelands—Tracking Changes*, National Land and Water Resources Audit, Canberra.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

CALLITRIS FORESTS AND WOODLANDS

- Pure stands are restricted to localised pockets on undulating to flat land, most often in fire-protected sites. An alliance with eucalypt species is more common. Other outlying populations occur on upland rocky areas protected from regular fire events.
- Generally dominated by a herbaceous understorey with only a few shrubs.
- Associated tree species include mulga (*Acacia aneura*), wilga (*Geijera* spp.), sugarwood (*Myoporum* spp.) and buloke or belah (*Casuarina* spp.).
- Associated shrub species include *Eremophila, Dodonaea*, chenopods such as *Atriplex, Maireana, Sclerolaena* and grasses such as *Triodia, Plectrachne, Aristida* and *Austrostipa.*
- In the Australian Capital Territory *C. endlicheri* (black cypress pine) woodlands occurs and in New South Wales and South Australia *C. glaucophylla* (white cypress pine) woodlands and *C. preissii* (Rottnest Island pine) open forests and other unknown callitris species occur. *C. glaucophylla* woodland and open forests with mixed eucalypt and casuarina species occur in Queensland. *C. rhomboidea* tall open and closed forests occur in Tasmania and *C. gracilis* and *C. glaucophylla* woodlands occur in Victoria.

Callitris forests and woodlands: facts and figures

Vegetation class	Tree
Structural formation	Open forests, woodlands, open woodlands, low woodlands
Major vegetation group	MVG 7. Callitris forests and woodlands
Number of IBRA regions	25
Pre-European extent (km^2)	30 963
Present extent (km^2)	27 724
Area protected (km^2)	1 728

Murray Fagg

Callitris woodland, Tailem Bend, South Australia

Home

Summary

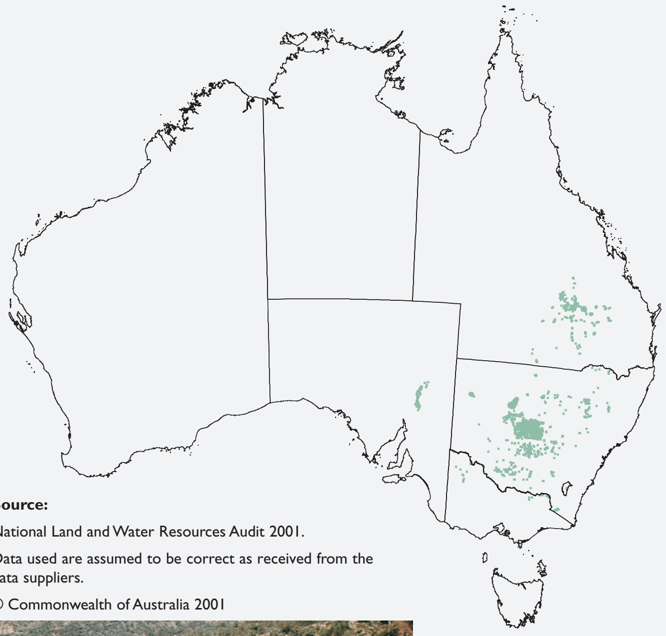
Contents

Geography

- Occur in the drier country of southern Queensland and in central New South Wales. Small pockets also occur in South Australia (large area throughout the Flinders Ranges), southern New South Wales and northern Victoria.
- Largest area occurs in New South Wales (22 132 km^2).
- Occur in areas where the summers are hot to very hot and the winters are mild to warm. Rainfall is variable from 400 mm to 600 mm.
- Occur mainly at the drier end of the forest – woodland vegetation spectrum.

John Neldner

Callitris glaucophylla open forest with *Eucalyptus crebra* emergent north of Mitchell, Queensland



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Murray Fagg

Callitris pine/grassland, Warren Gorge, Flinders Ranges, South Australia

Home

Summary

Contents

Change

- Approximately 10% of pre-European extent cleared accounting for 0.3% of total clearing in Australia.
- Approximately 3000 km^2 cleared since European settlement.
- Modified by selective logging for timber since the early days of settlement (e.g. callitris pine was used in the nineteenth century to build homes for the early European settlers in areas such as Rosedale and Sandy Creek in South Australia). The termite resistance of cypress pine has made it a very important flooring timber and—previously—a framing timber.
- State forests in the Brigalow Belt of New South Wales and Queensland contain extensive forest areas dominated by cypress where silvicultural and fire management practices foster its precedence over other canopy trees.
- Modified (particularly understorey species) for pastoral activities associated with sheep and cattle. Understorey species may also have been affected by modified fire regimes since settlement.
- Cleared for mining activities in some localised areas.
- Recruitment and regeneration affected by total grazing pressures from native and feral species as well as stock.
- Many of the woodlands have historically been burnt by broad-scale and very hot wildfires.

Callitris glaucophylla woodland, Snowy River National Park

Murray Fagg

Tenure

Callitris forests and woodlands mainly occur on leasehold and freehold land.

New South Wales:	leasehold land, freehold land, some state forests and protected areas
Queensland:	state forests, freehold land, leasehold land
South Australia:	freehold land and protected area
Victoria:	protected areas and freehold land

Key values

- Biodiversity
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Timber values—early settlers used callitris for construction, now the forests provide specialty timbers

Management considerations

- Clearing and edge effects, especially for smaller remnants
- Total grazing pressure and its management—native, stock and feral animals
- Fire regime/likelihood of hot fires (e.g. some remnant stands in Pilbara have been protected from fire for extensive periods)
- Weed control

These forests and woodlands have been extensively cleared for agriculture (especially brigalow and mulga communities) and modified by pastoral activities or (in localised areas) mining activities. In recent years, as the pastoral industry has faced an economic downturn, some of these forests and woodlands have been purchased for conservation (e.g. in Western Australia). Clearing of these woodlands is continuing in Queensland (NLWRA 2001).

References

National Land and Water Resource Audit (2001) *Landscape health in Australia,* National Land and Water Resources Audit, Canberra.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

CASUARINA FORESTS AND WOODLANDS

- Casuarinas are a distinctive part of the Australian landscape. The name *Casuarina* is derived from the Malay *Kasuari* and alludes to the similarity between the drooping foliage of the genus and that of the feathers of the cassowary bird (Boland et al. 1994).
- The original genus *Casuarina* has been subdivided into two genera *Casuarina* and *Allocasuarina.*
- Pure stands of casuarina are restricted in area to specific sites, such as:
  - coastal foredunes of eastern Australia (e.g. coast she-oak [*Casuarina equisetifolia*]);
  - fringes of flow lines or in swamps (grey she-oak [*C. glauca],* Western Australia swamp she-oak [*C. obesa*]; river oak [*C. cunninghamiana*]); or
  - rock outcrops (e.g. *Allocasuarina huegeliana* on granitic soils and near outcrops in Western Australia).

Casuarina forests and woodlands: facts and figures

Vegetation class	Tree
Structural formation	Open forests, low open forests, woodlands, open woodlands, low open woodlands, low woodlands
Major vegetation group	MVG 8. Casuarina forests and woodlands
Number of IBRA regions	36
Pre-European extent (km²)	73 356
Present extent (km²)	60 848
Area protected (km²)	8457

Murray Fagg

Allocasuarina decaisneana woodland, Canning Stock Route, Western Australia

Species distribution

Typical species in inland areas include belah (*C. cristata*), drooping she-oak (*C. stricta*) and river she-oak *(C. cunninghamiana*). Coast she-oak (*C. equisetifolia*) can also occur in association with coastal banksias along the south-east and eastern seaboards in less exposed sites.

Australian Capital Territory
C. cunninghamiana, *A. verticillata* and *Eucalyptus nortonii.*

New South Wales
A. verticillata, *C. cunninghamiana*, *C. glauca*, *C. pauper*, *A. leuhmanii*, *C. cristata.*

Queensland
Allocasuarina luehmannii, *C. cristata*, *C. equisetifolia*, *A. torulosa* (forest oak), *A. littoralis*, *C. cunninghamiana*, *C. glauca* (swamp oak).

South Australia
C. pauper, *A. verticillata*, *A. luehmannii* with *Allocasuarina* dominant.

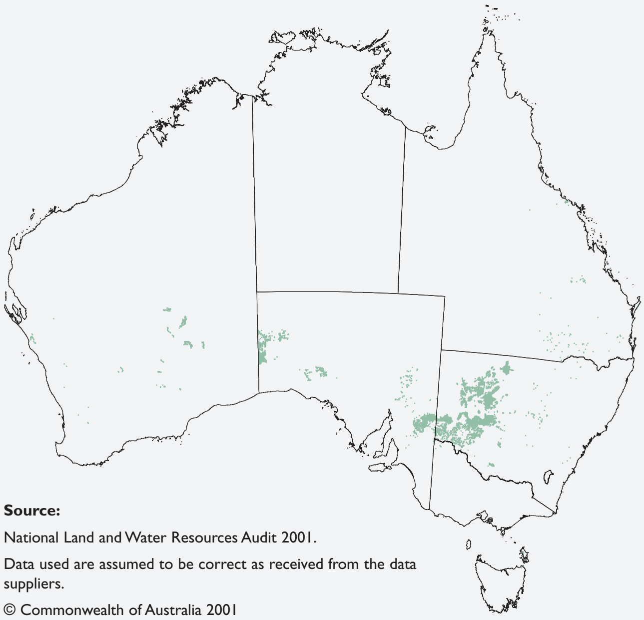
Tasmania
A. verticillata, *A. littoralis.*

Victoria
C. pauper woodland (mixed).

Western Australia
A. cristata, *A. huegeliana*, *C. obesa.*

Geography

- Primarily on littoral and riverbank sites along the south-eastern, eastern and northern coast of Australia and on rocky sites throughout the continent.
- In association with acacia and eucalypts in other inland areas.
- The largest distribution is in western New South Wales (40 698 km²).



Source:

National Land and Water Resources Audit 2001.

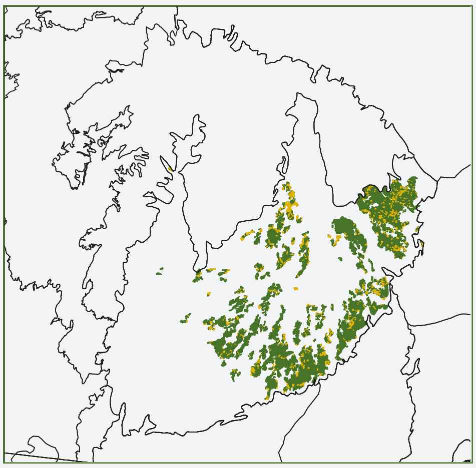
Data used are assumed to be correct as received from the data suppliers.

Change in extent of vegetation

West Balonne Plains subregion, Mulga Lands bioregion, Queensland

Present extent

Pre-European extent



Change

- Approximately 17% of pre-European extent cleared accounting for 1.3% of total clearing in Australia.
- Approximately 13 000 km^2 cleared since European settlement.
- Modified by selective logging for timber (including specialist timber uses of species such as *Allocasuarina fraseriana* in Western Australia and *Casuarina torulosa* for shingles and shakes in eastern Australia).
- Other areas have been modified by sheep and cattle grazing.
- Species and communities may also have been affected by changed fire regimes. Reports suggest an increase in some she-oak species at the expense of other co-dominants in regularly burnt areas.
- Due to the limited size many areas still remain intact, although some have been modified for sheep and cattle grazing and some have been cleared for urban use.
- Casuarinas associated with extreme sites (e.g. swamps or outcrops) have been relatively protected from interference and many occur within conservation areas.
- Some casuarina communities along creek-lines and water-courses in dryland salinity areas have been affected by increased waterlogging and salinity as a result of clearing and fragmentation of landscapes. In some localised areas the forests and woodlands have also been cleared for mining activities.
- Threats to these restricted-site communities include rising watertables and dryland salinity in temperate Australia, and coastal development affecting wetland and supratidal forests of *Casuarina glauca*.

Tenure

Casuarina forests and woodlands occur on a wide range of tenures.

Australian Capital Territory:	freehold land
New South Wales:	mostly leasehold land, some freehold land and protected areas
Queensland:	freehold land, some leasehold land, small areas protected or in state forests
South Australia:	protected areas, leasehold land and some freehold land
Tasmania:	freehold land
Victoria:	protected areas
Western Australia:	other crown land, some reserved crown land, leasehold land and protected areas

Key values

- Biodiversity including variation in species associated with the different plant communities
- Remnants support a wide range of vertebrate and invertebrate species
- Coastal ecology as a part of estuarine and brackish wetland systems
- Specialty timbers

The wood of most casuarinas is very hard and therefore provides excellent fuel. *Casuarina equisetifolia* is reputed to be the best fuel wood in the world as it is relatively smokeless when it burns. Branchlets are used as fodder for stock during drought.

Management considerations

- Clearing and edge effects
- Changes to fire regime (e.g. from surrounding land uses)
- Weed control
- Changes to coastal ecology and tide regimes
- Management of casuarina along creek lines, watercourses and swamps provides challenges in many parts of Australia as salinity concentrations and groundwater levels increase.

References

Boland D.J., Brooker M.I.H., Chippendale G.M., Hall N., Hyland B.P.M., Johnston R.D., Kleinig D.A. & Turner J.D. 1994, *Forest Trees of Australia*, CSIRO Publishing, Collingwood, Australia.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Murray Fagg

Casuarina cristata ssp. *pauper* woodland, Carrawinya National Park, Queensland

MELALEUCA FORESTS AND WOODLANDS

- The preferred common name for the larger species with the appropriate bark character is paperbark with some qualifying adjective (Boland et al. 1994).
- The northern Australian melaleucas are dominated by the broad-leaved paperbark (*Melaleuca viridiflora*), weeping paperbark (*M. leucadendra*), silver paperbark *(M. argentea*), blue paperbark (*M. dealbata*) and yellow-barked paperbark (*M. nervosa*) with forb and grassy understoreys. Other species in the Northern Territory include *M. citrolens*, *M. cajuputi*, *M. stenostachya*, *M. minutifolia*, *M. acacioides* and in Queensland, *M. tamariscina*, *M. bracteata*, *M. stenostachya*, *M. saligna*, *M. arcana*, *M. clarksonii*, *M. citrolens*, *M. foliolosa* and *M. fluviatilis*.
- In southern and eastern Australia the melaleucas are confined mainly to the wetter watercourses and swamps with the paperbarked tea-tree (*M. quinquenervia*), the most widespread coastal species. In New South Wales additional coastal woodland and forest species include *M. decora*, *M. sieberi*, *M. nodosa* and *M.linariifolia*.
- In Western Australia melaleuca forests and woodlands are restricted to pockets in specific sites, such as the swamp paperbark (*M. preissiana*) on subcoastal swamp areas and (*M. rhaphiophylla)* on creek lines and watercourses.
- Very small coastal areas in South Australia and Victoria include *M. lanceolata* (moonah), *M. halmaturorum* ssp. *halmaturorum*, *M. brevifolia*, *M. lanceolata* ssp. *lanceolata*.

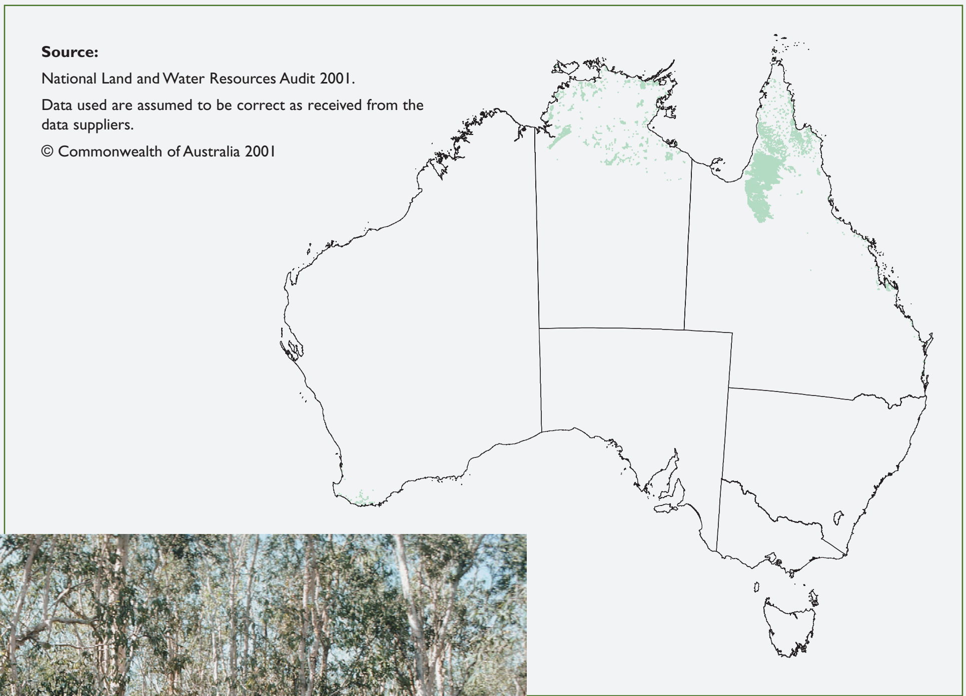
Associated species vary throughout Australia, depending on the underlying site conditions. In drier areas of Australia, emu bushes (*Eremophila* spp.) and other shrubs dominate the understorey, whilst in damper and wetter areas in the east and south the understorey is dominated by sedges and aquatics.

Melaleuca forests and woodlands: facts and figures

Vegetation class	Tree
Structural formation	Open forest, woodland, low woodland
Major vegetation group	MVG 9. Melaleuca forests and woodlands
Number of IBRA regions	35
Pre-European extent (km^2)	93 501
Present extent (km^2)	90 513
Area protected (km^2)	7812

Geography

- While Australia is the home of most melaleucas, some tropical species extend beyond Australia to New Guinea, New Caledonia, Malaysia, India and Indonesia (Boland et al. 1994).
- Primarily in the coastal and subcoastal areas of monsoonal northern Australia in the Northern Territory and in far northern Queensland on the areas adjacent to the Gulf of Carpentaria and on the Cape York Peninsula.
- Largest area occurs in Queensland (70 014 km^2).
- Small pockets along the subtropical and temperate coasts of Queensland, New South Wales and Western Australia, and around fringes of rivers and coastal wetlands.
- Some of the better known species have a marked preference for damp or wet sites which dry out seasonally, particularly on or near the coast including brackish and saline areas (Boland et al. 1994).




Murray Fagg

Melaleuca woodland, Kakadu National Park, Northern Territory

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Summary

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Change

- Approximately 3% of pre-European extent cleared accounting for 0.3% of total clearing in Australia.
- Approximately 3000 km^2 cleared since European settlement.
- The remoteness of the extensive monsoonal melaleuca forests and woodlands and their comparatively harsh site conditions, particularly during periods of seasonal inundation, has protected them from major changes.
- In less remote coastal areas the wetlands have been extensively cleared and in-filled for development or urban expansion. Historically some of the swamp areas have also been developed for intensive agriculture (cropping and grazing), particularly where the soils have been high in peat.
- Many of the early settlers grew potatoes in the seasonally drier parts of melaleuca swamps to sustain their small settlements. Selected swamps have also been mined for peat and other materials used in horticulture. Drainage of these systems also has a high likelihood of disturbing acid sulphate soils.
- Areas have been cleared for grazing and cropping (e.g. for sugar cane on the Herbert floodplain). Many melaleuca wetlands in coastal northern New South Wales and Queensland have been altered by drainage and floodgates (part of floodplain management programs of the 1970s and 1980s). In dryland salinity areas, melaleuca communities along creek lines and watercourses have been affected by increased waterlogging and salinity.

Murray Fagg

30 km north of Grafton, New South Wales

Tenure

Melaleuca forests and woodlands occur across a range of land tenures.

Northern Territory:	largely freehold land and leasehold land, some in protected area
Queensland:	largely leasehold land, then freehold land and protected area, some state forest and reserved crown land
South Australia:	mostly freehold land
Victoria:	largely in protected areas, some freehold land
Western Australia:	protected areas, some on freehold land and in state forest

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Summary

Contents

Key values

- Biodiversity including understorey grasses and shrubs, coastal and estuarine systems
- Flood retention basins and nutrient sinks—a key part of floodplain systems
- Honey and florist products—flowers and foliage

Management considerations

Management of melaleuca stands on creek lines, watercourses and wetlands provides challenges in many parts of Australia, particularly as part of integrated floodplain management. Melaleucas exposed to dryland salinity are also under severe threat. Change in floristic structure has occurred with many of the lakes in south-west Western Australia.

Specific management needs include:

- management of the local site conditions that support these communities, (e.g. hydrological and tidal regimes);
- clearing and edge effects;
- isolation and faunal barriers caused by roads/powerlines;
- weed control (e.g. aggressive weeds such as arum lily); and
- rehabilitation as part of improved floodplain management.

References

Boland D.J., Brooker M.I.H., Chippendale G.M., Hall N., Hyland B.P.M., Johnston R.D., Kleinig D.A., & Turner J.D. 1994, *Forest Trees of Australia*, CSIRO Publishing, Collingwood, Australia.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Murray Fagg

Paperbark Swamp, Nourlangie, Kakadu National Park

Murray Fagg

Melaleuca quinquenervia, roadside swamp, Bellingen, New South Wales

OTHER FORESTS AND WOODLANDS

- Covers a series of forest and woodlands of limited extent including leptospermum forests and the banksia woodlands on the south-eastern, eastern and western coastal areas, to the *Agonis* forests on the western temperate coastal areas near Gardner River in Western Australia.
- The variety of woodlands is extensive and includes the northern mixed species woodlands dominated by genera such as *Adansonia* (baobab), *Bauhinia, Pandanus* and *Terminalia* woodlands in northern Australia. Other inland woodlands include those dominated by *Hakea, Heterodendron, Myoporum* and *Geijera–Flindersia* woodlands in the northern subhumid/semi-arid areas, and the *Macropteranthes* (bonewood) and *Lysiphyllum* communities of inland Queensland.
- Victorian examples inlcude *Eucalyptus viminalis*, *Acacia melanoxylon* and *Allocasuarina verticillata* communities; *Leptospermum lanigerum*, *Allocasuarina verticillata* mixed woodland; *Banksia integrifolia* and *B. serrata* woodlands; *Alectryon oleifolius* ssp. *canescens*, *Myoporum platycarpum* grassy woodlands.
- Tasmanian communities include leptospermum and banksia species.

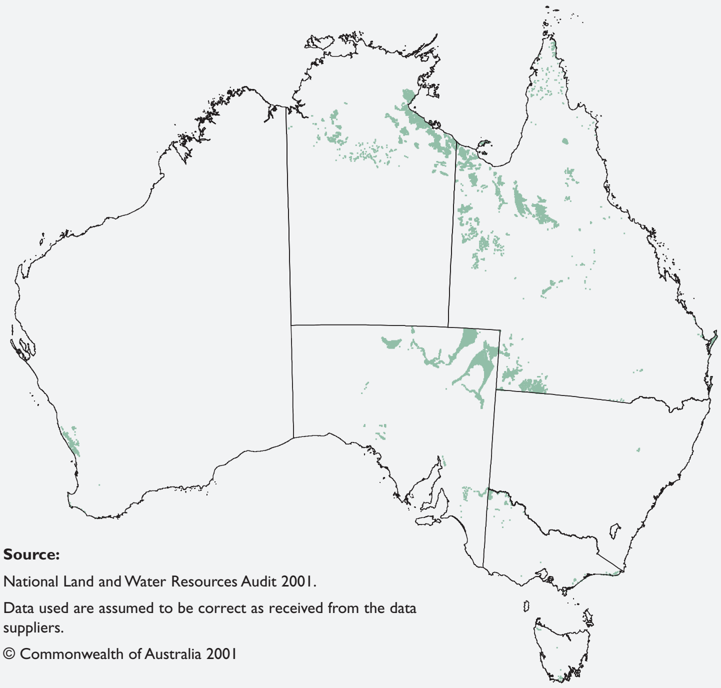
These forests and woodlands exhibit a variety of subforms, with varied understoreys ranging from low trees and shrubs, to low shrubs and to tussock grasses depending on the environments that they occur in—from northern monsoon areas, to semi-arid areas to temperate coastal areas in the south-east and western areas of Australia.

Other forests and woodlands: facts and figures

Vegetation class	Tree
Structural formation	Open forest, low open forest, woodland, open woodland, low woodland, low open woodland
Major vegetation group	MVG 10. Other forests and woodlands
Number of IBRA regions	55
Pre-European extent (km^2)	125 328
Present extent (km^2)	119 384
Area protected (km^2)	15 350

Geography

- Largest areas occur in Queensland, South Australia and Northern Territory.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Murray Fagg

Terminalia fitzgeraldii, Kimberley Western Australia

Change

- Approximately 5% of pre-European extent cleared accounting for 0.6% of total clearing in Australia.
- Approximately 6000 km^2 cleared since European settlement.
- Northern and inland forests and woodlands have been mainly modified for pastoral activities and the southern coastal forests and woodlands have been mainly modified by urban development. These have been thinned to encourage the growth of ground layer grasses or partly cleared for cropping.
- Foremost threats are fragmentation of woodland areas, regular or intense wildfires, grazing, and clearing. Recent changes in land clearing policies in parts of Australia has seen a shift away from the clearing of woodlands to their protection and management. Consequently, there are issues associated with understanding and managing these limited extent forest and woodland areas.
- Other threats include urban encroachment on the banksia forests and woodlands that occur on the coastal areas, while fire regimes can affect the communities in the northern and inland areas. Many of the forests and woodlands have historically been burnt by broad-scale wildfires.

Tenure

Other forests and woodlands occur across a range of land tenures.

Northern Territory:	leasehold land, freehold land
Queensland:	largely leasehold land; freehold land, protected area, reserved crown land and state forests
South Australia:	leasehold land, protected areas, some freehold land
Tasmania:	protected areas, state forests, little freehold land
Victoria:	protected areas and state forests
Western Australia:	freehold land, state forests, protected areas, other crown land

Key values

- Biodiversity including a variety of overstorey and understorey species
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Ecotourism including bushwalking and landscape features

Other forests and woodlands tend to attract some interest from the wider community and tourists possibly as a result of the variety of dominants that provide complexity in many of their environments.

Key values are primarily the restricted ecological communities and the protection of endangered species. These are significant in forest and woodland areas which are either geographically restricted in area or which have become restricted through fragmentation.

Management considerations

Management provides challenges in many parts of Australia within the current context of changing management, grazing pressures and fire regimes.

Specific management needs include:

- management of the local site conditions that support these communities, (e.g. hydrological, fire and grazing regimes);
- clearing and edge effects;
- wildlife corridors between remnants;
- tourist/visitor management (scenic landscapes); and
- weed control.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

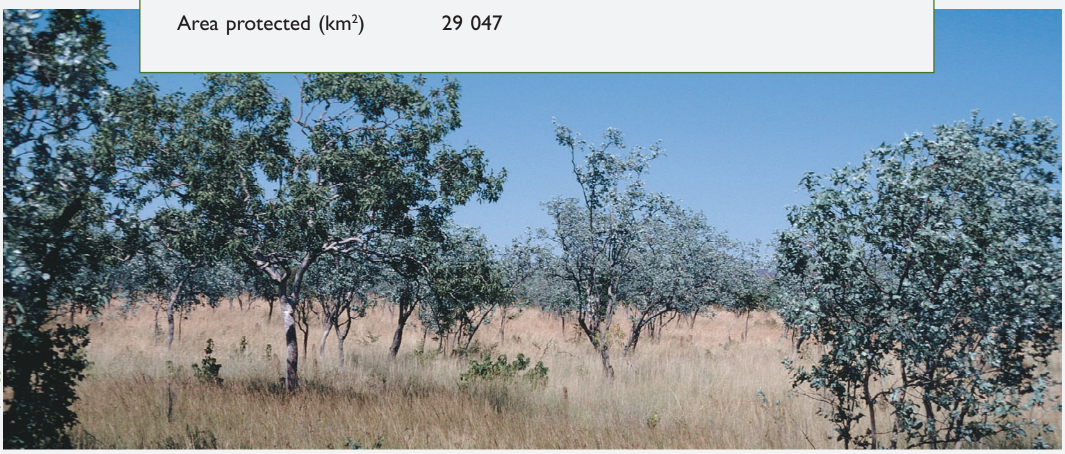
Collaborative Australian Protected Areas Database 2000

EUCALYPT OPEN WOODLANDS

- Characterised by broad spacing between canopy trees with the result that the understorey often appears more dominant.
- Overstorey is dominated by many of the eucalypts that typify the eucalypt woodlands.
- Dominant species include *E. dichromophloia, E. tetrodonta* (Darwin stringybark) and *E. loxophleba* (York gum) in Western Australia.
- Open woodlands with low shrubs occur in south-western Western Australia and include *E. wandoo* and *E. salmonophloia* (salmon gum); in southern Australia (South Australia and Victoria) to include *E. leucoxylon* (yellow gum), *E. tetrodonta* in Queensland, *E. sieberi* (silvertop ash), *E. macrorhyncha* (red stringybark) and *E. sideroxylon* (red ironbark) in New South Wales.
- Open woodlands over hummock grasses are restricted largely to central Queensland, the Kimberley in Western Australia and northern Northern Territory supporting a range of *Eucalyptus* species over a *Triodia* and *Plectrachne* understorey.
- Co-dominants in the northern areas include *Acacia, Ventilago, Callitris* and *Casuarina* in the inland areas to *Banksias* in the rocky and sandstone areas.
- The understorey varies from shrubs, heaths, tussock grasses and hummock grasses. Tussock grasses associated with the open woodlands include *Sorghum, Heteropogon, Chrysopogon, Bothriochloa, Aristida, Themeda, Heteropog*on and *Austrostipa.* Variation in understorey reflects the variety of climatic zones and site conditions supporting these woodlands.

Eucalypt open woodlands: facts and figures

Vegetation class	Tree
Structural formation	Woodland (open, tall open, low open, low), mallee woodland, open mallee woodland, shrubland, open shrubland, tall open forest, isolated clumps of trees, isolated trees
Major vegetation group	MVG 11. Eucalypt open woodlands
Number of IBRA regions	66
Pre-European extent (km²)	513 943
Present extent (km²)	384 310
Area protected (km²)	29 047



Murray Fagg

Pterygopappus lawrencii, Abrotanella forsterioides, Ben Lomond National Park, Tasmania

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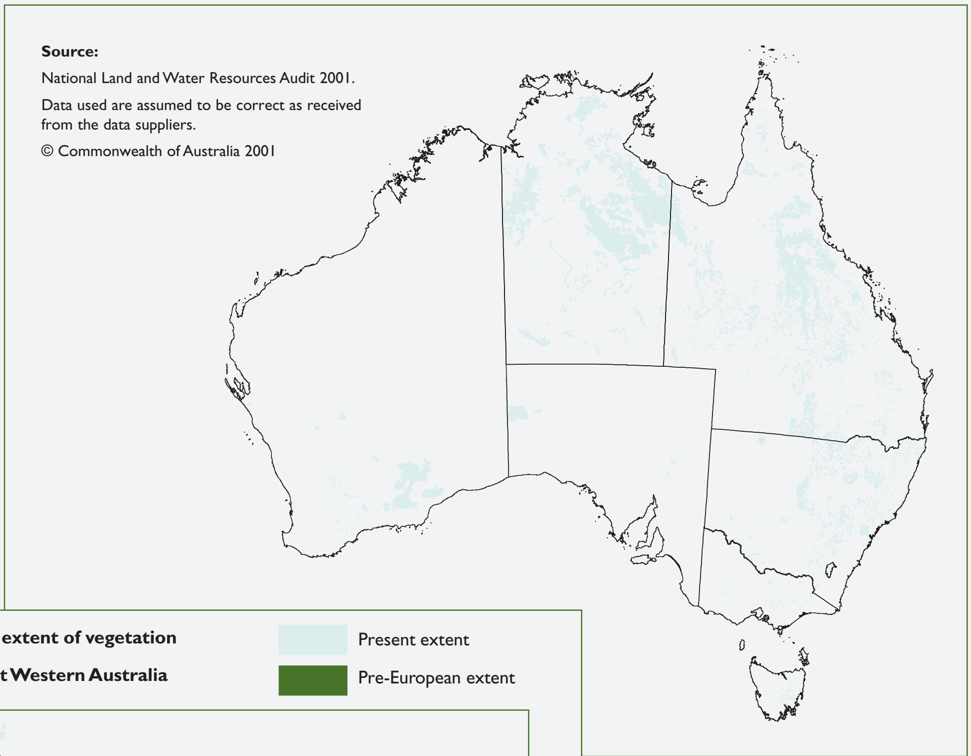
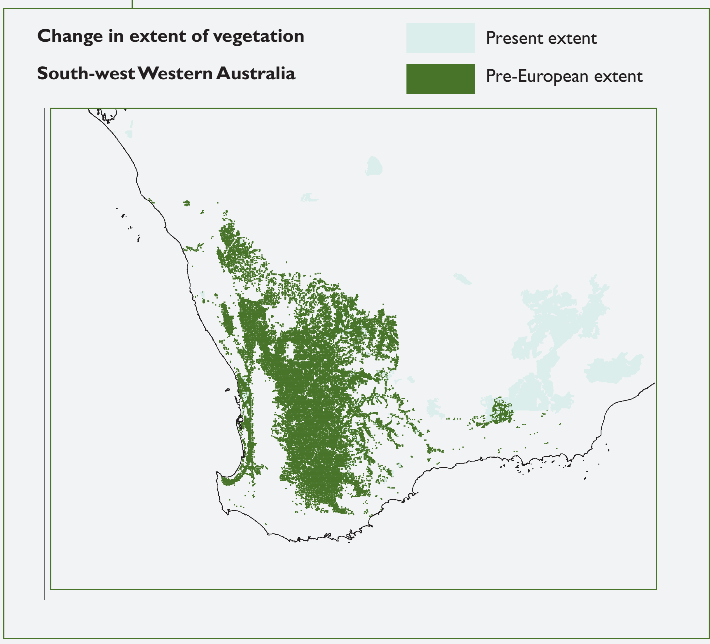
Geography

- Occur in lower rainfall areas on the fringes of forested areas or where soil moisture or nutrients may limit tree growth.
- Extensive, particularly in the semi-arid interior and the tropics and cover many dry inland plains and downs and some rocky outcrops.
- Largely in northern Australia and eastern Australia; the inland areas of south-west Western Australia where annual rainfall levels are below 400mm to 500mm; scattered areas in southern South Australia, Victoria and eastern Tasmania.
- Largest areas are in Northern Territory (175 775 km²) and Queensland (134 421 km²).





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Summary

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Change

- Approximately 25% of pre-European extent cleared accounting for 13.2% of total clearing in Australia.
- Approximately 130 000 km^2 cleared since European settlement.
- Removed from many cereal cropping and sheep grazing lands in the south-east and the far south-west of Australia. In the northern parts of Australia they have been modified by pastoral activities and changed fire regimes. In Queensland, New South Wales and Victoria, pasture improvement and tree thinning have been extensively employed within the grassy woodlands, while the shrubby understorey of others has been removed to increase pasture growth.
- Spread of urban development has encroached on these open woodlands to the extent that some are considered to be threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), while others are under consideration for listing.
- The open woodlands in agricultural and outer urban areas have been extensively modified and are therefore restricted in distribution and extent. Some of these woodlands are considered to be endangered at a local and national scale.
- Due to their proximity to intensive agricultural and urban areas, the fire regime in these communities has been modified and many of the woodlands have been invaded by aggressive introduced plant species.
- Threats include fragmentation of woodland areas, regular or intense wildfires, and overgrazing. Recent changes in land clearing policies has seen a shift in public attitude away from the clearing of open woodlands to the protection and management of these areas, including use of native pasture grasses. Consequently, there are issues associated with understanding and managing these open woodland areas for multiple values.

Tenure

Eucalypt open woodlands occur on a range of land tenures.

Australian Capital Territory:	leasehold land, reserved crown land, little in state forests
New South Wales:	freehold land, state forests, protected areas, some leasehold land
Northern Territory:	leasehold land, freehold land, some protected areas
Queensland:	leasehold land, freehold land, some protected areas and state forests
South Australia:	protected areas, little on freehold land and leasehold land
Tasmania:	scattered areas on freehold land
Victoria:	all scattered isolates on freehold land, protected areas and state forests
Western Australia:	other crown land, leasehold land, protected areas, isolated small areas on freehold land

Key values

- Biodiversity including some of the most restricted communities in Australia
- Many of the eucalypt open woodlands occur within catchments of the main Australian water supply dams
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Ecotourism and scenic landscapes

The value of these open woodlands for indigenous people, conservation and tourism has been recognised through a variety of Natural Heritage Trust supported projects.

Management considerations

Management requirements are associated with protecting the range of values of woodland areas. The majority remain in private ownership, raising issues of equity relating to stewardship and management costs to enable protection for multiple values.

Specific management needs include:

- control of clearing and other threats on the edges of remnants;
- wildlife corridors between remnants;
- fire—particularly in terms of changes to 'natural' fire regimes brought on by the fuel loads of introduced grasses and grazing land management practices;
- weed control; and
- total grazing pressure from domestic, feral and native animals.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000


Murray Fagg

Eucalyptus crebra open woodland, west of Atherton, Queensland

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TROPICAL EUCALYPT WOODLANDS/GRASSLANDS

- This group contains the so-called tall bunch-grass savannas of far north Western Australia and related eucalypt woodland and eucalypt open woodland communities in the Northern Territory and in far north Queensland, including Cape York Peninsula.
- Typified by the presence of a suite of tall annual grasses (notably *Sorghum* spp.) but does not include communities in more arid sites where *Triodia* becomes more dominant.

Tropical eucalypt woodlands/grasslands: facts and figures

Vegetation class	Tree
Structural formation	Woodland, low woodland, low open woodland
Major vegetation group	MVG 12. Tropical eucalypt woodlands/grasslands
Number of IBRA regions	18
Pre-European extent (km^2)	256 434
Present extent (km^2)	254 228
Area protected (km^2)	28 903

Diane Napier

Eucalyptus tetrodonta and *Eucalyptus foelscheana* woodland, *Sorghum intrans* tussock grassland, Northern Territory

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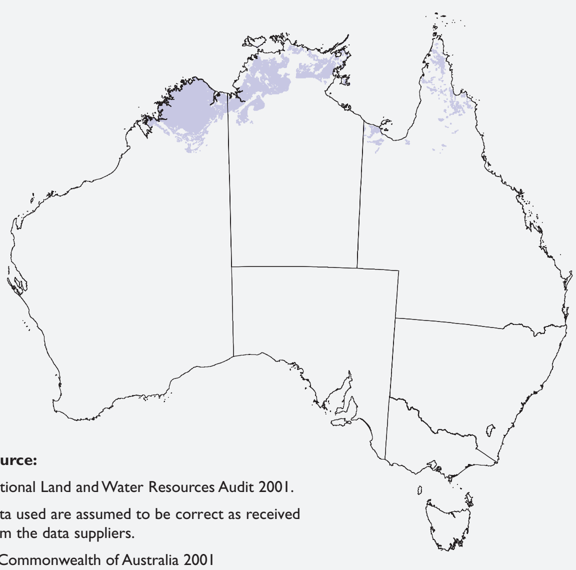
Species

- Woodlands include a mix of species *Eucalyptus tectifica* (Darwin box), *E. tetrodonta* (Darwin stringybark), *E. miniata*, *Corymbia foelscheana*, *C. latifolia*, *C. flavescens*, *C. polycarpa*, *C. nesophila*, *C. clarksoniana*, *C. grandifolia*, *C. bleeseri*, *C. ferruginea*, *Erythrophleum chlorostachys* with an understorey of:
  - *Sorghum* spp., *Sehima nervosum* grassy understorey;
  - *Triodia* spp. or *Chrysopogon* spp., *Sorghum* spp. grassy understorey;
  - *Sorghum plumosum*, *Heteropogon triticeus* grassland understorey;
  - *Sehima nervosum*, *Sorghum* spp. or *Chrysopogon* spp., tussock grass understorey; or
  - *Sorghum* spp., *Triodia* spp. grassland understorey.
- Low woodlands of *Corymbia dichromophloia*, *Eucalyptus tintinnans* with an understorey of:
  - *Sorghum* spp., *Triodia bitextura* grassy understorey;
  - *Sorghum* spp. grassland understorey; or
  - *Corymbia dichromophloia*, *Eucalyptus tectifica* low open woodland with *Sehima nervosum*, *Sorghum* spp. tussock grass understorey.

Geography

- Principally found across monsoonal and tropical northern Australia on sandstone plateaus from the northern Kimberley to Cape York Peninsula.
- The major distribution is in the northern Kimberley region of Western Australia (126 321 km^2) and adjacent in the Northern Territory (107 254 km^2).



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Diane Napier

Eucalyptus miniata and *Corymbia bleeseri* woodland, annual *Sorghum* spp. and *Heteropogon triticeus*, Northern Territory

Tenure

Tropical eucalypt woodlands and grasslands occur largely on leasehold land.

Northern Territory:	leasehold land, freehold land, protected areas and some other crown land
Queensland:	leasehold land, protected areas, freehold land, some state forests
Western Australia:	leasehold land, reserved crown land, other crown land, protected areas, some freehold land

Change

- Approximately 9% of pre-European extent cleared accounting for 0.2% of total clearing in Australia.
- Approximately 2000 km^2 cleared since European settlement.
- Substantially in natural condition.
- Threats include fragmentation, weed infestation, regular or intense wildfires and over grazing. There are issues associated with understanding and managing these areas for multiple values. Part of this is providing support to Indigenous groups and developing among these groups an understanding of methods of feral animal and weed control.

Key values

- Biodiversity including some of the most restricted communities in Australia
- Faunal remnants of a wide range of vertebrate and invertebrate species
- Ecotourism and scenic landscapes

Management considerations

Management requires protection of the range of values that exist in these woodland areas.

- Fire particularly in terms of changes to 'natural' fire regime brought on by the fuel loads of introduced grasses and grazing land management practices
- Weed control
- Total grazing pressure from domestic, feral and native animals

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

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ACACIA OPEN WOODLANDS

- Dominant acacias include *Acacia aneura* (mulga), *A. georginae* (Georgina gidgee), *A. tephrina*, *A. cambagei*, *A. harpophylla* (brigalow), *A. peuce* and *A. papyrocarpa*.
- The most widespread species is mulga (*A. aneura*).
- In some places, casuarina and eucalypts occur as occasional emergents. The ground layers are generally herbaceous or chenopod shrubs such as *Atriplex, Maireana, Sclerolaena* and grasses such as *Triodia, Eragrostis, Plectrachne, Aristida* and *Austrostipa.*

Acacia open woodlands: facts and figures

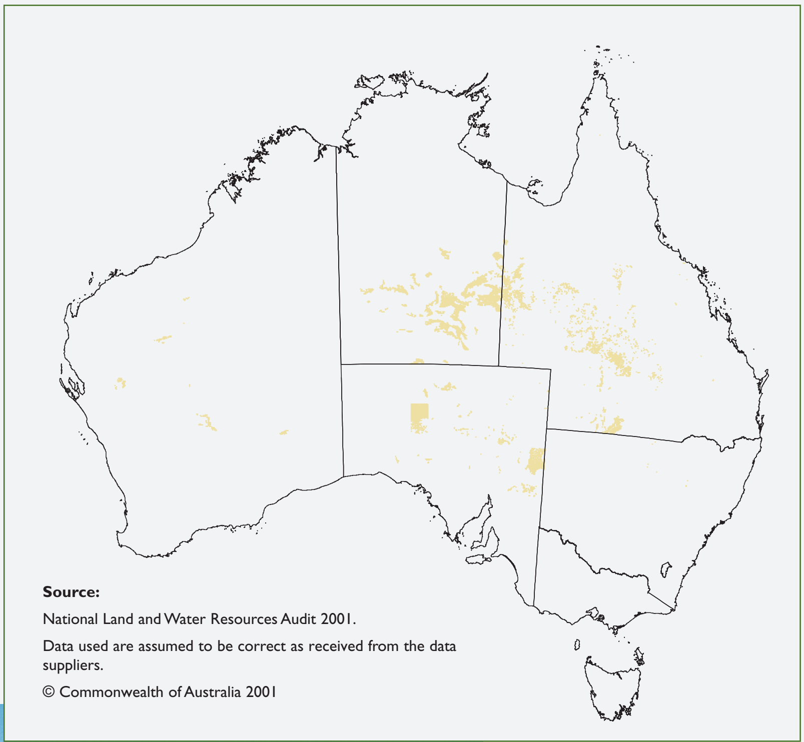
Vegetation class	Tree
Structural formation	Open woodland, low open woodland, isolated trees
Major vegetation group	MVG 13. Acacia open woodlands
Number of IBRA regions	27
Pre-European extent (km^2)	117 993
Present extent (km^2)	114 755
Area protected (km^2)	10 950

Murray Fagg

Acacia burkittii, near Mootwingie, New South Wales

Geography

- Occur mainly throughout the semi-arid and arid regions of south-eastern, northern and north-eastern Australia. The climatic conditions are generally dry, hot summers, with cool to warm winters. Rainfall is variable although maximum falls either in summer (northern) or in winter (southern).
- Occur on largely extensive undulating plains and downs, low hills and valleys of range country.
- Largest areas occur in the Northern Territory (48 703 km²) and Queensland (36 734 km²).



Murray Fagg

Mulga (*Acacia aneura*) open woodland over *Eragrostis eriopoda*, near Thargomindah, Queensland

Change

- Approximately 3% of pre-European extent cleared accounting for 0.3% of total clearing in Australia mainly as a result of pastoral activities in Queensland.
- Approximately 3000 km^2 cleared since European settlement.
- Modified by clearing for pastoral activities, change in local drainage systems, increased local grazing pressure by providing stock watering, an overall increase in grazing through the introduction and spread of feral animals and changes to fire regimes.
- Main threats include regular or intense wildfires, increased grazing pressure and continued clearing.

Key values

- Biodiversity including some of the most widespread communities in Australia and also some of the most threatened as a result of past changes in condition and extent
- Faunal remnants of a wide range of vertebrate and invertebrate fauna species

Management considerations

- Control of clearing
- Wildlife corridor re-establishment between remnants
- Fire regimes—often changed from what is presumed to be 'natural'
- Weed control
- Pasture management—including the issues of buffel grass versus native grass species

The majority of the open woodlands remain in private ownership or leasehold raising issues of equity relating to stewardship and management for multiple values.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Tenure

Acacia open woodlands occur largely on leasehold land.

New South Wales:	leasehold and very small areas on freehold land
Northern Territory:	leasehold land, some freehold land, little other crown land
Queensland:	leasehold land, isolated areas on freehold land, some in protected areas
South Australia:	leasehold land, protected areas, little on freehold land
Western Australia:	leasehold land, some other crown land

MALLEE WOODLANDS AND SHRUBLANDS

- Mallee eucalypts grow from a lignotuber, and are multi-stemmed trees found in harsh site conditions with usually a flattened canopy, which in windswept coastal areas of Australia can be stunted or angled. The number of branches may be influenced by the frequency of bushfires and by soil type.
- Widespread mallee species include *Eucalyptus dumosa* (white mallee), *E. socialis* (red mallee), *E. gracilis* (yorrell), *E. oleosa* (red mallee), *E. incrassata* (ridge-fruited mallee) and *E. diversifolia* (soap mallee).
- Most diverse range occurs across Western Australia and South Australia.
- In some wetter areas the eucalypts may exhibit mallee habits in response to regular fires. Typical examples include black gum (*E. aggregata*), mountain grey gum (*E. cypellocarpa*), narrow-leaved sallee (*E. moorei*), Kybean mallee (*E. kybeanensis*), narrow-leaved peppermint (*E. robertsoni*) and swamp gum (*E. ovata*) (Read 1994). In Tasmania, the snow gum (*E. pauciflora*) also forms a mallee on the exposed subalpine areas.
- Eucalypts are the most widespread tree component. It rarely exceeds 6 m in height. Co-dominants can include species of *Melaleuca, Acacia* and *Hakea* in areas such as the Big Desert in Victoria, the Ninety Mile Desert, parts of Eyre Peninsula and in the wheatbelt and southern coastal areas of Western Australia.
- Support a variety of understoreys depending on precipitation, soil types and fire regimes. In subhumid areas mallee formations are dominated by grasses and shrubs and in the semi-arid areas the understorey below mallee species such as *E. oleosa, E. socialis* and *E. youngiana* is dominated by hummock grasses such as *Triodia and Plectrachne*.

Mallee woodlands and shrublands: facts and figures

Vegetation class	Mallee shrub, shrub, tree, tree mallee
Structural formation	Woodland (low mallee, low open mallee, low open, low, mallee, open mallee, tall open mallee), forest (low closed mallee, low open mallee, open mallee), shrubland (low, low open and closed, mallee, open mallee, sparse mallee, tall mallee, tall closed and open mallee, tall, tall sparse)
Major vegetation group	MVG 14. Mallee woodlands and shrublands
Number of IBRA regions	39
Pre-European extent (km^2)	383 399
Present extent (km^2)	250 420
Area protected (km^2)	75 485

Mallee near Murray Bridge, South Australia

Murray Fagg

Species distribution

South Australia

Widespread—Kangaroo Island has a suite of mallee species including *E. diversifolia*, *E. remota*, *E. rugosa*.

Western Australia

Occurences of *E. erempohila*, *E. tetragona* (tallerack), *E. dongarraensis*, *E. loxophleba* (York gum), *E. cooperiana*, *E. redunca* (mallee wandoo), *E. gongylocarpa*, *E. nutans*, *E. transcontinentalis*, *E. decipiens* (limestone marlock), *E. staeri*, *E, cornuta* (yate) and *E. lehmannii.*

Northern Territory

E. gamophylla (blue mallee), *E. pachycarpa* and *E. setosa*.

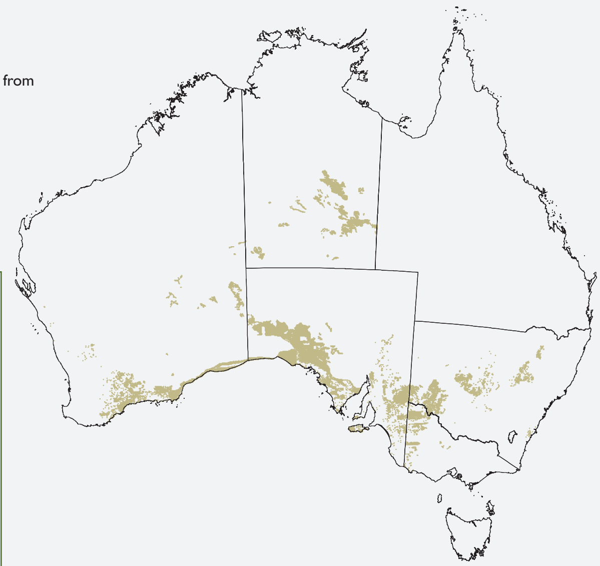
Geography

- Mallee woodlands and shrublands are located in the semi-arid areas of southern Australia in New South Wales, north-western Victoria, southern South Australia and southern Western Australia.
- Make up the most arid of the eucalypt-dominated communities of temperate Australia (Groves 1994).
- Climatic conditions consist of cool winters and hot dry summers.
- Largest area occurs in South Australia (118 531 km^2).

Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

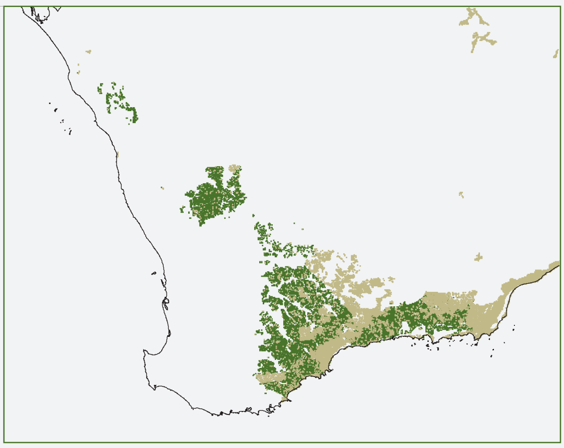


Change in extent of vegetation

South-west Western Australia

Present extent

Pre-European extent



Change

- Approximately 35% of pre-European extent cleared accounting for 13.6% of total clearing in Australia including large areas of southern Western Australia and South Australia and northern Victoria.
- Approximately 133 000 km^2 cleared since European settlement.
- Removed from many cereal cropping and sheep grazing lands in the southern and eastern parts of Australia over the last 50 years.
- Clearing of the mallee in South Australia commenced approximately 1900 following the widespread introduction of the stump-jump plough. Most of the South Australian Murraylands, Yorke and Eyre Pensinsula areas were cleared before World War II. Tops of sandhills were cleared later in the 1960s as part of the rabbit control program. The Kangaroo Island mallee community was cleared following World War II with the soldier settlement scheme.
- Pastoral activities and altered fire regimes have modified mallee in the inland and more arid areas of Australia beyond the rainfall limits of cropping.
- Large expanse of mallee occur in reserves on the border of South Australia and Victoria and in Southern South Australia.
- The oil mallee industry is being developed as a mechanism of addressing dryland salinity and waterlogging in more arid areas of Australia affected by rising water tables.
- Threats include fragmentation of remaining areas, regular or intense wildfires. and grazing impact on understorey. Associated issues in understanding and managing mallee areas for multiple values are yet to be fully explored.


Murray Fagg
Mallee, near Lake Grace, Western Australia

Tenure

Mallee woodlands and shrublands occur on a range of land tenures.

New South Wales:	leasehold land, freehold land, protected areas and little in state forests and reserved crown land
Northern Territory:	leasehold land, freehold land and little in protected areas
South Australia:	freehold land, protected areas, leasehold land, little on other crown land
Victoria:	protected areas, state forests and freehold land
Western Australia:	other and reserved crown land, protected areas, small and isolated areas on freehold land

Key values

- Biodiversity since they include some of the most widespread communities in Australia
- Faunal remnants of a wide range of vertebrate and invertebrate species including birds and mammals (e.g. rare and endangered species such as the Black-eared Miner and the vulnerable Mallee fowl in south-western New South Wales and eastern South Australia)
- The value of these communities for Indigenous people, conservation and tourism has been recognised at State/ Territory and national levels

Management considerations

- Control of clearing and threats on the edges of remnants
- Wildlife corridor between remnants
- Weed control (e.g. aggressive weeds such as South African love grass and other aggressive perennial grass species)
- Managing total grazing pressure (including domestic, native and feral animals)
- Rising water tables in cropping areas affected by dryland salinity

The majority of the mallee communities remain in private ownership or under leasehold and provide a particular public policy challenge for government as communities request increased stewardship and multi-value management in response to pastoralist access to these natural resources.

References

Groves R.H. 1994, *Australian Vegetation,* second edition, Cambridge University Press.

Read I.G. 1994, *The Bush – A Guide to the vegetated landscapes of Australia,* University of New South Wales, Reed Books Pty Ltd.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Murray-Darling Basin Commission

Mallee wood stacked to fuel irrigation, Loveday Riverland, South Australia

LOW CLOSED FORESTS AND CLOSED SHRUBLANDS

- Characterised by dense foliage in the upper layers and by low stunted species usually between 5 m and 10 m in height, sometimes referred to as 'scrubs'.
- Occur in a range of climatic zones, but many occur within coastal or subcoastal environments dominated by *Banksia*, *Leptospermum* and *Kunzea* species or *Melaleuca* with a mix of other species. A few occur in alpine environments in Tasmania.
- Support a large range of species, partly as a result of their geographical range and partly from the variation in soils and site conditions.

Low closed forests and closed shrublands: facts and figures

Vegetation class	Shrub, heath shrub, tree
Structural formation	Shrubland (closed, tall closed, low closed), low closed forest
Major vegetation group	MVG 15. Low closed forests and closed shrublands
Number of IBRA regions	31
Pre-European extent (km^2)	15 864
Present extent (km^2)	8749
Area protected (km^2)	2215

Kathy Tracy

Coastal melaleuca, Bournda National Park, New South Wales

Species distribution

Western Australia

A mixture of casuarina, melaleuca and acacia species occur in this group (e.g. *Allocasuarina campestris*, *Acacia rostellifera*, *A. acuminata*, *A. ligulata*, *Melaleuca cardiophylla*, *M. megacephala* and *M. uncinata*).

New South Wales

Coastal distributions of banksia and melaleuca species with *Muehlenbeckia* in the Riverina.

Eastern Victoria

Distributions of *Leptospermum lanigerum*, *Melaleuca squarrosa*, *L. continentale*, *M. ericifolia*, *L. laevigatum*, *Acacia mucronata* and *Callistemon pallidus.*

Western Victoria

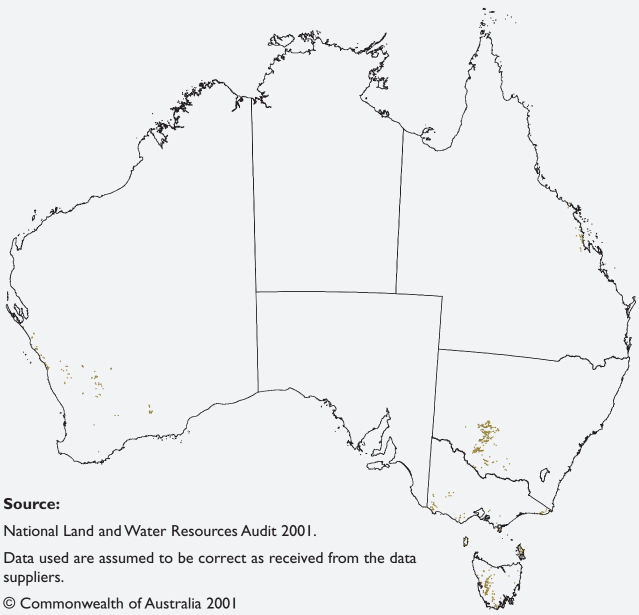
Includes a range of *Leptospermum* and *Eucalyptus* species.

Tasmania

Incudes *Melaleuca ericifolia*, *Leptospermum laevigatum*, *L. scoparium*, *Pomaderris apelata*, *Ozothamnus turbinatus*, *L. lanigerum*, *L. glaucescens*, *Melaleuca squarrosa*, *M. squamea* and *Eucalyptus amygdalina.*

Geography

- Position in the landscape is variable from near coastal to mountain tops.
- Extent varies from a few hectares to larger pockets. They are generally patchy in occurrence within these areas depending on specific local site conditions.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Tenure

Low closed forests and closed shrublands occur largely in protected areas or state forests.

New South Wales:	leasehold land and freehold land
Queensland:	protected areas, state forests, leasehold land, isolated areas on freehold land
Tasmania:	protected areas, freehold land, state forests and other crown land
Victoria:	protected areas, state forests and isolated areas on freehold land
Western Australia:	some leasehold land, protected areas, other crown land and isolated fragments on freehold land

Change

- Approximately 45% of pre-European extent cleared accounting for 0.7% of total clearing in Australia.
- Approximately 7000 km^2 cleared since European settlement.
- Extent has decreased in coastal areas often as a result of urban development and clearing for agriculture. Fire regimes may also have changed from 'natural' for many occurrences.

Key values

- With about one-third of the remaining extent of this vegetation type already in protected areas, the values of these landscapes are well recognised
- The communities often support diverse faunal communities and provide food and shelter for fauna that are often both reliant on this vegetation group and on the surrounding landscapes

Management considerations

- Protection from loss by clearing, grazing, infrastructure development
- Maintenance of appropriate fire regimes
- Management requirements are community specific

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

ACACIA SHRUBLANDS

- Overstorey is dominated by multi-stemmed acacia shrubs. The most common are mulga (*Acacia aneura*) shrublands.
- Other dominant species include gidgee *(A. cambadgei), A. victoriae*, turpentine mulga *(A. brachystachya*), *A. resinomarginea*, Georgina gidgee (*A. georginae), bowgada (A. ramulosa),* pindan (*A. eriopoda*), *A. tetragonophylla*, *A. loderi*, brigalow (*A. harpophylla*), bendee (*A. catenulata*), *A. torulosa*, *A. orthocarpa*, *A. victoriae*, *A. ligulata*, *A. sclerosperma*, *A. turnida A. eriopoda* and snakewood (*A. eremaea*).
- Associated species include grevillea, emu bush (*Eremophila* spp.) and a wide range of chenopod species (*Atriplex, Maireana, Sclerolaena* and *Senna* spp.).
- Density of the overstorey affects the type of understorey that occurs within these communities. It is also affected markedly by rainfall events that can include both winter and summer rains.

Acacia shrublands: facts and figures

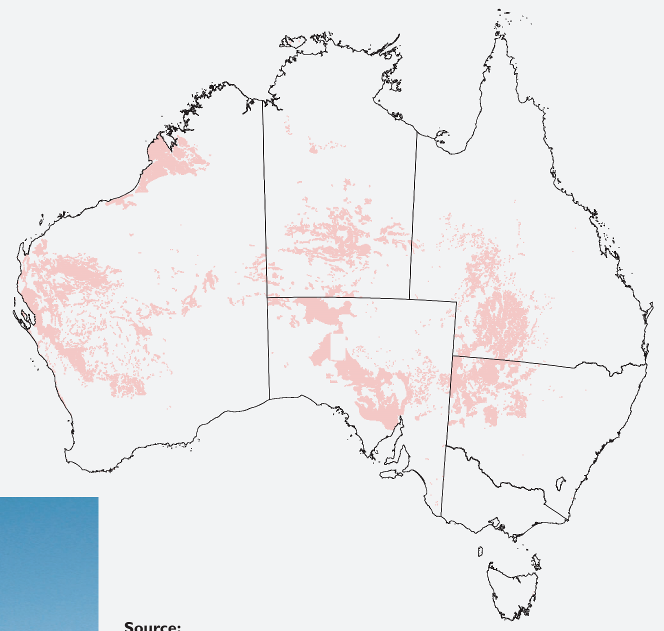
Vegetation class	Shrub
Structural formation	Shrubland (tall, tall open, tall closed, tall sparse, closed, sparse, open, low sparse)
Major vegetation group	MVG 16. Acacia shrublands
Number of IBRA regions	61
Pre-European extent (km^2)	670 737
Present extent (km^2)	654 279
Area protected (km^2)	20 225

Murray Fagg

Acacia carnei, Wanaaring, New South Wales

Geography

- Dominates large areas of Australia particularly Western Australia, the Northern Territory, South Australia, Queensland and New South Wales.
- Largest area occurs in Western Australia (238 771 km^2).
- Occurs mainly in semi-arid and arid regions (less than 300 mm of rainfall each year), although they also extend into the tropical semi-arid regions of north-west Queensland and eastern Northern Territory.
- Climatic conditions are generally dry, hot summers, with cool to warm winters. Rainfall is variable although maximum falls either in summer (northern) or in winter (southern).
- Occur largely on extensive undulating plains and downs, low hills and valleys of range country.



Source:
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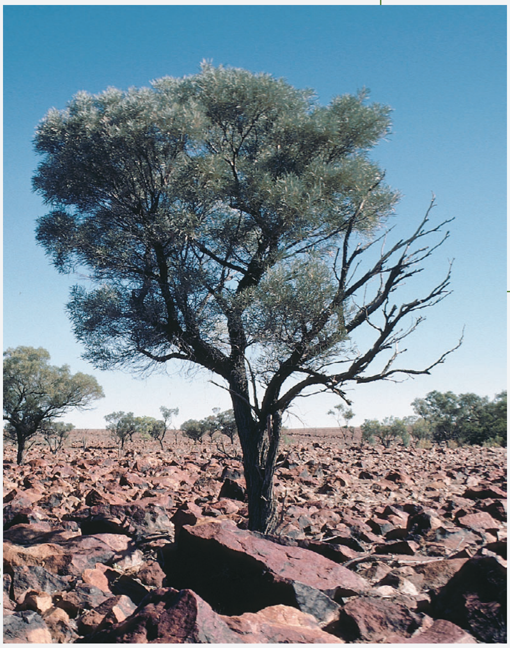


Murray Fagg

Acacia cambagei, near Coopers Creek, Innamincka, South Australia

Change

- Approximately 3% of pre-European extent cleared accounting for 1.7% of total clearing in Australia as a result of pastoral activities.
- Approximately 16 000 km^2 cleared since European settlement.
- Some have been protected in conservation areas.
- Threats include regular or too intense wildfires, combined grazing pressure from domestic, feral and native animals causing loss of understorey and some clearing.

Key values

- Biodiversity including a large variety of species within the plant communities, particularly after seasonal or cyclonic rains
- Faunal remnants of a wide range of vertebrate and invertebrate species

The key values are mainly associated with the biodiversity and eco-tourism values, the restricted ecological communities and the protection of endangered species. These shrublands have posed a challenge to the people who have tried to rehabilitate or maintain the areas for pastoral activities during extremes of seasonal conditions.

Management considerations

As with other rangelands areas there are the public policy issues of stewardship and land capability to support use, especially on leasehold lands.

- Feral animal control and overall management of grazing pressure
- Avoidance of further fragmentation of the remnant areas
- Fire regimes
- Weed control including the issues of pasture grasses (e.g. buffel grass versus native perennial grasses)

Investment in predictive rangelands monitoring systems are an imperative and would provide increased opportunities for efficiencies in pastoral management and nature conservation investments.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Tenure

Acacia shrublands occur largely on leasehold land.

New South Wales:	leasehold land, some protected areas, little in state forests
Northern Territory:	leasehold land, freehold land, little in protected areas
Queensland:	leasehold land, some protected areas
South Australia:	leasehold land, freehold land, little in protected areas
Tasmania:	freehold land
Victoria:	protected areas and freehold land
Western Australia:	leasehold land, other crown land, reserved crown land, protected areas, small scattered areas on freehold land

OTHER SHRUBLANDS

- Dominated by a broad range of shrub species that may include mixed species communities and mosaics of several communities. They do not fit well in other shrubland groups.
- Dominated by a range of genera including *Allocasuarina, Banksia, Bursaria, Dodonaea, Eremophila, Grevillea, Kunzea, Leucopogon, Muehlenbeckia, Persoonia, Thrytomene, Neofabricia, Nitraria,* and *Melaleuca* species.
- Density of the overstorey affects the type of understorey that occurs. Understorey is also affected markedly by the rainfall events, which can include both winter and summer rains.

Other shrublands: facts and figures

Vegetation class	Shrub
Structural formation	Shrubland (open, tall, tall open, tall sparse, tall closed, low sparse, low, low open)
Major vegetation group	MVG 17. Other shrublands
Number of IBRA regions	60
Pre-European extent (km^2)	115 824
Present extent (km^2)	98 947
Area protected (km^2)	18 279

Murray Fagg

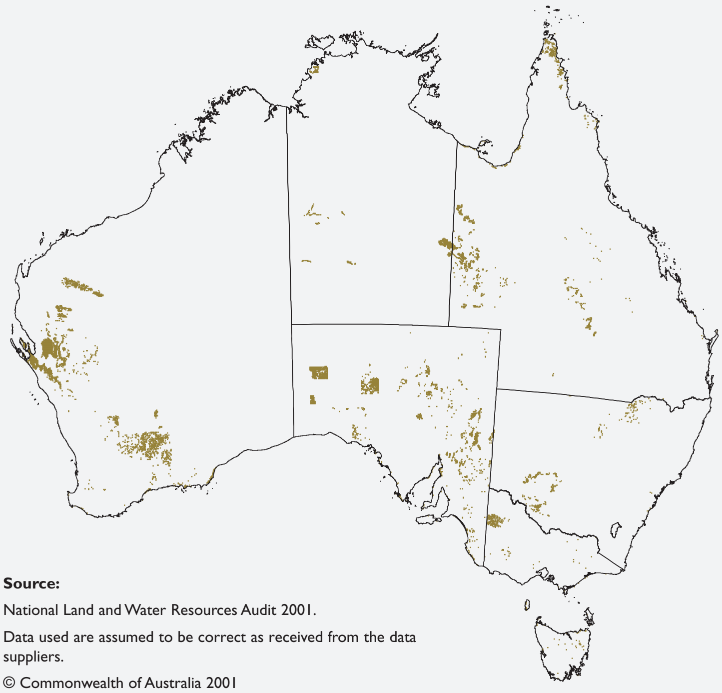
Tiverron Station, South Australia

Geography

- Occur mainly in semi-arid and arid regions of Australia with some in the temperate climates of Tasmania and Victoria.
- Usually occur in low undulating inland areas on a variety of soils.

Murray Fagg

Atalaya hemiglauca, Eremophila freelingii, Seaevola spicata, Cassia sturtii, Sida spp., *Acacia tetragonophila*, near Tibooburra, New South Wales



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Murray Fagg

Coopers Creek main channel (*Muehlenbeckia* spp.), Burke and Wills Bridge, Queensland

Change

- Approximately 15% of pre-European extent cleared accounting for 1.7% of total clearing in Australia mainly as a result of pastoral activities.
- Approximately 17 000 km^2 cleared since European settlement.
- Issues relate to total grazing pressure, clearing in some cases and fire regimes. Some of these shrublands have been protected in conservation areas.
- Threats include regular or intense wildfires and grazing pressure.

Key values

- Biodiversity including a large variety of species within the plant communities, particularly after seasonal or cyclonic rains
- Faunal remnants of a wide range of vertebrate and invertebrate species

Key values are mainly associated with biodiversity values, the restricted ecological communities and the protection of endangered species. These shrublands are home to a wide range of birds and mammals, including some rare and endangered species (e.g. the dense and diverse shrublands near Hyden and Southern Cross in Western Australia).

Management requirements

There are inherent management requirements associated with protecting the range of values that exist in these mixed shrubland areas.

As with other rangelands areas there are the public policy issues of stewardship and land capability to support use, especially on leasehold lands. Specific management needs include:

- feral animal control and overall management of grazing pressure;
- avoidance of further fragmentation of the remnant areas;
- fire regimes; and
- weed control including the issues and values of buffel grass versus native perennial grasses.

Investment in predictive rangelands monitoring systems is an imperative and would provide increased opportunities for efficiencies in pastoral management and nature conservation investments.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Tenure

Other shrublands occur largely on leasehold land and protected areas.

New South Wales:	leasehold and freehold land
Northern Territory:	leasehold and freehold land
Queensland:	leasehold land, freehold land, protected areas, reserved crown land
South Australia:	protected areas, leasehold and freehold land
Tasmania:	leasehold land, protected areas, some other crown land, little scattered freehold land
Victoria:	protected areas
Western Australia:	freehold land, other crown land and protected areas

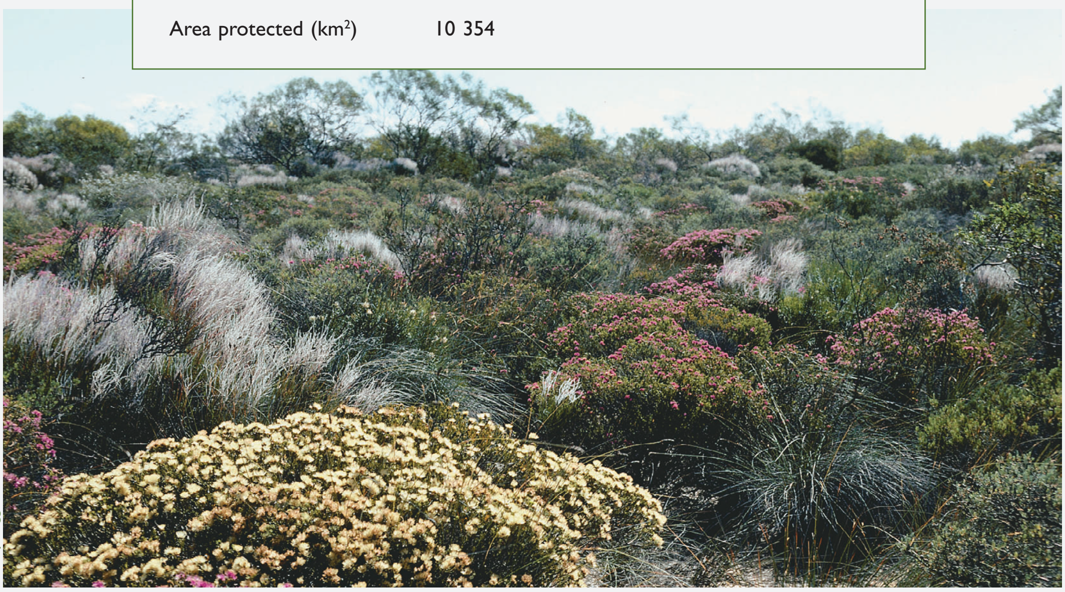
HEATH

The early explorers and their botanists such as Sir Joseph Banks collected many of the original collections of these genera.

- Open, closed or mixed shrublands dominated by plant genera typical of infertile or waterlogged sites, generally within the coastal, montane, sandy soils or laterite soils. Plants belonging to the family Epacridaceae, such as the common heath (*Epacris impressa*) the floral emblem of Victoria are perhaps the most widely recognised group as being typical of heaths.
- Typical areas include the coastal sand masses of northeast New South Wales and southeast Queensland such as Fraser Island and Cooloola, headlands (Victorian and New South Wales coastlines, Kwongan areas of Western Australia and southern coastal areas of Western Australia).
- Many heath areas are dominated by endemic Australian plants which provide a key sense of place for many Australians. Dominant species include *Allocasuarina, Baekea, Banksia, Calytrix, Hakea, Kunzea, Epacris, Grevillea, Leptospermum, Melaleuca, Leucopogon, Prostanthera, Richea* and *Xanthorrhoea.*
- Although the dense nature of many of these heath communities restricts human movement, some of these communities are more familiar to the Australian community as the majority of the population of Australia lives or retires near the coastal areas.

Heath: facts and figures

Vegetation class	Heath, shrub, mallee shrub, Xanthorrhoea
Structural formation	Heathland and shrubland (various cover and heights), open and tall sparse Xanthorrhoea
Major vegetation group	MVG 18. Heath
Number of IBRA regions	42
Pre-European extent (km^2)	47 158
Present extent (km^2)	25 861
Area protected (km^2)	10 354

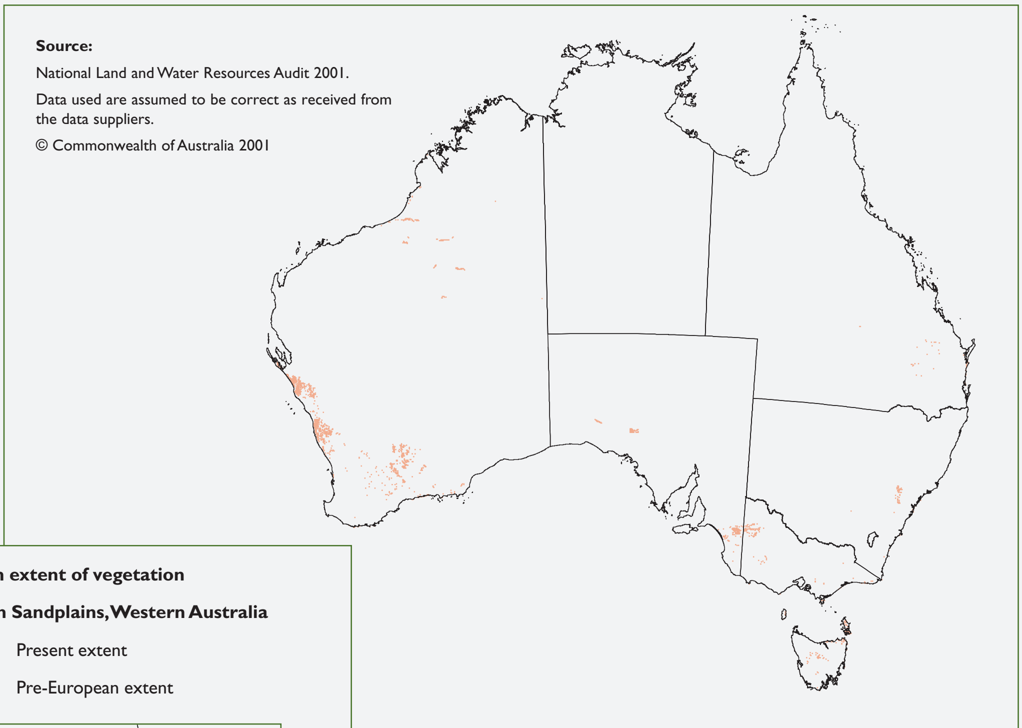


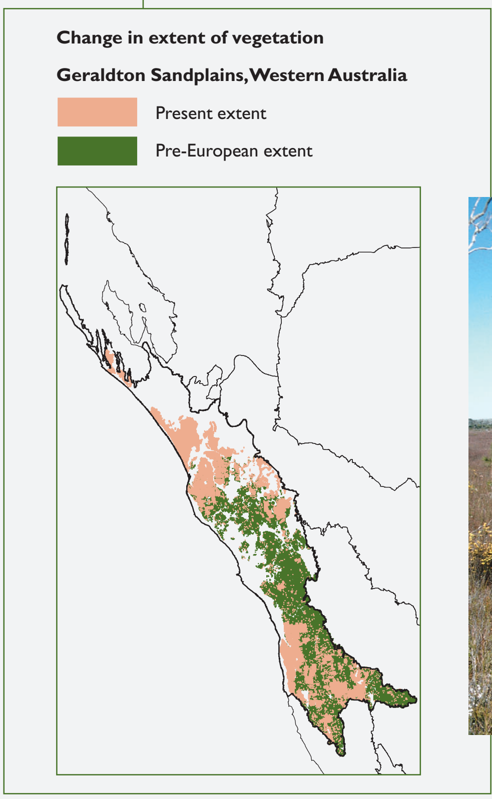
Murray Fagg

Kalbarri National Park, Western Australia

Geography

- Located on either infertile, drainage impeded or waterlogged sites or sandy soils, generally on the coastal sand masses or plains from Cape York Peninsula, southwards to Victoria and Tasmania, across southern Australia and northwards again to Geraldton.
- The major distribution is found in Western Australia (17 822 km²).
- Also found in certain montane areas.






Murray Fagg

Melaleuca quinquenervia, Dilwynia floribunda, swamp-heath, Red Rocks near Coffs Harbour, New South Wales

Change

- Approximately 45% of pre-European extent cleared accounting for 2.2% of total clearing in Australia.
- Extent in Western Australia most affected by clearing with 54% of heath lost in the south west.
- Approximately 22 000 km^2 cleared since European settlement.
- Near major population centres and along the eastern seaboard heath communities have been modified extensively by clearing for urban areas, recreation and by heavy mineral sand mining.
- Variety of species in some of these communities have some of the richest vascular plant communities in the world.
- Land clearing for urban development still persists as a major threat to these communities, although recent trends in land clearing controls in most States have recognised the importance of these areas.
- Heath communities tend to attract more interest from the wider community and tourists, possibly as a result of the variety of the species present, their variety of flowering and their proximity to the residential areas in Australia.
- Threats include the increasing number of people in Australia who wish to live near coastal areas, and the regular or intense wildfires that are part of hazard reduction management near urban areas.

Banksia aemula, north of Coffs Harbour, New South Wales

Murray Fagg

Tenure

Heath occurs on a range of land tenures.

New South Wales:	protected areas, some on reserved crown land, small areas scattered on freehold land and state forests
Queensland:	state forests, protected areas, little on freehold land
South Australia:	protected areas, little on freehold land
Tasmania:	other crown land, protected areas, freehold land and small areas on state forests
Victoria:	protected areas, some state forests
Western Australia:	freehold land, other crown land and protected areas

Key values

- Biodiversity including a variety of species and communities
- Ecotourism, including bushwalking and landscape features

Historically, the public has placed a high value on the cultural and heritage values associated with these heath communities.

Management considerations

- Isolation and faunal barriers caused by roads/powerlines
- Tourist/visitor management (e.g. access to beaches)
- Clearing and control of clearing for urban development
- Fire since the dense structure and presence of flammable volatile oils and resins increase the fire hazard; regimes are usually altered from 'natural' recognising the issues of hazard reduction burning near urban areas
- Weed control (e.g. aggressive weeds such as boneseed, veldt grass, South African love grass)
- Feral animals (e.g. foxes) and their pressure on native flora and fauna

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Damian Shepherd

Scrub heath, Doyles Rd, Corrigin, Western Australia

TUSSOCK GRASSLANDS

- Tufted habit, usually dominated by specific genera such as *Astrebla, Danthonia (Austrodanthonia), Dicanthium, Eragrostis, Poa, Themeda, Sorghum, Stipa, Heteropogon, Ophiuros, Oryza, Eragrostis, Spinifex* and *Bursaria*.
- Support a large range of species, partly as a result of this geographical range and partly as a result of the variation in soils and site conditions.
- Ecologists working in these tussock grassland areas have been fascinated by the seasonal variations and distinct relationships with the underlying landform and soils.

Tussock grasslands: facts and figures

Vegetation class	Tussock grasslands
Structural formation	(Tussock grassland) wide range of cover and height
Major vegetation group	MVG 19. Tussock grasslands
Number of IBRA regions	70
Pre-European extent (km^2)	589 212
Present extent (km^2)	528 998
Area protected (km^2)	16 556

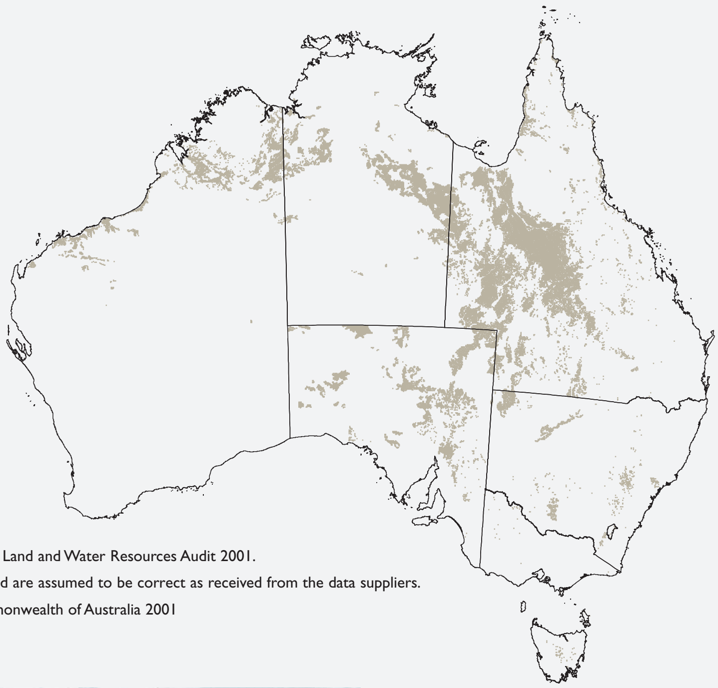
Murray Fagg

70 km south west of Blackall, Queensland

Home
Summary
Contents

Geography

- Extend from tropical to semi-arid and some temperate areas of Australia and include valuable areas for pastoralism (e.g. the Mitchell Grasslands). The major distributions occur in western Queensland, central Northern Territory and throughout South Australia.
- Largest area is in Queensland (282 547 km^2)
- The position in the landscape is variable from tableland and montane communities to floodplains and localised clay pans.



Source:
National Land and Water Resources Audit 2001.
Data used are assumed to be correct as received from the data suppliers.
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Murray Fagg

Mitchell (tussock) grassland, north of Cunnamulla, Queensland

Home
Summary
Contents

Change

- Approximately 10% of pre-European extent cleared accounting for 6.1% of total clearing in Australia.
- Approximately 60 000 km^2 cleared since European settlement.
- Generally, the tussock grasslands have not been cleared. Many have been extensively grazed as many species are palatable to cattle and sheep when the growth is young and soft.
- Changes have tended to be related to the effects of different fire regimes and the impacts of total grazing pressure, especially during climate extremes of drought. Fire regimes may affect the growth of these tussocks and other annual and short-lived perennial grasses and a range of colonising species may replace the dominant tussock grasses immediately after a fire.
- Threats include the potential for regular or intense wildfires, and total grazing pressure. Localised grazing pressure has also been observed from native marsupials on clay pans on the islands of the northwest shelf.

Key values

- Biodiversity including a variety of species and communities
- Ecotourism including bushwalking and landscape features
- Pastoralism producing a substantial proportion of Australia's rangelands output

These tussock grasslands appear to attract tourists from a scenic landscape perspective. The growth ecotourism has led to a greater awareness of the need to manage these systems to allow opportunity for ready access, and at the same time to protect the values that attract the tourists. The value of these grasslands for Indigenous people has also been more widely recognised recently.

These grasslands provide shelter for a large variety of reptiles and small marsupials in Australia.

Tenure

The tussock grasslands occur across a range of tenures.

Australian Capital Territory:	leasehold protected areas
New South Wales:	freehold land, protected areas, leasehold land
Northern Territory:	leasehold land, some freehold land
Queensland:	leasehold land, freehold land, some in protected areas
South Australia:	leasehold land, freehold land, some in protected areas
Tasmania:	freehold land, patches in protected areas
Victoria:	isolated small areas on freehold land and in protected areas
Western Australia:	leasehold land, some in protected areas, reserved crown land and water production

Management considerations

- Fire—used as a tool to replicate 'natural' conditions and foster biodiversity and production values
- Weed control (e.g. aggressive weeds such as buffel grass and ruby dock)
- Feral animals and their pressure on native flora and fauna
- Grazing pressure from domestic, feral and native animals and the management of grazing using tools such as climate forecasting to determine feed alerts and property management planning to protect sensitive land types from excessive grazing

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

John Neldner

Astrebla pectinata tussock grassland, south west of Mount Isa, Queensland

John Neldner

Astrebla lappacea tussock grassland (dry), south east of Winton, Queensland

HUMMOCK GRASSLANDS

- Dominated mainly by *Triodia* often with associated sparse eucalypt and or acacia overstorey.
- Commonly known as spinifex or porcupine grasses.
- Hummock forming evergreen perennials, which appear as mounds up to 1 m in height. In between the mounds or hummocks the ground is usually bare or exposed.
- Common and widespread, but areas of spinifex as the dominant overstorey species area relatively limited in distribution as acacia and eucalypt species occur as occasional emergents in many of the communities.
- Species include *Triodia pungens*, *T. basedowii*, *T. irritans*, *T. wiseana*, *T. brizoides*, *T. longiceps*, *T. bitextura*, *T. schinzii*. *Zygochloa paradoxa* occurs in western Queensland. *Zygochloa* also occurs in inland sandy areas such as Simpson Desert, Strzelecki Desert and Tirari Desert (Shephard 1992).
- Provide shelter for a large variety of reptiles and small marsupials in inland Australia.

Associated species vary from the large range of short-lived ephemeral plants that proliferate after seasonal or cyclonic rains. Although the spinifex species vary in their time of flowering, they tend to flower in mass which provides a colourful feature in the landscape.

Tussock grasslands: facts and figures

Vegetation class	Hummock grassland
Structural formation	Hummock grassland and low, low open, low sparse, open and sparse hummock grassland
Major vegetation group	MVG 20. Hummock grasslands
Number of IBRA regions	38
Pre-European extent (km²)	1 756 962
Present extent (km²)	1 756 104
Area protected (km²)	125 404

Murray Fagg

Triodia basedowii, Alice Springs Desert Park

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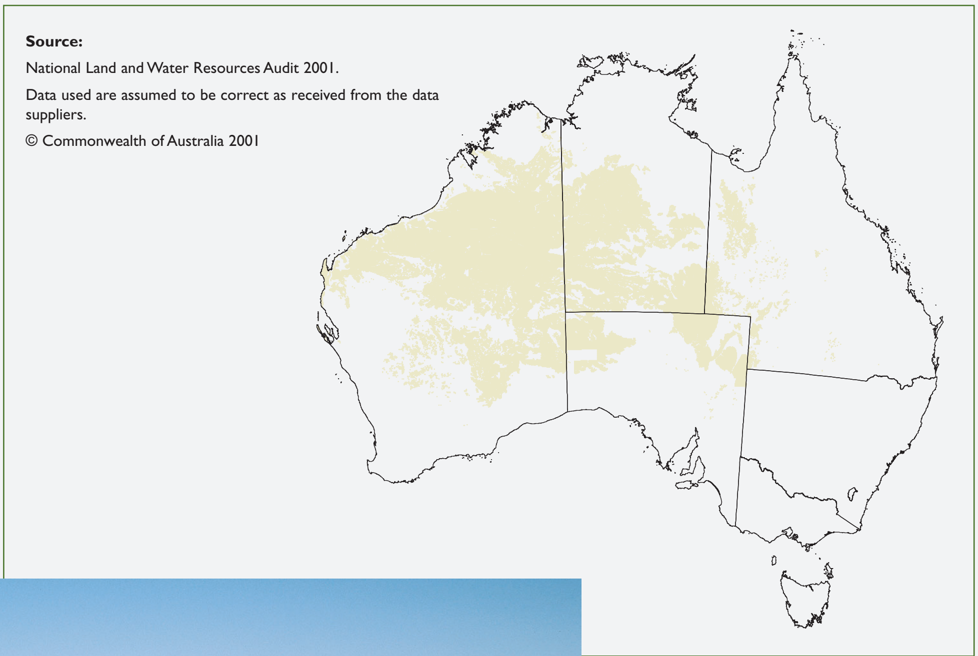
Geography

- Occur in Western Australia, Northern Territory, Queensland and South Australia—they are the largest major vegetation group in Western Australia (998 696 km^2).
- Occur where temperatures are extreme, annual rainfall is 200–300 mm and rainfall is highly variable.
- Soils are sandy or skeletal with flat, undulating or hilly terrain from near coastal limestone islands (Barrow Island in Western Australia) to extensive sandy plains inland in semi-arid and arid areas of Australia.
- Extent is large in some areas—particularly evident when major lightning strikes ignite the spinifex and the burning spinifex can be seen as a red glow in the sky from some distance.
- Support a large range of species, partly as a result of this geographical range and partly as a result of the variation in soils and site conditions.



Murray Fagg

Triodia basedowii, *Crotalaria eremaea*, Welford National Park, Queensland

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Change

- Causes of the changes appear to relate to seasonal conditions (including extremes such as drought and cyclonic events), land management practices and fire regimes. Generally, the hummock grasslands have not been cleared or extensively grazed. Some grazing occurs by some domestic stock but mostly by feral animals. Some hummock grasslands are palatable to cattle when the growth is young and soft.
- Changes that have occurred tend to be related to the effects of different fire regimes and the impacts of the introduction of feral animals on the flora and fauna species.
- Fire regimes may affect the growth of these hummocks and other annual, short-lived perennial grasses. A range of colonising species may replace the dominant hummock grasses immediately after a fire.

Key values

- Biodiversity including a variety of species and communities
- Ecotourism including bushwalking and landscape features

Management considerations

- Fire is used as a tool in some areas, although the understorey species can be modified by the intensity and regularity of fire regimes
- Weed control (e.g. aggressive weeds such as buffel grass and ruby dock)
- Feral animals and their pressure on native flora and fauna
- Total grazing pressure from domestic, feral and native animals, especially in times of drought and around watering points.

References

Shepherd M. 1992, *The Simpson Desert. Natural History and Human Endeavor,* Royal Geographical Society of Australasia, Giles Publications, Adelaide.

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Tenure

Hummock grasslands occur across a range of tenures.

Northern Territory:	leasehold land, freehold land, other crown land, little in protected areas
Queensland:	leasehold land and protected areas
South Australia:	freehold land, protected areas, some on leasehold land
Western Australia:	other crown land, leasehold land, reserved crown land, some in protected areas

OTHER GRASSLANDS, HERBLANDS, SEDGELANDS AND RUSHLANDS

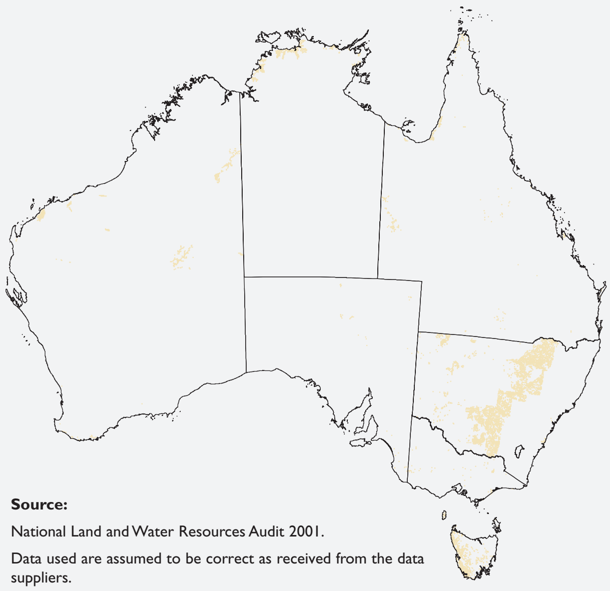
- Dominated by non-woody or herbal species such as grasses, sedges, rushes, ferns or a mixture of these. The sedgelands and rushlands are often referred to as wetland communities and support a large range of species, partly as a result of their geographical range and partly as a result of the variation in soils and site conditions.
- Occur on a range of sites from shallow soils to seasonally inundated areas to saline and freshwater (e.g. sedgelands are located on seasonally or periodically inundated water-logged and wet areas). Ferns tend to dominate specific humid areas where the environment is less variable between seasons.
- Provide local distinctive structural variations in the landscape and a variety of habitats for faunal species.
- Often associated with an overstorey of scattered and isolated trees such as in swamps (e.g. distribution of sedgelands in Western Australia is associated with eucalypt, acacia and melaleuca species). Other associated species can vary from the large range of short-lived ephemeral plants that proliferate after seasonal or cyclonic rains to longer-term perennials that rely on underground organs such as rhizomes. Although the range of species varies in their time of flowering, each tends to flower en masse which provides a colourful feature in the landscape.
- Although these communities are widespread and tend to be related to specific environmental and site conditions, they are generally localised in their extent. As such, many are not mapped individually on broadscale maps for Australia. Nevertheless they provide a variety of environments that are critical for many rare and endangered species.
- Some of the communities are relatively restricted in location (e.g. *Gahnia* sedgelands in South Australia and Victoria). Others may occur more widely (e.g. *Gymnoschoenus* or button grass plains in Tasmania).
- Fire regimes may affect growth and in some instances rapid shifts in floristic and structural components may occur in relation to these events.

Other grasslands group: facts and figures

Vegetation class	Sedge, tussock grass, rush, forb
Structural formation	Sedgeland, tussock grassland, rushland and forbland with a range of cover and heights
Major vegetation group	MVG 21. Other grasslands, herblands, sedgelands and rushlands
Number of IBRA regions	64
Pre-European extent (km^2)	100 504
Present extent (km^2)	98 523
Area protected (km^2)	10 438

Geography

- Occur across Australia with the largest areas in New South Wales which are most likely derived grasslands and in Tasmania where they occur as natural grasslands.
- Variable position ranging from near water-gaining sites, to floodplains to montane and exposed highlands in semi-arid to temperate areas of Australia. Extent of communities is generally very restricted in area as a result of the controlling site factors.
- It is likely that many areas are unmapped and that the restricted and biodiverse nature of the wetland communities requires a finer scale of mapping. The large strip stretching from north to south in New South Wales is classified as unspecified grasslands.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Murray Fagg

Gymnoschoenus sphaerocephalus, Lyell Highway, Tasmania

Murray Fagg

Humpty Doo, Northern Territory

Change

- Approximately 2% of pre-European extent cleared accounting for 0.2% of total clearing in Australia.
- Approximately 2000 km^2 cleared since European settlement.
- Generally, many of these communities have persisted with time as they tend to occur on extreme sites. The changes that have occurred tend to be related the effects of:
  - altered hydrological conditions;
  - changes in fire regimes;
  - impacts from feral animals;
  - impacts of localised tourism on the flora and fauna species;
  - increasing salinity; and
  - eutrophication (nutrient enrichment of water bodies through natural and human induced activities).

Key values

- Landscape function as natural water filters
- Biodiversity including a variety of species and communities
- Ecotourism, including bushwalking and landscape features

These communities appear to attract tourists from a scenic landscape perspective and from the variety of flora and fauna species present. The growth in recent eco-tourism has led to a greater awareness of the need to manage these systems to allow on the one hand the opportunity to readily access these areas, whilst on the other hand protecting the very values that attract the tourists.

Management considerations

- Upstream landscape management
- Tourist/visitor management (e.g. raised walkways and scenic landscapes)
- Fire regimes replicating 'natural' conditions
- Weed control
- Feral animals and their pressure on native flora and fauna

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

1996/97 Land Use of Australia, Version 2

Collaborative Australian Protected Areas Database 2000

Tenure

Other grasslands, herblands, sedgelands and rushlands occur largely on leasehold and freehold land.

New South Wales:	freehold land, leasehold land and some in protected areas
Northern Territory:	freehold land, leasehold land, protected areas
Queensland:	leasehold land, freehold land, little in protected areas
South Australia:	protected areas, leasehold land and freehold land
Tasmania:	protected areas, state forests, other crown land and scattered areas on freehold land
Victoria:	scattered across freehold land, protected areas
Western Australia:	leasehold land, some in protected areas and reserved crown land

CHENOPOD SHRUBLANDS, SAMPHIRE SHRUBS AND FORBLANDS

- Overstorey is dominated by a range of hardy low shrub species.
- Widespread in the near-estuarine, arid and semi-arid areas and occur generally as extensive flats.
- Site conditions tend to affect the type of shrub species that occur within these communities.
- In damp and water-logged areas (e.g. on drainage areas and fringing salt lake areas) samphires dominate the overstorey.
- Species in samphire communities include *Halosarcia*, *Salicornia*, *Sclerostegia* and *Sarcocornia* genera.
- Species in chenopod communities are drought and salt tolerant and include the *Sclerolaena*, *Atriplex* (salt bush), *Maireana* (blue bushes, cotton bush), *Chenopodium* and *Rhagodia* genera.

Chenopod group: facts and figures

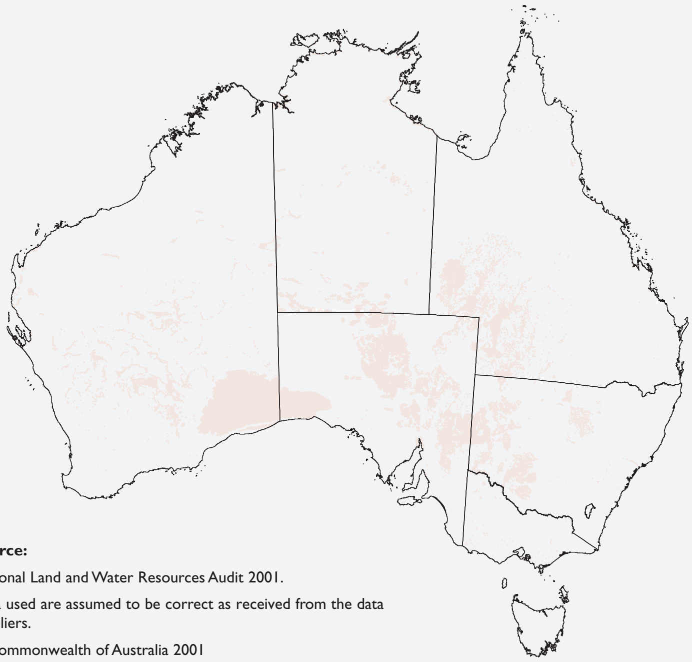
Vegetation class	Chenopod shrub, samphire shrub, shrub, forb, tussock grass
Structural formation	Chenopod shrubland (closed, low, low open, low sparse, open, tall), samphire shrubland (closed, low open, low, low sparse, sparse), forbland (low closed, low, low open, low sparse, open, sparse, tall sparse), shrubland (low open, low, low sparse, sparse, tall), tussock grassland (low)
Major vegetation group	MVG 22. Chenopod shrublands, samphire shrubs and forblands
Number of IBRA regions	72
Pre-European extent (km^2)	563 389
Present extent (km^2)	552 394
Area protected (km^2)	57 952


Murray Fagg

Maireana sedifolia, Brookfield Conservation Park, Blanchetown, South Australia

Geography

- Widespread across Australia's rangelands and cover large areas of Queensland, New South Wales, South Australia and Western Australia.
- Largest areas occur in Western Australia (189 665 km^2) amd South Australia (182 644 km^2).
- Occur mainly on extreme sites such as saline areas around salt lakes and over a wide range of site conditions—from near coastal and estuarine to near salt lakes.
- In many estuarine, semi-arid and arid areas, the shrubs are relatively stunted as a result of waterlogging and seasonal extremes.



Source:

National Land and Water Resources Audit 2001.

Data used are assumed to be correct as received from the data suppliers.

Murray Fagg

Samphire flats, Wapengo Lagoon, Bega, New South Wales

Change

- Approximately 2% of pre-European extent cleared accounting for 1.1% of total clearing in Australia.
- Approximately 11 000 km^2 cleared since European settlement.
- Most of these communities have remained intact since European settlement. In some cases the communities have increased in extent because of increased salinity and water-logging (e.g. valley floors of the Wheatbelt of Western Australia, Victoria and New South Wales have extended in area at the expense of other communities).
- Rangeland chenopod shrublands may also have been affected by pastoral production through overgrazing of feral and domestic animals.
- In other areas such as estuaries some of these communities have been protected in conservation areas. However in estuaries, particularly along the temperate east and southern coasts, wetlands have also been drained and filled for urban, recreation and port uses.
- Threats for coastal occurrences include infilling for urban areas, changes to tidal regimes and isolation from the estuary by roads and infrastructure.
- Many of these communities support mosquitos. Until recently this meant fogging and drainage where the communities were close to urban environments. A more balanced approach to management is being advocated by coastal planning groups, recognising the importance of salt marshes to coastal and estuarine fisheries.

Tenure

Chenopod shrublands, samphire shrubs and forblands occur mainly on leasehold land.

New South Wales:	leasehold, freehold land, some protected areas, state forests, reserved crown land
Northern Territory:	leasehold land, freehold land, little other crown land
Queensland:	leasehold land, some protected areas, reserved crown land, freehold land
South Australia:	leasehold land, protected areas
Victoria:	freehold land, protected areas, state forests
Western Australia:	leasehold land, some other crown land, protected areas

Key values

- Rangeland production
- Coastal and estuary fisheries, providing the basis for prawn and fish industries
- Biodiversity including a variety of species and communities such as migratory waders
- Ecotourism, including bird watching and landscape features

The values of these communities for fisheries are well recognised (e.g. nutrient cycling and algal production within salt marshes of the Gulf of Carpentaria is the basis for prawn populations and therefore the lucrative Gulf of Carpentaria prawn fishery).

One of the most widespread and economically important species for pastoral production is *Atriplex vesicaria* found across the rangelands. The chenopod shrublands show a range of palatability and varying responses to grazing and form the permanent mosaic of the shrub layer in the rangelands.

These shrublands are home to a wide range of birds and mammals, including some rare and endangered species and migratory waders.

Management considerations

- Protection of the areas from in-filling, loss of tidal flows and urbanisation
- Hydrological changes (waterlogging and salinity resulting from clearing and or revegetation of degraded areas)
- Weed control
- Feral animals and their pressure on native flora and fauna

Data sources

Australian Native Vegetation Assessment 2001

National Vegetation Information System, Version 1

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Collaborative Australian Protected Areas Database 2000

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MANGROVES, TIDAL MUDFLATS, SAMPHIRES, CLAYPANS, SAND, ROCK, SALT LAKES, LAGOONS AND FRESHWATER LAKES

- Includes natural environments that occur on coastal areas or in restricted locations. Mangrove, salt marshes, and marine wetlands occur on coastal plains and lowlands. Communities need to tolerate a high but variable range of salinities and tidal influences (including daily waterlogging or in some instances inundation). Exposure varies from location to location.
- Other wetlands or extreme communities occur in areas subject to drought seasonal conditions (sand, rock, claypans) or continual, periodic or seasonal inundation (lagoons, salt lakes, freshwater lakes).

Mangroves group: facts and figures

Vegetation class	Mixed
Structural formation	Tree, tussock grass, forb
Major vegetation group	MVG 23. Mangroves, tidal mudflats, samphires, claypans, sand, rock, salt lakes, lagoons and freshwater lakes
Number of IBRA regions	85
Pre-European extent (km²)	112 063
Present extent (km²)	106 999
Area protected (km²)	28 242

Murray Fagg

Coongie Lakes, South Australia

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Species distribution

Mangroves are dominated by trees on the coast including:

Northern Territory
Rhizophora stylosa (red mangrove), *Ceriops tagal*, *Exoecaria ovalis.*

Northern Queensland
Avicennia marina, *Ceriops tagal*, *Rhizophora stylosa*, *Exoecaria agallocha*, *Pemphis acidula*, *Bruguiera gymnorhiza.*

South-east Queensland
Avicennia marina, *Aegiceras corniculatum*, *Bruguiera gymnorhiza.*

New South Wales
Aegiceras corniculatum, *Avicennia marina.*

Victoria
A. marina spp. *australasica.*

Tasmania
A. marina var. *resinifera.*

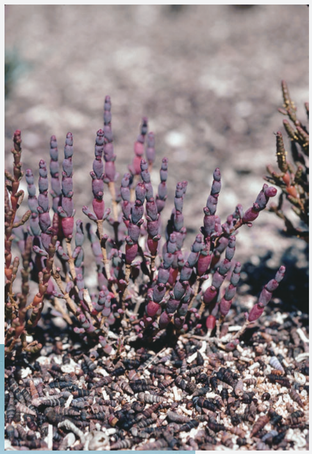
Saltmarshes are dominated by forbs and low shrubs and may occur on the coast or inland on naturally saline soils or soils undergoing salinisation.

Queensland
Halosarcia, *Suadea.*

New South Wales
Sarcocornia quinqueflora chenopod shrublands.

Tasmania
Saline aquatic plants—*Ruppia*, *Lepilaena* and fresh water aquatic plants—*Potamogeton*, *Triglochin*, *Villarsia.*

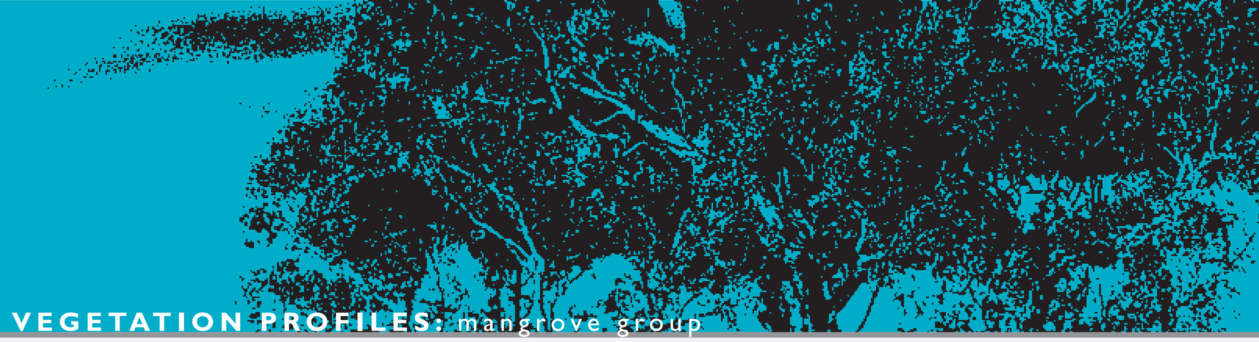
Samphire, Adelaide, South Australia



Murray Fagg

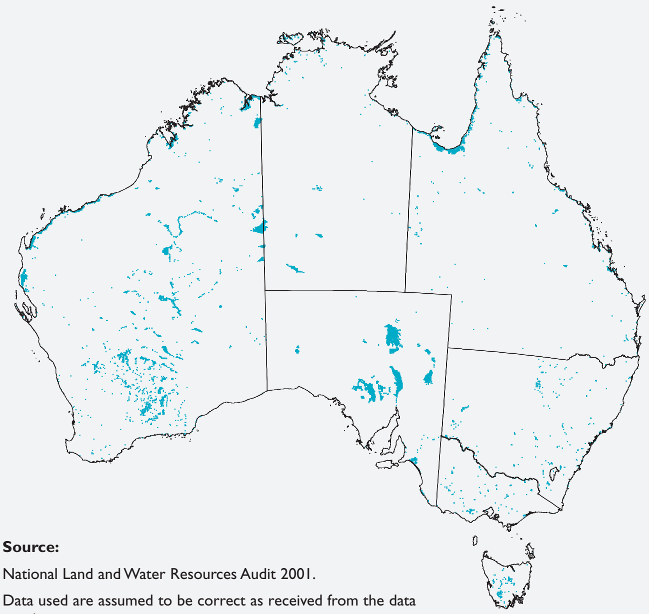
Murray Fagg

Salt marshes near Port Augusta, Western Australia



Geography

- Occur over a wide range of site conditions, from near coastal and estuarine to salt lakes and freshwater lakes to naturally saline inland areas across Australia.
- Mangroves are widespread although contained to coastal environments. Australia has many mangroves through tropical, subtropical and temperate areas. This range is rarely seen in other countries. Mangroves do not occur in Tasmania.
- Samphires are found in the coastal mudflats and marine plains, adjoining mangrove areas in many instances, but also cover extensive marine plains inland from the southern Gulf of Carpentaria and other parts of the tropical north.
- Extensive areas devoid of vegetation can be found as bare ground, either sand dune, claypan or salt lakes in the harsh environments of the arid interior.
- Coastal sand masses can often contain extensive areas of bare sands, mostly as active dunes.



Source:

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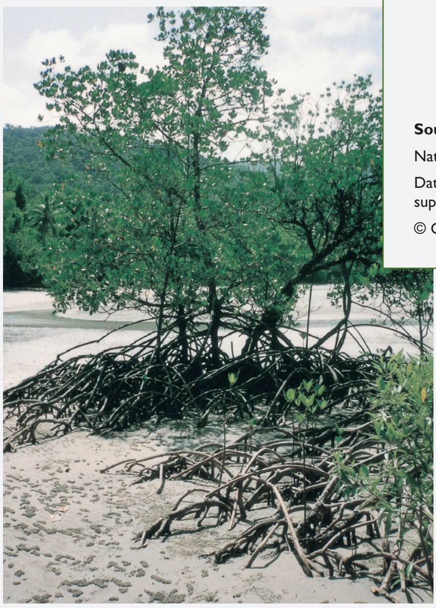

Maria Cofinas

Mangroves, Queensland

Change

- Many of these communities are in substantially natural condition.
- Those in more populated areas have been modified by changing local site conditions, including hydrological conditions, tidal flows and salinity levels in the upper soil profiles.
- Some have been lost through infilling and clearing for urbanisation, port works and industrial areas near coastal and estuarine areas or modified through changing nutrient and sediment regimes.
- Generally these communities have increased as a result of clearing of near-coastal land and the increased sediment loads on estuaries—mangroves colonising what were previously sand spits.
- There has been a major change in how some of these areas have been recognised through planning strategies and conservation. The latter includes the recognition of the biological values in salt lakes (e.g. Goldfields in Western Australia—Lake Carey and Lake Lefroy are among some of the larger lakes) and fisheries habitat protection controls in most States and Territories.

Key values

- Coastal and estuarine ecology and fisheries habitat
- Biodiversity including a variety of species and communities
- Ecotourism including boardwalks and guided fishing tours

These communities are home to a wide range of birds and mammals, including some rare and endangered species and also provide a breeding ground for many estuarine and marine species.

Management considerations

- Protection of the areas from in-filling, changes to tide regimes and urbanisation
- Hydrological changes (waterlogging and salinity resulting from clearing and or revegetation of degraded areas)

Data sources

Australian Native Vegetation Assessment 2001

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Collaborative Australian Protected Areas Database 2000

Murray Fagg

Samphire flats, St Kilda Beach, near Adelaide, South Australia

NATIONAL LAND AND WATER RESOURCES AUDIT

Who is the Audit responsible to?

The Minister for Agriculture, Fisheries and Forestry – Australia has overall responsibility for the Audit as a program of the Natural Heritage Trust. The Audit reports through the Minister for Agriculture, Fisheries and Forestry to the Natural Heritage Board which also includes the Minister for the Environment and Heritage.

How is the Audit managed?

An Advisory Council manages the implementation of the Audit. Dr Roy Green, with a background in research, science policy and management chairs the Advisory Council. Members and observers on the Advisory Council and the organisations they represent are: Warwick Watkins (LWRRDC), Bernard Wonder (AFFA), Stephen Hunter (EA), John Radcliffe (CSIRO), Peter Sutherland (SCARM), Jon Womersley (SCC), Roger Wickes (SCARM) and Colin Creighton (Audit).

What is the role of the Audit Management Unit?

The Audit Management Unit's role has evolved over its five-year life. Phases of activity include:

Phase 1. Strategic planning and work plan formulation—specifying (in partnership with Commonwealth, States and Territories, industry and community) the activities and outputs of the Audit—completed in 1998–99.

Phase 2. Project management—letting contracts, negotiating partnerships and then managing all the component projects and consultancies that will deliver Audit outputs—a major component of Unit activities from 1998–99 onwards.

Phase 3. Reporting—combining outputs from projects in each theme to detail Audit findings and formulate recommendations—an increasingly important task in 2000–2001 and the early part of 2001–02.

Phase 4. Integration and implementation—combining theme outputs in a final report, working towards the implementation of recommendations across government, industry and community, and the application of information products as tools to improve natural resource management—the major focus for 2001–2002.

Phase 5. Developing long term arrangements for continuing Audit-type activities—developing and advocating a strategic approach for the continuation of Audit-type activities—complete in 2001–2002.

The Audit Management Unit has been maintained over the Audit's period of operations as an eight-person multidisciplinary team. This team as at August 2001 comprises Colin Creighton, Warwick McDonald, Stewart Noble, Maria Cofinas, Jim Tait, Rochelle Lawson, Sylvia Graham and Drusilla Patkin.

How are Audit activities undertaken?

As work plans were agreed by clients and approved by the Advisory Council, component projects in these work plans were contracted out. Contracting involves negotiation by the Audit to develop partnerships with key clients or a competitive tender process.

Facts and figures

• Total Audit worth, including all partnerships	in excess of $52 m
• Audit allocation from Natural Heritage Trust	$34.19 m
• % funds allocated to contracts	~ 92%
• Total number of contracts	149

Natural Heritage Trust
Helping Communities
Helping Australia
A Commonwealth Government Initiative

National Land and Water Resources Audit
A program of the Natural Heritage Trust

www.nlwra.gov.au/atlas