Cunninghamia

A journal of plant ecology for eastern Australia

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Cunninghamia

A journal of plant ecology for eastern Australia

***Cunninghamia*: a journal of plant ecology for eastern Australia** publishes original research papers on all aspects of plant ecology with particular emphasis on the vegetation and flora of eastern Australia. Descriptive, experimental and historical studies of plant communities, populations, individuals, their interactions with other organisms and their management are acceptable. Acceptance is the responsibility of an editorial committee chaired by the Scientific Editor. All papers are peer-reviewed.

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Allan Cunningham, botanist and explorer (1791–1839)

Cover: Spinifex dune mallee shrubland (ID171) dominated by the mallee species *Eucalyptus socialis* and *Eucalyptus dumosa* with the hummock grass *Triodia scariosa* (spinifex) dominating the ground cover, in Tarawi Nature Reserve in far south western New South Wales. This widespread plant community is one of the few in the NSW Western Plains that remains in good condition with reasonable representation in conservation reserves.
Photo: Jaime Plaza

Cunninghamia

A journal of plant ecology for eastern Australia

Volume 9(3): 329–450 • 2006

Foreword 329

New South Wales Vegetation Classification and Assessment: Introduction — the classification, database, assessment of protected areas and threat status of plant communities. 331
J.S. Benson

New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains 383
J.S. Benson, C.B. Allen, C. Togher and J. Lemmon

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Foreword

NSW Vegetation Classification and Assessment Project

This issue of *Cunninghamia* contains the first two papers of a project involving the classification and assessment of the native vegetation of New South Wales, Australia (NSWVCA). Besides developing a comprehensive typology of the vegetation, the project aims to assess the protected area and threat status of the State's vegetation. It collates information on vegetation composition, geographic distribution of plant communities, physiographic features, threats, aspects of condition, planning and management and representation in protected areas into a single database system. A photographic library is also being collated for use with the database and use in publications and education programs.

Due to the scope of the project, it is to progress across four sections of New South Wales: Western Plains, Western Slopes, Tablelands and Coast and Escarpment. These sections are based on the IBRA Version 6 Bioregional boundaries. On completion, a uniform, fine resolution, vegetation classification would exist on a single database system.

The introductory paper describes the aims and methods of the project including classifying the NSW vegetation and description of the NSWVCA database. A number of database reports can list plant communities by planning regions such as bioregions or catchment management authority (CMA) areas. It also describes threat criteria for grading plant communities into five threat categories and also methods of determining the protected area status of each community.

Part 1 of NSWVCA describes 213 plant communities classified for the NSW Western Plains that cover 57% of NSW. This section of the State mainly comprises arid and semi-arid alluvial plains, sand plains and some stony ranges of low relief. Part 1 also contains an analysis of the protected area and threat status of the plant communities in the NSW Western Plains. This provides a detailed audit of the protected area system in that region.

This vegetation classification and database system has been constructed to fulfil local, regional, state and national vegetation classification, planning, assessment and reporting requirements. While the classification should improve with better information, this initial effort should contribute to the conservation and management of native vegetation, native species and the ecological processes that underpin them.

J.S. Benson, March 30, 2006.

New South Wales Vegetation Classification and Assessment: Introduction — the classification, database, assessment of protected areas and threat status of plant communities

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Abstract: A vegetation classification titled, NSW Vegetation Classification and Assessment (NSWVCA), is described. It aims to classify the native vegetation of New South Wales, Australia covering 80 million hectares distributed across 18 Australian bioregions. It is estimated that between 800 and 1200 plant communities will be described. The best available data is used to establish the classification including vegetation map descriptions, floristic groups derived from plot data and expert advice. Extensive field checking assists with the classification and status assessments. Plant communities are listed under five hierarchical levels and are recorded on a database containing 90 fields supported by 45 tables and 64 forms. 39 database reports list plant communities for several types of planning regions and under State and national broad vegetation classifications. Database fields include plant community scientific name, common name, three layers of characteristic species, an 'Authority' field that cites references supporting the definition of a community, substrate, soils, landform, distribution by various regions including bioregions and Catchment Management Authority areas, descriptions and lists of threatening processes and aspects of condition. Estimates of pre-European extent, current extent and areas in public reserves and secure property agreements are recorded and qualified with accuracy levels. One of five threat categories: 'critically endangered', 'endangered', 'vulnerable', 'near threatened' or 'least concern' is assigned to each plant community based on the application of six criteria including: the proportion of remaining extent compared to an estimated pre-European extent, loss of key species and plant community integrity.

The NSWVCA will progress over four geographical sections of NSW commencing with the mainly arid and semi-arid Western Plains (this volume), progressing eastwards to the Western Slopes, the Tablelands and finally the biologically complex Coast and Escarpment. The NSWVCA will assist with: selecting new protected areas, guiding incentive payments and land use decisions in the NSW property vegetation planning process, site assessment in environmental impact assessments, assisting with nominations and definitions of threatened ecological communities in State and Federal laws, prioritizing CMA and other regional targets for the protection and restoration of vegetation and assisting in public education about native vegetation.

A CD accompanying the paper contains a read-only version of the database and outputs of Part 1 of the NSWVCA project – the vegetation of the NSW Western Plains.

Cunninghamia **(2006) 9(3): 331–382**

Introduction

This paper describes the aims and methods of the project titled the New South Wales (NSW) Vegetation Classification and Assessment (NSWVCA) which aims to classify the native vegetation of NSW and evaluate the conservation significance of its components. Subsequent parts of this project will contain plant community descriptions and assessments of the protected area and threat status of plant communities in four sections of NSW, NSW Western Plains, NSW Western Slopes, NSW Tablelands and NSW Coast and Escarpment. Part 1, the NSW Western Plains, is published in this volume.

The main aim of the project is to deliver a typology of plant communities in NSW in a database format that can be easily accessed and manipulated. Each plant community is cross-referenced to several other ecological and vegetation classifications covering NSW or Australia. The database format facilitates queries of combinations of the information fields and a series of database reports allows lists of plant communities to be generated for particular planning regions or for broad vegetation classification categories. Criteria for assessing the threat and protected area status of each classified plant community are included in this paper. These assist with prioritizing management or conservation programs.

The NSWVCA scheme is pertinent to environmental assessments under various laws and regulations (Figure 1) including:

- *NSW Environmental Planning and Assessment Act 1979* that directs local, regional and state planning;
- *NSW Threatened Species Conservation Act 1995,* amended 2004 that provides for the nomination and listing of ecologieal communities as critically endangered, endangered or vulnerable;
- *NSW Native Vegetation Act 2003* that contains provisions for property vegetation planning that require site assessment of vegetation and a regional perspective;
- *NSW Catchment Management Act 2003* that provides for the preparation of Catchment Management Plans and setting targets for protecting faeets of the environment;
- *NSW Natural Resource Commission Act 2003* that provides for the setting of State standards and targets for natural resource management, ineluding on the topics of vegetation, biodiversity, soils, salinity and wetlands;
- *Australian Environmental Protection and Biodiversity Conservation Act 1999*, that provides for the nomination and national listing of ecological communities as critically endangered, endangered or vulnerable. Breaching eertain threat thresholds can trigger Commonwealth aetion to protcet sites.

The summarized knowledge about eaeh elassified community, along with threat and protected area status assessments should assist with:

- Setting priorities for new conservation reserves or property agreements;
- Setting priorities for payments to landholders under property agreements;
- Assisting with site assessment in land use change applications;
- Setting targets for protecting and restoration eeological communities;
- Listing of threatened ecological communities under legislation;
- Monitoring progress in protecting aspects of biodiversity;
- Edueating the public about the habitats and native vegetation.

The study area: regional partitions of New South Wales

New South Wales is loeated in south-eastern Australia (Figure 2) and is about 80 million heetares in area (Table 1). A number of regional divisions of NSW are used in land use planning and are used in deseribing the distribution of plant communities:

NSW Administrative Divisions

There are three Administrative Divisions in NSW (Figure 2) that broadly eorrespond to major land uses:

- The *Western Division* is composed of arid and semi-arid plains and peneplains, mainly used for stock grazing with some cropping on the eastern margins on lake beds and on some floodplains. It is about 70% naturally vegetated but the vegetation structure and composition have been severely modified by 150 years of stoek and feral animal grazing. Most of the land is held under long term Western Lands Leases.

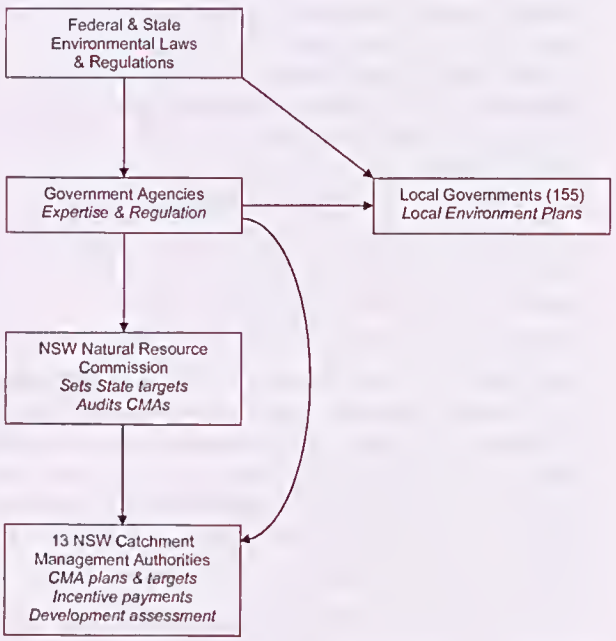

Fig. 1. Natural resource organisations and regulations in New South Wales.

Table. 1. Area of New South Wales, Australian Capital Territory and the Murray Darling River Basin.

Region	Hectares
NSW	79,939,847
ACT + Jervis Bay Territory	242,249
NSW + ACT + Jervis Bay	80,182,096
Murray Darling Basin in NSW	59,847,469 (75% NSW)

• The *Central Division* is mainly composed of alluvial plains and floodplains with some ranges and hills. It is the main agricultural region of NSW and the centre for cropping and irrigation. Between 20 and 30% of the native vegetation remains (Benson 1999) but less than 5% remains of some plant communities. The extent of clearing has resulted in a very fragmented cover of native vegetation and continual clearing is reducing existing patch sizes. Most of the Central Division is freehold land with only 1.2% in public conservation reserves and 3.9% in state forests (NSW State Forests and DEC Estate GIS shape files 2004).

• The *Eastern Division* is composed of the higher altitude, undulating western slopes and tablelands including alpine regions. It also includes the wet and topographically rugged eastern escarpment, coastal valleys and plains and the NSW coastline. It is rich in biodiversity. Vegetation has been cleared for agriculture on better soils and on flatter terrain. Large patches of vegetation remain on poor soils or rugged topography, including on granite or sandstone ranges, along the eastern escarpment and along some sections of the coast. About half of the Division is held under freehold title but large areas of public land remains in public conservation reserves, state forests and held under various types of leases. Over 90% of the seven million people who reside in NSW live in this Division. Urbanization is a major threat to the natural environment along the coast.

Climate zones

NSW contains eight major climate zones (Figure 3) using the Stern et al. (2000) modification of the world climatic zone map in Koppen (1931). The climatic zones are defined through combining average rainfall and temperature with the distribution of rainfall through the year.

IBRA Bioregions

The Interim Biogeographic Regionalization of Australia (IBRA) (Thackway & Cresswell 1995) was produced through cooperative efforts of Australian, State and Territory governments to provide a broad framework for conservation planning. The Bioregion classification is based on combinations of climatic, substrate and soils. 18 of the 80 IBRA Bioregions in Australia (Thackway & Cresswell 1995, version 6.0) are wholly or partly in NSW (Figure 4). The biodiversity, conservation and history of 17 of these Bioregions (excluding the recently enlarged South Eastern Queensland Bioregion) are described in NSW National Parks and Wildlife Service (2003) and Benson (1999).

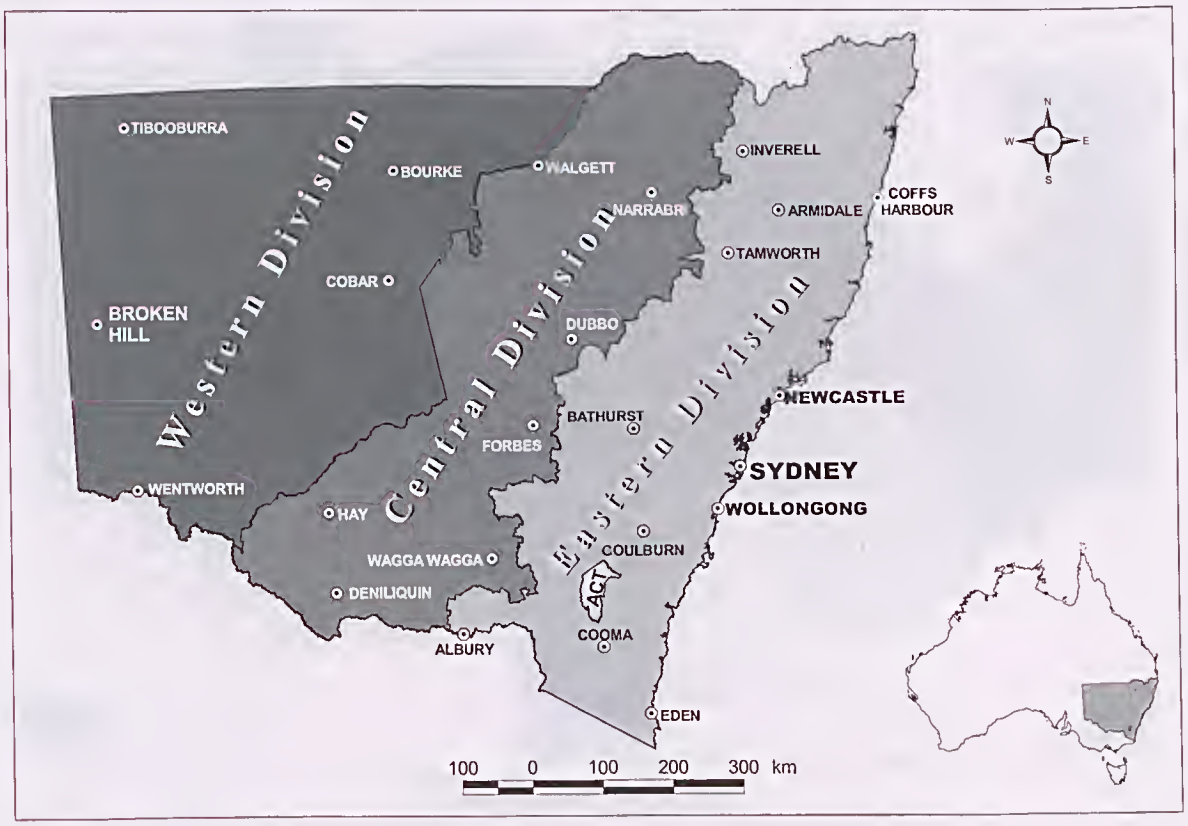

Fig. 2. New South Wales Administrative Divisions. Most of the Western Division is held under long term leases for grazing.

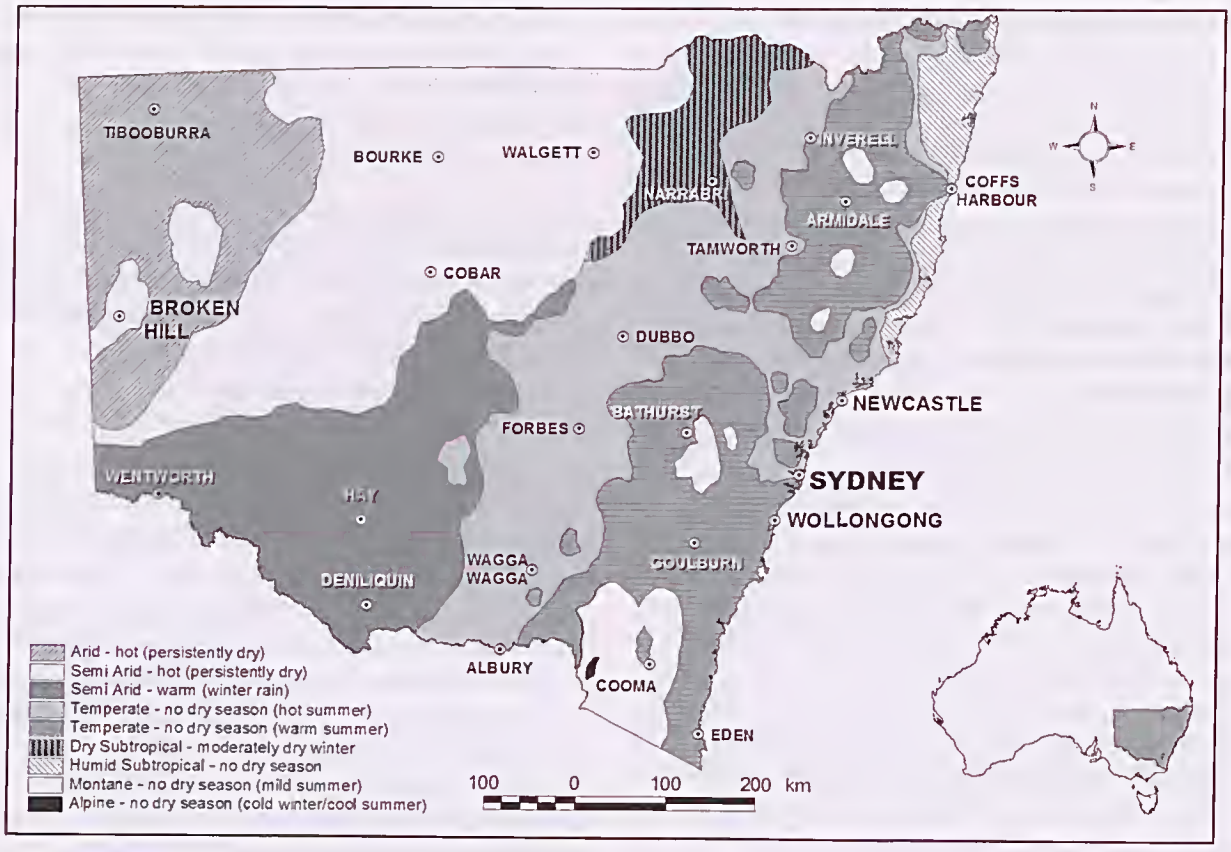

Fig. 3. Climate zones of New South Wales based on Stern et al. (2000).

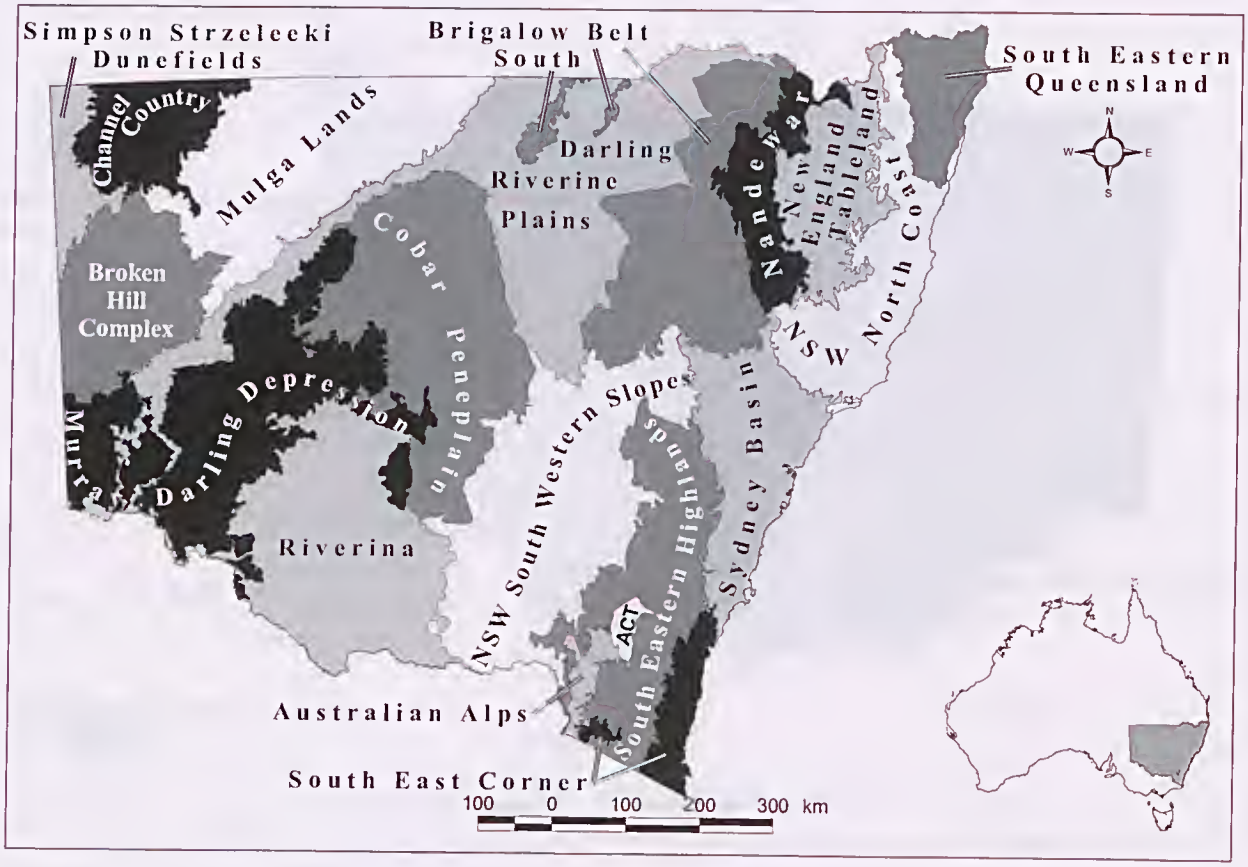

Fig. 4. IBRA Bioregion areas in NSW (IBRA Version 6.0, Thaekway & Cresswell 1995)

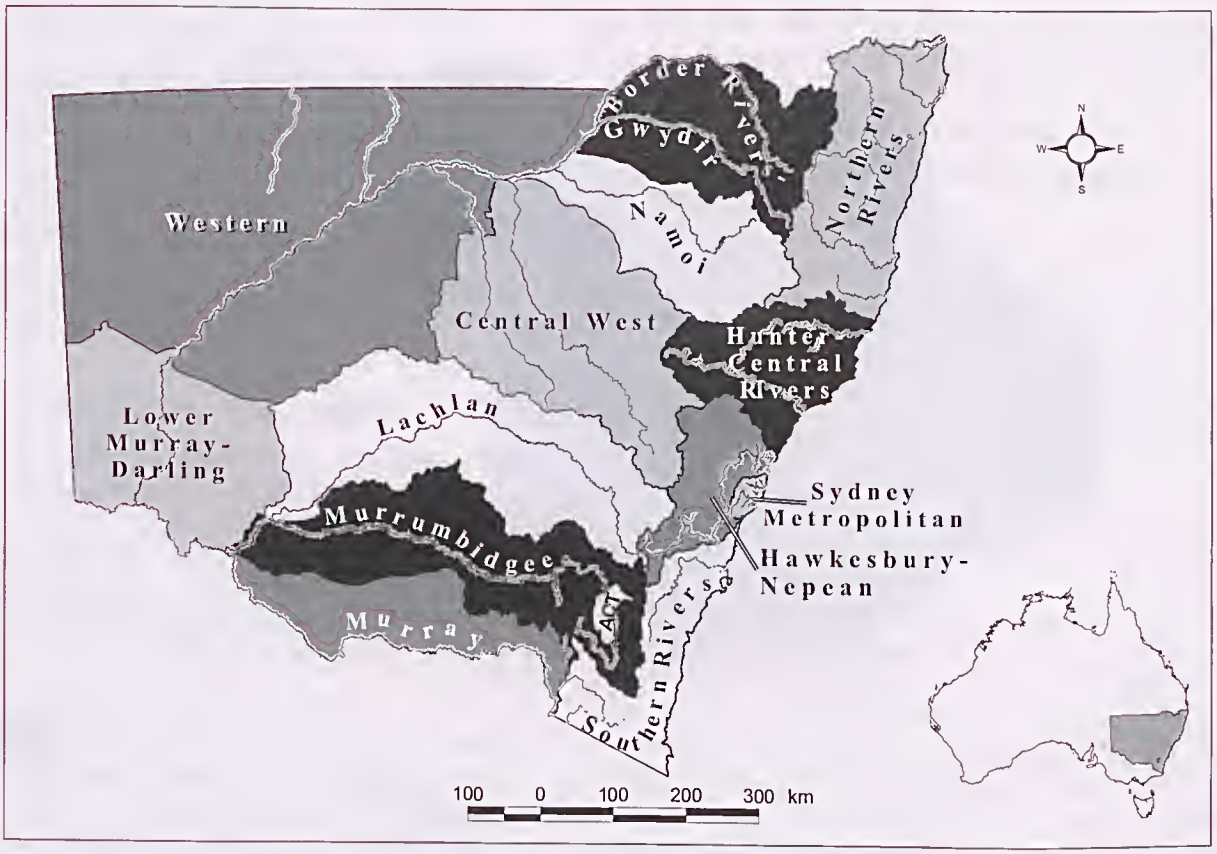

Fig. 5. Catchment Management Authority area boundaries showing the major rivers in New South Wales

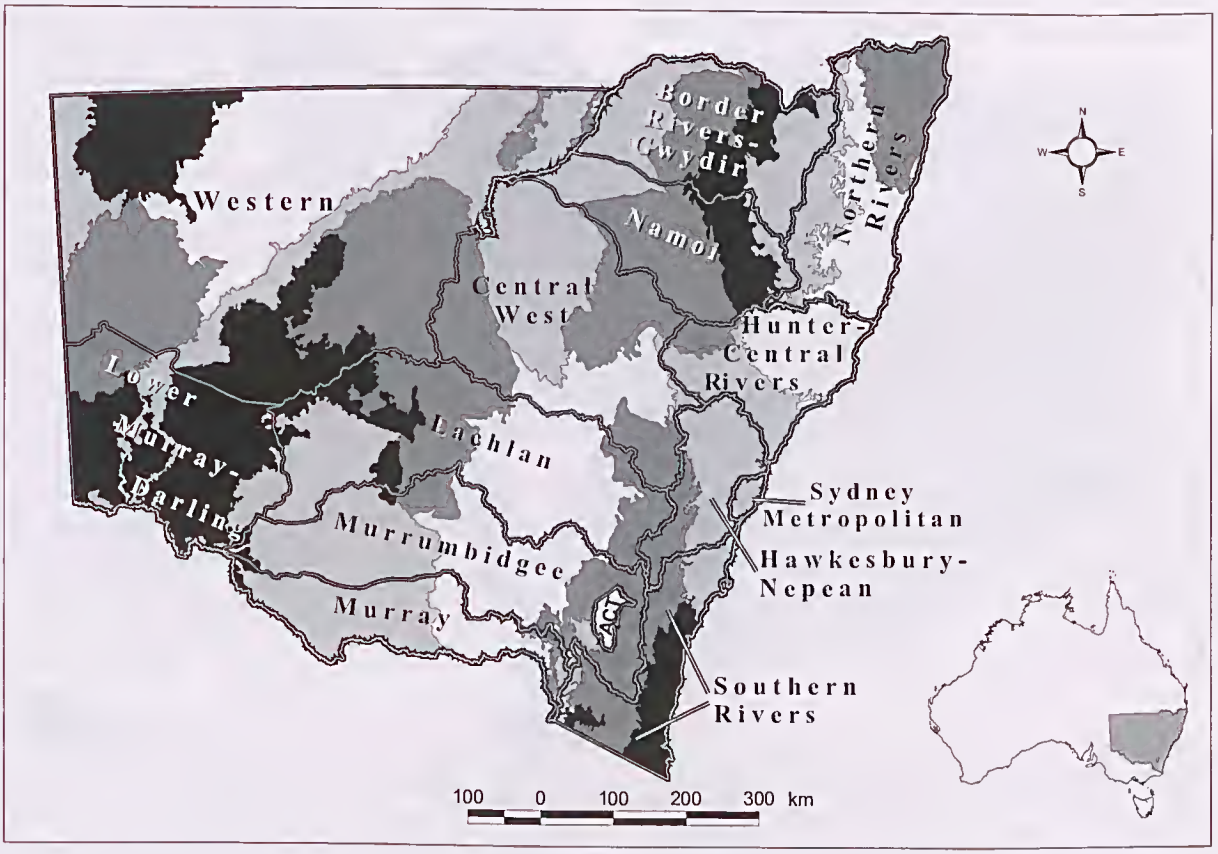

Fig. 6. Catchment Management Authority area boundaries in relation to the IBRA Bioregions Version 6.0 boundaries in New South Wales

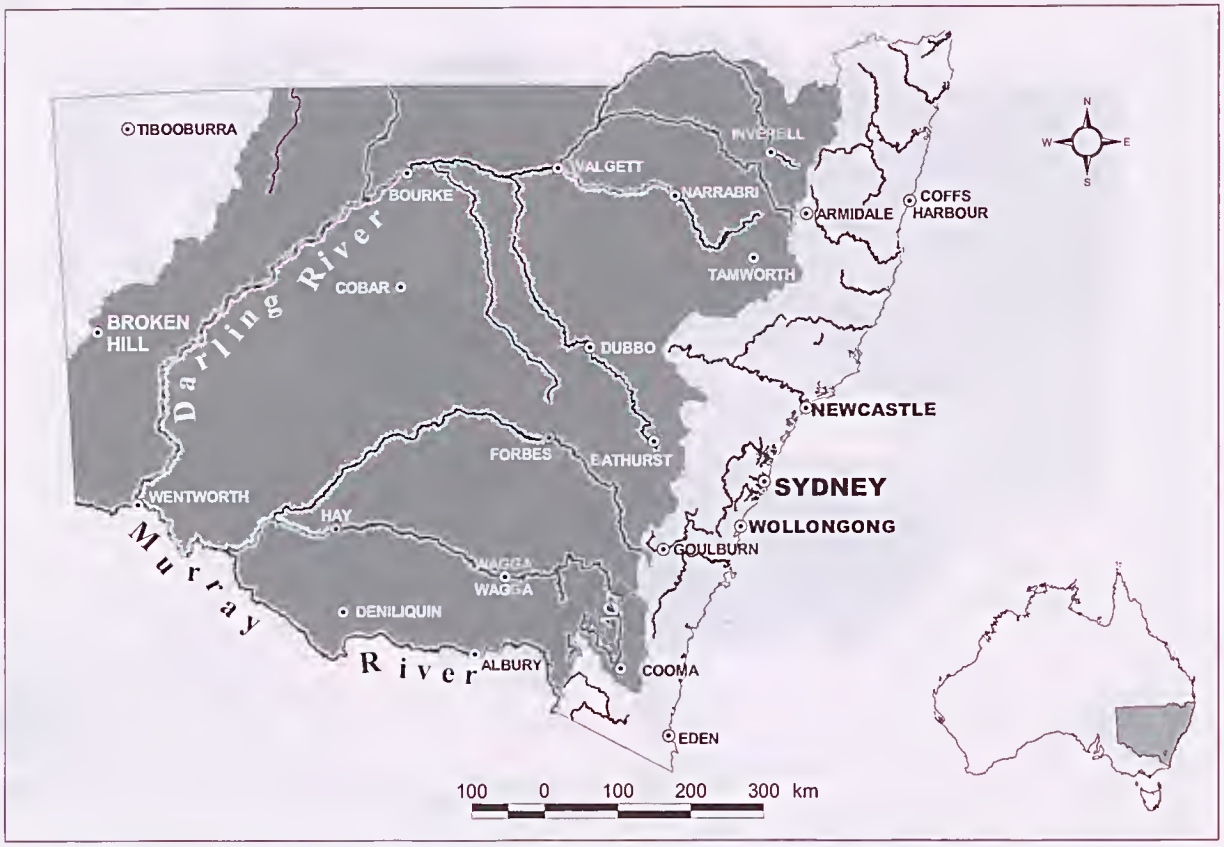

Fig. 7 The Murray-Darling Basin in relation to New South Wales. The Basin covers about 75% of NSW.

Fig. 8. The NSWVCA is progressing across fours sections of New South Wales from the Western Plains to the Western Slopes, Tablelands and Coast and Eastern Escarpment. These sections are defined by the boundaries of groups of IBRA (Version 6.0) Bioregions.

IBRA Bioregion sub-regions

Some Australian States have sub-divided the IBRA Bioregions into smaller units to produce more homogenous classifications for environmental planning. In NSW, this began with descriptions of sub-regions of western NSW (Morgan & Terry 1992) and was extended across the whole State by the NSW Department of Environment and Conservation (DEC) (2004). The resulting NSW IBRA sub-region map divides the 18 IBRA Bioregions in NSW into 129 sub-regions.

Botanical Divisions of NSW

Anderson (1961) described 12 Botanical Divisions of NSW. While this classification is older than the IBRA Bioregions, some of the Botanic Divisions make good sense from the botanical viewpoint and are still used to describe distributions of plant communities. Location in Botanic Divisions is recorded for about 300 000 plant specimens collected in NSW and housed in the New South Wales Herbarium, Sydney.

Catchment Management Authority Areas

The NSW Catchment Management Act 2003 defines 13 Catchment Management Authority areas (CMAs) (Figure 5) administered by Catchment Management Authorities. The Authorities are charged with making statutory Catchment Action Plans that contain targets for protecting aspects of landscapes in the catchments. The CMA boundaries include river catchments and vary considerably from the IBRA Bioregion boundaries (Figure 6). The four CMAs that run eastwards and the six that run westwards off the NSW Great Dividing Range contain large altitudinal gradients and landform variation compared to the IBRA Bioregions. For this reason the IBRA Bioregions tend to contain a more homogenous group of vegetation types compared to the CMA areas.

Local Government Areas

As of December 2004, there were 155 Local Government Areas (LGAs) in NSW but future amalgamations are likely to reduce this number. Local Governments are able to make Local Environmental Plans (LEP) under the NSW Environmental Planning and Assessment Act 1979. These LEPs can substantially affect land use and the management of vegetation.

Murray-Darling Basin

The Murray-Darling Basin is Australia's most important agricultural region, accounting for 41 per cent of the nation's gross value of agricultural production (Murray Darling Basin Commission http://www.mdbc.gov.au/naturalresources/basin_stats/statistics.htm). About 57% (59 847 470 ha) of the M-D Basin occurs in NSW (Figure 7, Table 1) covering about 75% of the State. Large areas of the Basin are under threat from salinity, soil degradation, clearing of native vegetation and biodiversity loss.

Producing the NSWVCA across four sections of NSW

Due to the scope of the project, the production of the NSWVCA is to will be divided between four sections of NSW beginning with the arid/semi-arid inland plains and progressing to the humid, east coast: (Figure 8) (Table 2). The NSW sections are based on groups of bioregional boundaries (IBRA Version 6.0 of Thackway & Cresswell 1995) (Figure 4). The order of production of the NSWVCA is:

- This introduction and overview paper that describes the aims and methods of the project;
- Part 1 (Benson et al. 2006, this volume) covering the classification and assessment of the plant communities of the NSW Western Plains. This incorporates the NSW sections of the eight IBRA Bioregions: Simpson-Strzelecki, Channel Country, Mulga Lands, Broken Hill Complex, Murray-Darling Depression, Riverina, Cobar Peneplain and the Darling Riverine Plain Bioregions (Figure 4). It includes the entire Western and Lower Murray/Darling Catchment Management Authority areas (CMAs) and the western parts of the Border Rivers/Gwydir, Namoi, Central West, Lachlan, Murrumbidgee and Murray CMAs (Figure 5).
- Part 2 is planned to cover the classification and assessment of the plant communities of the NSW Western Slopes incorporating the NSW sections of the three IBRA Bioregions: Brigalow Belt South, Nandewar and the New South Wales South Western Slopes Bioregions (Figure 4). The Western Slopes includes the middle sections of the Border Rivers/Gwydir, Namoi, Central West, Lachlan, Murrumbidgee and Murray CMAs (Figure 5);
- Part 3 is planned to cover the classification and assessment of the plant communities of the NSW Tablelands that incorporate the NSW sections of the three IBRA Bioregions: New England Tableland, South Eastern Highlands and Australian Alps Bioregions (Figure 4). The tablelands include the upper sections of the Border Rivers/Gwydir, Namoi, Central West, Lachlan, Murrumbidgee, Murray, Northern Rivers, Hunter/Central Rivers, Hawkesbury/Nepean and Southern Rivers CMAs (Figure 5);
- Part 4 is planned to cover the classification and assessment of the plant communities of the NSW Eastern Escarpment and Coast. This is the most complex section biologically. It incorporates the NSW sections of the four IBRA Bioregions: South East Queensland, NSW North Coast, Sydney Basin,

South East Corner (Figure 4). It includes most of the area in the Northern Rivers, Hunter/Central Rivers, Hawkesbury/Nepean and Southern Rivers CMAs (Figure 5).

Once the classification and assessment of the vegetation is complete for each section, the results and descriptions of the plant communities will be published and made available on the internet.

Vegetation Classification

Any region can be sub-divided into units based on subjective or objective analyses of biotic or abiotic variables. The units may vary in number and size depending on the scale and purpose of the classification. They are often used as surrogates for biodiversity in landscape management. Mapped units can be used in GIS applications to form a basis for conservation planning (Margules & Usher 1989) including in irreplaceability analyses (Pressey et al. 1994, Ferrier et al. 2000). Abiotic landscape classifications based on geology, landforms and soil types include the ecosystem mapping of British Columbia, Canada by Banner et al. (1996) and the categorisation and mapping of landscapes in New South Wales by Pressey et al. (2000) and Mitchell (2002). Biotic ecological classifications are mainly based on structural or physiognomic attributes of vegetation and vascular plant species composition. Species of lower plants (bryophytes, algae) can also be used in vegetation classification. Species of fauna are less often used because many species are highly mobile and therefore unsuitable in static landscape classifications. Other classes of species such as invertebrates, bacteria, viruses, lichens, fungi lack taxonomic treatment or are difficult to recognise in the field, so are rarely used.

Benefits of vegetation classification

Vegetation composition and structure are often selected for classifying landscapes because:

- Vascular plant species are well described and defined in taxonomic treatments – at least in 'western' countries;
- It is relatively easy to record vegetation structure and/or the presence or absence of plant species;
- Variation in plant species composition/abundance and vegetation structure often reflects natural or human-induced disturbance;
- Trained ecologists and land managers can generally recognize dominant plant species and vegetation structure in the field;
- Some evidence exists for correlations of vertebrate animal species with vegetation patterns (Mazzer et al. 1998) but there is less congruence of vegetation types with invertebrate species (Dangerfield et al. 2003).

Classifying vegetation

Vegetation can be classified through structural or physiognomic attributes such as life form, leaf size, height of strata and canopy cover. Alternatively, vegetation can be classified through a floristic approach by describing variation in species composition across a region. The latter can involve analyses of patterns of dominant plant species or all plant species (Kent & Coker 1992). Often elements of both structural and floristic approaches are used in vegetation classification. Sometimes a vegetation classification is nested under broader abiotic classifications exemplified in the approach to ecosystem definition in Queensland, Australia (Sattler & Williams 1999, Queensland Herbarium 2003, Wilson et al. 2002).

The attributes of leaf size and deciduous versus evergreen leaf retention have often been used to define high hierarchical orders in northern hemisphere vegetation classification (Dansereau 1951). However, these attributes are less useful for dividing most Australian vegetation. Dominant plant species life forms (Raunkiaer 1934) have been widely used in categorising vegetation throughout the world. In Australia, life forms form a core of the influential vegetation classification scheme of Beadle & Costin (1952). They are also a major component in the structural classifications of the widely used projected foliage cover / height class classification of Specht (1970) and the crown separation / height class classification of Walker & Hopkins (1990). These structural classifications have the advantage of requiring minimum knowledge of plant species taxonomy but they tend to classify vegetation into broad classes such as 'tall open forest' or 'open shrubland' and each class contains numerous floristic communities generally spread over large distributions.

Floristic approaches to ecological community classification commenced in Europe in the late 19th and early 20th Century culminating in the Zurich-Montpellier School of phytophysiology described by Braun-Blanquet (1932), with subsequent modifications by various botanists including Poore (1955). Bridgewater (1981) comments on the use of the Braun-Blanquet approach in classifying Australian vegetation. These early methods involved subjective analyses of species occurrences in sample plots, grouping plots with similar plant associations and attributing a name to that grouping. Modern numerical methods of classification require similar plot data to that used in the Braun-Blanquet method and include species presence/absence or a scaled cover abundance scores. Today, sample plots and numerical analyses form a basis of most modern ecological classifications and underpin many vegetation map unit classifications.

A long debate ensued between the plant sociologist (community) school (Clements 1928, Braun-Blanquet 1932), who maintain that assemblages of species exist in serial and climax stages, and the 'individualist' or 'continuum concept'

school (Gleason 1926 later modified by Whitaker 1962 and others) who question plant community theory and argue that individual species distribution is dictated by environmental determinants and not by association with other species. Austin (1991) and Grossman et al. (1998) summarize this debate. Based on his nodal ordination analysis of 193 vegetation plots in semi-arid vegetation in south-eastern Australia, Noy Meir (1971) suggested that vegetation can be described by using both continuous and discontinuous mathematical models. Recently, there has been some rapprochement between the 'schools' (Austin & Smith 1989, Austin 1991) partly due to the acknowledgment that the community concept has practical advantages in landscape management. Austin (1991) proposes that the community concept is useful for descriptive purposes on a 'regional' basis but less applicable over larger areas.

The concept of fidelity or 'characteristic species' to describe plant communities arose in Switzerland (Gradmann 1909) and was pivotal in the plant community classification methodologies developed by Braun-Blanquet (1932) in the first half of the 20th Century. Subsequently, Goodall (1953) developed an index of fidelity using statistical methods applied to plant species frequency plot data. The issue of setting desired degrees of similarity among vegetation stands to distinguish plant communities is discussed in Mueller-Dombois & Ellenberg (1974) who suggest using a 25–50% index of similarity of shared species occurrences in stands as a rule of thumb to define a 'plant association'. Homogeneity analysis of group associations (Bedward et al. 1992) derived in cluster analyses, such as those described in Faith (1991), can assist with selecting floristic groups in floristic datasets. However, species composition varies from place to place depending on land use history or changes in the environment. It is the degree of species dissimilarity over a geographical range that determines when species assemblages should be considered as separate communities and recorded as such.

Vegetation mapping

Vegetation mapping generally involves aerial photographic interpretation of vegetation structure, major life forms and dominant species patterns. The quality of vegetation mapping is limited by the quality of aerial photographs and the interpretation of them, along with the quality of underpinning data layers such as geology and soils maps. Rarely does vegetation mapping depict all floristic groups derived in numerical analysis of plot data or discerned through expert field observation. Some vegetation map units are more homogeneous than others. This is largely dictated by scale, the methods used in the mapping and the complexity of the vegetation patterns. Benson (1995) describes four different qualities of vegetation mapping based on scale and the quantity and quality of field sampling.

International vegetation classifications

An example of a quantitative data-driven classification includes the past 30 years sampling of the British flora in over 33 000 plots to deliver a National Vegetation Classification of over 400 plant communities (Rodwell 1991, 1992, 1995). This classification, and a qualitative one that preceded it (Ratcliff 1977), have been important for setting conservation priorities in Britain. A European Vegetation Classification (Mucina et al. 1993), involving most European countries, continues to develop using the sampling and plant community concepts of Braun-Blanquet.

Intense plot sampling and numerical classification are conceivable for places such as Europe where there are high numbers of expert botanists and ecologists. In contrast, developing countries in the tropics that contain species-rich ecological communities have few field biologists to undertake intense sampling. The Australian situation lies somewhere between the two. Australia contains over 20 000 vascular plant species, has patchy (in terms of quality and extent) sampling and mapping of its vegetation, and, given the size of the country, has a limited number of expert ecologists to research vegetation.

A pertinent example of vegetation classification relevant to the Australian situation is the United States National Vegetation Classification (USNVC) produced by The Nature Conservancy (Grossman et al. 1998, Anderson et al. 1998). This took a practical approach that combines quantitative and qualitative data to develop a classification across the USA. Where quantitative data was incomplete for a region the USNVC used qualitative assessments arguing that 'qualitative assessments of vegetation across its range can be more robust than quantitative analyses based on incomplete and unrepresentative data sets' (Grossman et al. 1998). Expert plant ecologists from the various US states identified over 4100 'plant associations' within a physiognomic-floristic hierarchical framework of vegetation classification. The USNVC uses physiognomic criteria at the coarsest hierarchical levels while the floristic criteria are used at the finer levels. This classification has been widely adopted by US government agencies as a useful classification of the USA landscapes.

Continental scale vegetation classification and mapping in Australia

Beadle (1981) provides a thorough floristic classification and description of the vegetation in Australia as well as a coarse vegetation map based on the distribution of dominant genera.

A continental scale classification and vegetation map of Australia was developed by Carnahan (1976) updated in AUSLIG (1990). These coarse, 1:5 000 000 million scale

maps, depict present day and pre-European vegetation with the vegetation types coded for their main genera, life form and projective foliage cover.

In an attempt to classify the vegetation of Australia objectively, Specht et al. (1995) analysed floristic plots using the polythetic-divisive program TWINSPAN (Hill 1979), then added or split these groups based on other information. Specht et al. (1995) lists 921 major and minor floristic groups for Australia with some locations shown on small scale maps. Criticisms of this work focus on the relatively low number of floristic plots used in the analysis and the coarseness of some of the classified floristic groups (Hager & Benson 1994).

Sun et al. (1996) describe different vegetation classification and mapping systems in the forest areas of Australia and Bolton (1991) documents mandatory attributes to be recorded when sampling vegetation. The Australian National Vegetation Assessment section of the National Land & Water Resources Audit (2001) broadly classified the vegetation of Australia. It collated various vegetation maps to produce a small scale national vegetation map with basic descriptions of the map units. The National Vegetation Information System (NVIS), which arose from the vegetation theme in the Audit (National Land & Water Resources Audit 2001), is a more detailed project aimed at classifying Australian vegetation at a fine scale of resolution, i.e. to the plant association level where possible. However, this approach has encountered difficulties in comparing classifications across State boundaries and too little sample data is available for several parts of Australia to meet its definitional requirements. NVIS combines floristic and structural parameters to describe all various layers of a vegetation type.

Australian State and Territory vegetation classifications and mapping

Since the 1950s Australian States and Territories have classified and mapped their vegetation at various scales. Examples include: Beard & Webb (1974) 1:250 000 scale vegetation mapping of Western Australia, Kirkpatrick & Dickinson (1984) vegetation map of Tasmania (finer scale maps and classifications have since been produced for Tasmania) and a series of maps covering South Australia such as Forward & Robinson 1996 and Playfair & Robinson (1997). Most of Queensland has now been mapped at either 1:100 000 or 1:250 000 scale (Wilson et al. 2002). In Victoria, Ecological Vegetation Classes (EVCs) are mapped at 1:100 000 scale across the State (Victorian DNR 2001). Additionally, numerous regional and local scale vegetation maps have been produced in each state or territory.

An unfortunate feature of State-based vegetation survey and mapping projects is that they ignore similar work in adjoining States. Therefore, there are major inconsistencies in vegetation (or ecological) community classification across the State and Territory boundaries in Australia.

In terms of conservation assessment, Davies (1982) assessed the South Australian plant communities. Kirkpatrick et al. (1995) assessed plant communities in Tasmania. In Queensland, Sattler & Williams (1999) described and assessed the threat status of about 1100 regional ecosystems. The Queensland regional ecosystems are regularly updated on the web site: http://epa.qld.gov.au/nature_conservation/biodiversity/regional-ecosystems).

Table 2. Area of the four sections of NSW in which the vegetation of NSW is proposed to be classified and assessed.

Sections of NSW	Hectares	% NSW
Western plains	45,756,718	57.1%
Western Slopes	15,473,443	19.3%
Tablelands	8,178,110	10.2%
Coast and Escarpment	10,618,319	13.2%

Vegetation mapping and classification in NSW

The history of vegetation mapping and survey in NSW is reviewed in Benson (1999) and Keith (2004). Beadle (1945) produced a broad scale vegetation map of the western half of NSW, one of the first vegetation maps produced in Australia. Subsequently, Beadle (1948) described the pastures, soils and soil erosion of western NSW. Costin (1954) mapped the Monaro section of the Southern Tablelands and later co-authored a classification and map of the alpine vegetation in Kosciuszko National Park (Costin et al. 1979). Moore (1953) mapped part of the South Western and Central Western Slopes. These early, studies were followed by further regional mapping such as Biddiscombe (1963) covering the Macquarie River region of central NSW. The first attempt to produce a vegetation map covering all of NSW was a compilation map by Hayden (1971) but this was incomplete and very coarse in its scale.

In response to a growing awareness of ecology and environmental issues, the Royal Botanic Gardens and Domain Trust, Sydney (RBG) instigated a vegetation survey and mapping program in 1972. The RBG mapped most of the Sydney Basin Bioregion and published eight 1:100 000 map sheets for this area between 1986 and 1996 (eg Keith & Benson 1988, Benson 1992). It mapped the south-western section of NSW at 1:250 000 scale in four publications between 1991 and 1997 (Fox 1991, Scott 1992, Porteners 1993 and Porteners et al. 1997) and published a 1:1 million map of the north-west quarter of NSW (Pickard & Norris 1994). The RBG initiated a fine scale (1:25 000 published at 1:100 000) mapping of the Northern Tablelands (Benson & Ashby 2000). The RBG also completed a number of fine scale maps of conservation reserves. The RBG web site http://www.rbgsyd.nsw.gov.au/publications/cunninghamia includes a list of vegetation maps and surveys published in this journal.

Over the last 25 years, the NSW National Parks and Wildlife Service mapped the vegetation in many of its conservation reserves at fine scales of resolution. These maps sample vegetation types in locations across the State. From 1985 to 2000 the NSW NPWS mapped the remnant vegetation of about two thirds of the NSW wheat belt in the Central Division of NSW (Sivertsen & Metcalfe 1995, Metcalfe et al. 2003) as well as financing botanical surveys, mapping and classifications of broad vegetation types. Examples include the 1976–1990 survey and classification of rainforest vegetation of NSW (Floyd 1990) and the classification and mapping of the coastal heaths on the NSW north coast (Griffith et al. 2003).

Benson (1989) published a list of 430 plant communities in NSW and assigned reservation and threat codes to each community, however, this contained little detail about each community. Using available mapping information, Hager & Benson (1994) classified and assessed the status of forest communities in north-eastern NSW.

During the 1990s, the NSW NPWS initiated biological surveys and modelling of forest ecosystems as part of comprehensive regional assessments (CRA) of the forests in NSW. CRAs provide a basis for decisions on forest allocation to conservation or to timber production. Forests mainly occur in the wetter, eastern third of the State, however the last CRA covered the Brigalow Belt South Bioregion on the northern inland slopes and plains of NSW (RACAC 2004). These CRA projects have delivered a large volume of flora site data that have been used for modelling vegetation, for example, the vegetation of the Southern Forests by Gellie (2005).

In response to needs for regional vegetation planning under the NSW Native Vegetation Conservation Act 1998, the NSW Native Vegetation Mapping Program (NSWVMP) was initiated in 2000 and has surveyed and mapped approximately forty 1:100 000 map sheet areas. The inland areas cover parts of Hay Plain in the Riverina Bioregion, the eastern fringe of the Cobar Peneplain Bioregion and adjoining north-western parts of the NSW South-western Slopes Bioregion, parts of the Brigalow Belt South and Nandewar Bioregions, and the coastal and tablelands south of Sydney to Nowra in the Sydney Basin and NSW South Eastern Highlands Bioregions. Vegetation was sampled in thousands of plots (for example, Cannon et al. 2002, Horner et al. 2002, Lewer et al. 2002). However, the NSWNVMP program was curtailed in 2004 when there was a switch of emphasis to property planning and most of the vegetation maps have not been published.

Regional and fine scale vegetation mapping in NSW remains patchy and there is no ongoing program to fill the data gaps. Some parts of NSW contain no vegetation mapping or plot data. In other parts very detailed data exists. As of 2006, not one of the 18 IBRA Bioregions or 13 Catchment Management Authority areas had the native vegetation over its total area adequately field sampled or mapped at a reasonable scale. The coastal Sydney Basin Bioregion is the closest to having attained this goal.

To meet State and continental-scale environmental reporting, Keith (2004) compiled a 1:1 500 000 scale compilation vegetation map of NSW and developed this into a book that describes 99 'vegetation classes' in 12 'vegetation formations'. The NSWVCA plant communities are correlated to the Keith (2004) 'vegetation classes' in the NSWVCA database (described below) and a database report option can list plant communities for any of the Keith (2004) 99 vegetation classes.

Methods

The NSWVCA includes several inter-related stands of work:

- A classification of the vegetation of NSW including listing characteristic species for each plant community;
- An assessment of available data of each listed plant community such as pre-European and current extent, distribution in various regions, physiographic attributes and other details;
- Defining the protected areas in NSW, determining occurrences of communities in these areas and assessing the protected area status of each community;
- Assessment of the threat status of each plant community using definitions of threat categories and threat criteria;
- The construction of a database on which to store a range of information about each classified plant community that also relates the plant communities to other ecological classifications;
- Development of a number of standard reports in the database that list plant communities for regions used in land use planning in NSW or for commonly used broad vegetation classifications.

Classifying the plant communities

The NSWVCA is developing a vegetation classification derived from compilation and critical evaluation of existing information complemented by expert opinion and rapid field checking. The patchiness of vegetation data across NSW prevents a purely numerical classification. The approach is flexible depending on data availability. In Western NSW there is very little plot data or fine scale vegetation mapping so the classification requires a considerable degree of expert judgment. In the eastern quarter of NSW (Coast and Tableland Sections), there is considerable plot data and fine-scale vegetation mapping that could form a basis of quantitative assessment for the classification. The author does not have the resources to singly-handedly gap-fill survey plot data or vegetation mapping across the whole of NSW. The following methods are being employed:

1. Thoroughly review the published and unpublished literature including vegetation maps, vegetation

descriptions and selected plot data. Most of the literature in NSW on vegetation is held by government agencies. Some information is published. Much of the most useful information is unpublished including vegetation maps in Geographical Information System (GIS) format;

2. Interrogate vegetation map GIS files using ArcView version 3.3 (ESRI Inc. 1992–2002) software or later versions. Tables are produced on the extent of the vegetation map units from all the vegetation maps including those covering protected areas;

3. Assemble plot data for the region being studied. Analyses may or may not be undertaken depending on time. Existing analyses and descriptions are given priority for use in the classification;

4. Relate different datasets to each other through field checking, comparing botanical lists, plot data records or by comparing vegetation map unit descriptions. This mainly involves cross-comparisons of dominant or otherwise characteristic plant species, vegetation structure, soil types and geographical location;

5. If an area has been well surveyed and/or mapped for its vegetation, priority is given to using vegetation units described in such work. There are perhaps 30 000 floristic sample plots recorded on various databases in NSW (author's estimate). Parts of eastern NSW contain large amounts of vegetation plot and map data but there are gaps, particularly on private land. Furthermore, even in relatively well sampled regions, expert judgment is required to compare adjoining or overlapping vegetation datasets in order to derive a state-wide classification. Sample plot data and fine-scale vegetation mapping are non-existent or incomplete for large sections of the tablelands, western slopes and western plains of NSW. In these regions, broad-scale vegetation maps, plant community descriptions in reports or notes taken during field checks are key sources for describing plant communities;

6. Derive an initial plant community classification for a section of the State based on dominant and otherwise characteristic plant species;

7. Enlist the assistance of field botanists and ecologists who are experts on the vegetation of particular regions to critique the initial classification;

8. Check the plant communities in the field (see below);

9. Based on the notes taken during the field traverses and the expert critique, revise the initial classification for final documentation.

The 'Authorities' field in the NSWVCA database lists the main references used to define a community and the relationship between map units and the community. This should assist with future revisions of the classification by other researchers. Other information sources are cited in other fields in the database.

Field checking

Rapid vehicular field traverses are used to check the plant community classification including occurrences in protected areas. The sample points in the traverses are selected from vegetation maps or descriptions, areas containing floristic groups in reports, or, in cases where no data exists, by traversing major environmental gradients to sample the vegetation. At the time of writing there had been six field trips covering the NSW Western Plains and part of the of NSW Western Slopes. Over 500 hundred site assessments had been made over 18 000 km of field traverse. At each stop, dominant plant species are recorded or collected, threatening processes such as weeds are noted and notes are taken on soil, substrate and landscape features. Photographs are taken and a GPS latitude and longitude reading is recorded. This field information is important in verifying past work but also in gap-filling where data is poor. In some cases, plant communities are described using the information gathered during these surveys.

Listing characteristic species

Vegetation descriptions, plot data, expert knowledge of species composition of vegetation types, along with field checking, contribute to the listing of characteristic plant species in three vegetation layers. These layers are defined by life-form: trees (including mallee trees and emergent trees); shrubs (>0.5 m high), woody vines, epiphytes; and groundcover that includes all herbaceous vegetation and shrubs less than 0.5 m high.

It was deemed too cumbersome for a state-wide floristic classification to incorporate database fields to cater for the full range of potential vegetation strata i.e. emergent, tallest, several mid-layers and ground. In this sense the current database is similar to NVIS level 5 (NLWRA 2001, ESCAVI 2003) in its classification details.

A characteristic species is either common in one or more strata of the vegetation, or has high fidelity to a particular type of vegetation as determined in numerical analyses of plot data or through recorded observation. Common species are deemed to be those that occur at >40% of sample sites in a defined plant community. They should also be numerous at a site or contain consistent high cover classes in plot data recordings or observations. High fidelity species can be selected from survey plot data using the approach of Westhoff & van de Maarel (1980). For example, Benson & Ashby (2000) set a fidelity minimum of 0.8 for selecting high fidelity species in plant communities in the Guyra region on the Northern Tablelands of NSW.

Up to four of the most dominant or indicative plant species in the three layers are used to define the 'Scientific Name' of a plant community. The database's search function allows for a search and listing of plant communities with a specified species name in its Scientific Name.

Photography

During field traverses colour transparencies (slides) and digital photographs are taken of as many plant communities as possible, if possible over their range. Where the Botanic Gardens Trust is unable to take photographs of a plant community, images are obtained from other sources.

Images selected for the photographic archive are labelled and filed. The labelling includes plant community number (ID), list of main plant species photographed, location, latitude, longitude, date and photographer's name. A select number of these images are maintained at high and low resolutions. High resolution images are stored on DVDs. Low resolution (72 DPI) jpg images are linked to the NSWVCA database and stored on the Botanic Gardens Trust computer file server and on backup CDs. These can be viewed in the NSWVCA database in the Main Table Form (the main data entry form), via MS Internet Explorer, by selecting the Photo 1, Photo 2 or Photo 3 keys.

Relationship of the classification with vegetation maps

Some of the listed communities in the database will have a direct correlation to map units in various vegetation maps. However, many will not, either because the map unit is too heterogeneous and therefore has been sub-divided to reflect more homogenous floristic groups, or the plant community occurs in small areas or linear strips (such as along watercourses) that have not been mapped. In some cases, floristic groups derived and described from analyses of plot data are adopted as a plant community even though these groups are often not mapped in vegetation maps. It is likely that the NSWVCA classification will influence future vegetation map unit descriptions for areas that the NSWVCA covers but where mapping is absent or of poor quality.

Relationship of NSWVCA to other landscape classifications

The NSWVCA database contains fields that allow each plant community to be cross-referenced to other NSW or national vegetation and abiotic classifications. Database fields include:

- 'Forest Type RN 17' that lists the 235 forest types described in Research Note 17 published by the Forestry Commission of NSW (1989). Rarely does a plant community equate with a forest type so there is an option of selecting the qualifier 'part of a forest type';
- 'State Vegetation Map' that lists 99 vegetation classes depicted on a 1:1 500 000 compilation vegetation map covering NSW in Keith (2004);
- NVIS that lists 28 major vegetation groups and 56 major vegetation sub-groups (version 3, 2005) used by the Australian Government (ESCAVI 2003) in a broad classification of the vegetation of Australia;
- 'State Landscapes' that lists about 500 landscapes classified from abiotic layers of land systems, soil and geology in Mitchell (2002).

Interstate comparisons

The NSWVCA database contains a field titled 'Interstate Equivalent' that facilitates documentation of vegetation map units or plant communities described in other Australian States and Territories that appear similar to the plant communities in the NSWVCA. While inter-jurisdictional comparisons can be difficult, it can be done if there are reasonable descriptions of vegetation and/or lists of dominant or characteristic plant species. For example, the classification of the Vegetation of the Western Plains of NSW (see Benson et al. 2006, this volume) compares the NSWVCA communities with map units in South Australia described in Forward & Robinson (1996), Playfair & Robinson (1997), Foulkes & Gillen (2000) and Davies (1982); in Queensland the key reference is the ecosystem classification in Sattler & Williams (1999); and Victoria, comparisons are made with ecological vegetation classes (Victorian Department of Natural Resources 2001) and vegetation descriptions in other regional studies.

Derived or expanded plant communities

A number of plant communities listed in the NSWVCA have a larger estimated current extent compared to their estimated pre-European extent. These are judged to be 'derived' or 'expanded' plant communities. Deciding on whether a plant community is 'derived' is not easy because most plant communities across Australian and NSW have been substantially altered since European settlement. Also, there is no way of proving a community now considered to be 'derived' did not exist at the time of European settlement – perhaps in smaller patches or even in different locations than at present. However, if evidence or expert opinion suggests that plant communities are grossly modified in their structure and floristic composition they will be recorded as derived native vegetation. Setting a date from which a community can be judged as being derived would vary throughout the world. In Australia it is appropriate to use 1788, the time of European settlement.

Derived vegetation contains biodiversity and landscape values. An example of derived vegetation in NSW includes native grasslands derived from previously treed or shrub-dominated landscapes where the trees and shrubs have been cleared or grazed out. Other examples include shrublands or grasslands that have been derived from previous shrublands that were dominated by different species. For example, large areas of the inland south-western plains of NSW were once dominated by perennial saltbushes (*Atriplex* spp.) that have disappeared due to grazing and dieback.

Derived native vegetation is classed as 'native vegetation' under Section 6 of the NSW Native Vegetation Act 2003

wherein native vegetation is defined as being indigenous trees, understorey plants, ground cover and plants in a wetland. Section 20 of the Act stipulates that a native ground cover is one that contains greater than 50% indigenous species.

NSWVCA Hierarchy

The NSWVCA contains five hierarchical levels (Table 3) modified from the floristic — physiognomic approaches to vegetation classification in Beadle & Costin (1952) and sections IV to VI in the National Vegetation Information System (National Land and Water Resources Audit 2001, ESCAVI 2003). The hierarchy is similar to some levels in *The Terrestrial Vegetation of the United States* (Grossman et al. 1998). The NSWVCA hierarchies use combinations of vegetation structure, dominant life form, floristic composition and physiographic features to classify vegetation.

Structural class:

Vegetation structure is recorded in the 'structure' field in the NSWVCA database by selecting options from tables containing the structural classes in Walker & Hopkins (1990). These combine dominant growth-form, crown density and height of the tallest stratum. The growth forms are tree, tree mallee, shrub, mallee shrub, heath shrub, chenopod shrub, tussock grass, hummock grass, sod grass, sedge, rush, forb, fern, moss and vine. Wetlands are generally covered by sedgeland, forbland or rushland but may also include trees and shrubs. The height classes terms extremely tall, very tall, tall, mid-high, low and dwarf apply to different height thresholds depending on the growth-form (Walker & Hopkins 1990). For example, an 'extremely tall' tree is >35 m high, while an 'extremely tall' tussock grass is 3–6 m high. More than one density or height class can be recorded for each plant community because they may vary through successional or regrowth stages after natural or human-induced disturbance. If a plant community is deemed to be rainforest, the same structural formation code is recorded as for non-rainforest vegetation but additional codes are also added. These are based on the Australian rainforest physiognomic/structural classification of Webb (1968). They codify attributes of rainforest structure describing its complexity as being simple, simple-complex or complex; recording its leaf size based on average leaf size of canopy trees exposed to sunlight; recording indicator growth forms such as moss, fern, fan palm, feather palm, vine or none; and recording presence of emergents and whether they are sclerophyllous or rainforest species.

Formation Group:

These are coarse level floristic/ecological groupings of plant communities. The Formation Groups are modified from the major groups of plant communities described in *The Vegetation of Australia* by Beadle (1981). Beadle understood variation in vegetation across Australia and applied an understanding of ecological processes, soil and substrate in describing vegetation units. Over 60 Formation Groups are listed for NSW in the NSWVCA (Table 4). The classified plant communities can be listed from the database under any of these Groups. The standard reports from the database, described in Appendix A, list plant communities

Table 3: Summary of the NSW vegetation classification and assessment hierarchy

Hierarchical level	Main features for classification	Example(s)	Key references
Structural Class	Height and crown density of highest stratum and dominant life-form of major stratum.	Tall Closed Forest, Mid-high Open Woodland, Low Sedgeland, Very Tall Grassland	Walker & Hopkins (1990), Specht (1970), Beadle & Costin (1952)
Formation Group	Broad grouping of plant communities by dominant genera and environmental factors including climate, hydrology, soil type, landforms and distribution	Acacia shrublands of the inland slopes and plains	Beadle (1981) with Baur (1957) and Floyd (1990) used to define major rainforest groups.
Sub-formation	Grouping of communities with dominant/diagnostic species usually in the upper-most stratum	ID119 Sandplain Mulga	Analogous to 'Alliance' in Beadle & Costin (1952) and Beadle (1981). Similar to sub-formation in NVIS (NLWRA 2001).
Association	Dominant/diagnostic species from any strata	ID27 Yarran shrubland on peneplains and alluvial plains of central-northern NSW	Analogous to 'Association' in Beadle & Costin (1952) and association in NVIS (NLWRA 2001).
Sub-association	Variation of dominant/diagnostic species from subordinate strata in an Association	ID220 Purple Wood wattle shrubland of the arid zone sandplains	Analogous to 'Sub-association' in Beadle & Costin (1952) and sub-association in NVIS (NLWRA 2001).

in alphabetical order of the Formation Groups so that similar plant communities are bundled in the reports.

The Formation Groups are more complex than the 20 or so broad vegetation types used to describe Australian vegetation in Groves (1994) but similar in concept to the vegetation classes mapped and described for NSW in Keith (2004) – see the comparisons in Table 4. Some of Keith's (2004) vegetation class names are based on NSW geography (for example 'North-west Alluvial Sand Woodlands') whereas most of the Formation Groups used in the NSWVCA have generic names based on dominant genera or landscape types that can apply to any part of Australia.

The three finer hierarchical levels in the NSWVCA are generically labeled 'plant communities' for the purposes of describing the vegetation. The definitions of these three levels of classification are analogous to those used to define alliances, associations and sub-association in Beadle & Costin (1952) and reflect the national classification definitions used in the National Vegetation Information System (NLWRA 2001). The definitions are:

Sub-formation:

A group of floristically related associations of similar structure (*alliance* in Beadle & Costin 1952), or, a community with shared dominant growth form, cover, height and broad floristic code usually dominant Genus and Family for the three traditional strata (upper, mid and ground) (NLWRA 2001).

Association:

A community of which the dominant stratum has a qualitatively uniform floristic composition and which exhibits a uniform structure (*association* Beadle & Costin 1952), or, a community with shared dominant growth, height, cover and species (3 species) for the three traditional strata (upper, mid and ground) (NLWRA 2001).

Sub-association:

A sub-division of an 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), or, a community with shared dominant growth form, height, cover and species (5 species) for all layers/strata (NLWRA 2001);

Assigning a plant community to a level of classification is done subjectively, although objective rules could be made if sufficient floristic data were available. The reasons for selecting a particular classification level can be entered in the Authority field of the NSWVCA database. Allocation takes into account the overall species variation in all strata of a mapped or described plant community. Variation in species composition is documented through field-checking, judgment from the literature and/or from expert advice. If a recorded plant community contains a high degree of floristic consistency across its range, in all of its strata, it will be listed as an association. If a community contains significant species variation, often over a large geographical area, it will be assigned as a sub-formation. A number of communities in western NSW described in Benson et al. (2006) have been assigned as sub-formations due to the scarcity of floristic data or fine scale vegetation mapping that could form the basis of a finer level of classification. It is anticipated that plant communities listed as sub-formations will be sub-divided in the future with improved plot data and/or vegetation mapping.

Parameters of the NSWVCA

The NSWVCA is based on existing native and semi-native vegetation dominated by indigenous plant species that persist without regular human intervention or maintenance. This includes shallow freshwater and saline wetlands containing rooted or floating plants and communities in the littoral zone and shallow marine environments including seagrass beds. Deep marine flora are excluded at this stage but could be added in the future. The classification excludes highly altered vegetation such as croplands or highly modified pastures where natural woody canopy species and most natural ground species have been removed. It concentrates on listing late successional stages of vegetation but post-disturbance, early successional stages can be described in the 'variation and natural disturbances' field in the database.

The NSWVCA uses a floristic approach to classifying plant communities but records vegetation structural classes and abiotic features for each plant community. While species occur as continuums in environmental space and time, it is considered that species distribution overlaps, within regions, can be described or mapped. Most communities classified in the NSWVCA should be able to be mapped at scales of 1:100 000 for the western plains, 1: 50 000 for the western slopes and tablelands and 1: 25,000 for the geographically and geologically complex coast.

The NSWVCA also lists floristically distinct plant communities that occur in small patches or in linear strips that are often overlooked in regional scale vegetation mapping. These include seepage zones wetlands such mound springs, stream-side vegetation and distinct vegetation types that occur in small patches mosaics and are often mapped as complexes with other communities.

If information is available, the classification describes seasonal floristic variations. This is particularly relevant in the low rainfall regions of inland NSW where many ground species are ephemeral and only appear after rain.

All citations used to describe any aspect of a plant community are referenced in each record and produced in full in the 'Reference' field of the database. The plant species

Table 4. Formation Groups used in the NSWVCA that are based on the major groupings in Beadle (1981) compared to the NSW Map Unit Vegetation Classes in Keith (2004). Notes: DSF = Dry Sclerophyll Forests, WSF = Wet Sclerophyll Forests

Formation Groups in NSWVCA	Aeron.	Equivalent Vegetation Classes in Keith (2004)
Acacia Forests and Shrublands of the East Coast and Tablelands	AST	Southern Wattle DSF; Northern Gorge DSF
Acacia Woodlands and Shrublands of the Inland Slopes and Plains	ASI	Riverine Plain Woodlands; Brigalow Clay Plain Woodlands; North-west Plain Shrublands; Gibber Transitional Shrublands; Stony Desert Mulga Shrublands; Sand Plain Mulga Shrublands
Alpine Bogs and Fens	ABF	Alpine Bogs and Fens
Alpine Fjaeldmarks	AF	Alpine Fjaeldmarks
Alpine Heaths and Shrublands	AHS	Alpine Heaths
Alpine Herbfields	AHG	Alpine Herbfields
Casuarina Woodlands of the Inland Slopes and Plains	CCI	Riverine Sandhill Woodlands; Semi-arid Sand Plain Woodlands
Chenopod (Halophytie) Shrublands of the Inland	CHS	Riverine Chenopod Shrublands; Aeolian Chenopod Shrublands; Gibber Chenopod Shrublands
Coastal Cliff Communities	CCC	Maritime Grasslands
Coastal Sand Dune Grasslands, Forblands and Shrublands	CSD	Maritime Grasslands; Wallum Sand Heaths
Cypress Pine (*Callitris*) Woodlands Mainly of the Inland Slopes and Plains	CPW	North-west Alluvial Sand Woodlands; Riverine Sandhill Woodlands; Inland Rocky Hill Woodlands
Ephemeral Grasslands in Semi-arid or Arid Regions	EGA	Gibber Chenopod Shrublands; Sand Plain Mulga Shrublands
Eremophila, *Melaleuca* and *Dodonaea* Shrublands of the Inland	EMDI	North-west Plain Shrublands
Eucalyptus Box Woodlands of the East Coast Valleys	EBWC	Clarence DSF; Hunter-Maeleay DSF; Cumberland DSF; Southern Hinterland DSF; Northern Gorge DSF; Central Gorge DSF
Eucalyptus Box (Mostly Grassy) Woodlands of the Inland Plains	EBWP	Floodplain Transition Woodlands; Riverine Sandhill Woodlands; Inland Rocky Hill Woodlands; Western Peneplain Woodlands
Eucalyptus Box Woodlands of the Tablelands and Western Slopes	EBWT	New England Grassy Woodlands; Tableland Clay Grassy Woodlands; Southern Tableland Grassy Woodlands; Western Slopes Grassy Woodlands; Upper Riverina DSF; Pilliga Outwash DSF
Eucalyptus (Grassy or Shrubby) Woodlands and Forests on Low Fertility Soils on the East Coast	EWLFSC	Clarence DSF; Hunter-Maeleay DSF; Northern Gorge DSF; Southern Hinterland DSF; Coastal Dune DSF; North Coast DSF; Sydney Coastal DSF; Sydney Hinterland DSF; Sydney Sand Flats DSF; South Coast Sands DSF; South East DSF
Eucalyptus (Grassy or Shrubby) Woodlands and Forests on Low Fertility Soils on the Eastern Tablelands	EWLFST	New England DSF; Northern Escarpment DSF; Sydney Montane DSF; Northern Tableland DSF; Southern Tableland DSF
Eucalyptus (Grassy or Shrubby) Woodlands and Forests on Low Fertility Soils on the Western Slopes	ESWWS	North-west Slopes DSF; Upper Riverina DSF; Pilliga Outwash DSF; Western Slopes DSF; Yetman DSF
Eucalyptus Communities of Inland Watercourses and Inner Floodplains	EIW	Inland Riverine Forests; Inland Floodplain Woodlands; North-west Floodplain Woodlands
Eucalyptus / *Corymbia* Woodlands of the Tropics	EWT	North-west Alluvial Sand Woodlands; Desert Woodlands
Eucalyptus Ironbark Forests of the East Coast and Tablelands	EIFC	Clarence DSF; Hunter-Maeleay DSF; Cumberland DSF
Eucalyptus Ironbark Woodlands and Forests of the Inland Slopes, Plains and Peneplains	EIWI	Inland Rocky Hill Woodlands; Subtropical Semi-arid Woodlands
Eucalyptus Subalpine Woodlands and Forests	ESAW	Tableland Clay Grassy Woodlands; Subalpine Woodlands
Eucalyptus Swamp Communities of the Eastern Coast and Tablelands	ESCT	Coastal Swamp Forests;
Eucalyptus Tall Dry Shrub Forests and Woodlands of the Eastern Coastal Lowlands on Soils of Higher Fertility	TDSFEC	Clarence DSF; Hunter-Maeleay DSF; Cumberland DSF; Central Gorge DSF
Eucalyptus Tall Grassy Forests or Woodlands of the Eastern Coastal Lowlands on Soils of Higher Fertility	TGFEC	Coastal Valley Grassy Woodlands
Eucalyptus Tall Wet Shrub Forests of the Eastern Coastal Lowlands on Soils of Higher Fertility	TWFEC	North Coast WSF; South Coast WSF; Northern Escarpment WSF; Southern Escarpment WSF; Northern Hinterland WSF; Southern Lowland WSF

Formation Groups in NSWVCA	Acron.	Equivalent Vegetation Classes in Keith (2004)
Eucalyptus Wet Forests of the Eastern Tablelands	ECT	Northern Tableland WSF; Southern Tableland WSF; Montane WSF
Eucalyptus Woodlands on Rocky Hills of the Inland	EWRHI	Inland Rocky Hill Woodlands
Freshwater Wetlands: Aquatic communities of Coastal Lakes, Lagoons and Rivers	FWACL	Coastal Freshwater Lagoons
Freshwater Wetlands: Coastal Swamp Forests and Shrublands	FWECSF	Coastal Swamp Forests; Coastal Floodplain Wetlands
Freshwater Wetlands: East Coast and Tablelands Sedgeland Swamps	FWSS	Coastal Heath Swamps
Freshwater Wetlands: Inland Aquatic, Swamp and Shrubland Communities	FWI	Inland Floodplain Swamps; Inland Floodplain Shrublands
Freshwater Wetlands: Montane and Alpine Freshwater Lakes	FWMAL	Montane Lakes
Freshwater Wetlands: Montane Bogs and Fens	FWMB	Montane Bogs and Fens
Grasslands of Freshwater Aquatic Habitats of Periodically Flooded Soils	GFAPF	Semi-arid Floodplain Grasslands
Grasslands of Montane Regions often Dominated by *Poa*	GTM	Temperate Montane Grasslands
Grasslands on Coastal Headlands	GLZH	Maritime Grasslands,
Grasslands on Fine Texture Soils on the Inland Slopes and Plains	GFTI	Western Slopes Grasslands; Riverine Plain Grasslands; Semi-arid Floodplain Grasslands
Heaths and Shrublands on Coastal Headlands	HSCH	Coastal Headland Heaths
Heaths and Shrublands on Coastal Sands	HSCS	Wallum Sand Heaths; South Coast Heaths
Heaths on Siliceous Outcrops on the Tablelands and Western Slopes of South-eastern Australia	HSOT	Northern Montane Heaths; Southern Montane Heaths
Heaths on the Triassic Sandstones of Central-eastern New South Wales	HSOI	Sydney Coastal Heaths; Sydney Montane Heaths
Hummock Grasslands and Woodlands of the Inland Plains and Peneplains	HGI	Subtropical Semi-arid Woodlands; Dune Mallee Woodlands; Sand Plain Mulga Shrublands
Mallee Heaths and Shrublands of the East Coast and Tablelands	EMCT	Southern Hinterland DSF; Central Gorge DSF; New England DSF; North Coast DSF; Sydney Coastal DSF; Sydney Hinterland DSF; South East DSF; Sydney Montane DSF
Mallee Woodlands and Shrublands of Inland Sandplains and Sand Dunes	MWSI	Dune Mallee Woodlands; Sandplain Mallee Woodlands
Mallee Woodlands and Shrublands on Stony Ridges of the Inland	MWSR	Inland Rocky Hill Woodlands Slopes and Plains
Rainforest: Cool Temperate	RCT	Cool Temperate Rainforest
Rainforest: Dry	RD	Dry Rainforests
Rainforest: Gallery	RG	Subtropical Rainforest
Rainforest: Littoral	RL	Littoral Rainforest
Rainforest: Oceanic Islands	RO	Oceanic Cloud Forests, Oceanic Rainforests
Rainforest: Semi-Evergreen Vine Forests and Ooline	RSEVT	Western Vine Thickets
Rainforest: Sub-tropical	RST	Subtropical Rainforest
Rainforest: Warm Temperate	RWT	Northern and Southern Warm Temperate Rainforests
Rainforest-derived Genera Woodlands and Shrublands of the Inland Slopes and Plains	RDGI	Gibber Transitional Shrublands; North-west Plain Shrublands; Semi-arid Sand Plain Woodlands
Riparian Forests and Shrublands of the Eastern Coast and Tablelands (non-rainforest)	RIFEC	Eastern Riverine Forests
Saline Wetlands: Coastal Brackish Lakes	SWCBL	Coastal Freshwater Lagoons; Seagrass Meadows
Saline Wetlands: Coastal Salt-marsh	SWSM	Saltmarsh
Saline Wetlands: Mangrove Mudflats	SWM	Mangrove Swamps
Saline Wetlands: Saline and Clay Lakes (Playas) of the Inland	SWISL	Inland Saline Lakes
Saline Wetlands: Seagrass Meadows	SWSG	Seagrass Meadows

names listed in the characteristic fields or elsewhere in the database use the nomenclature of the *Flora of New South Wales* (Harden 1991–1993) and the Botanic Gardens Trust Sydney *Online Flora* http:www.rbgsyd.nsw.gov.au/search_plant_net.

Estimating pre-European and current extent

Pre-European extent and current extent estimates are recorded for each plant community. These assist with determining the loss of extent, threat status and protected area status of each community. The estimates are based on the best available data including pre-European and current extent vegetation maps, modeled vegetation maps, descriptions in the literature and expert advice. An estimate of a pre-European extent can be derived by extrapolating current extent to cleared areas by using abiotic information such as soil, geology or land system maps along with field checking (the term 'pre-European extent' is preferred to using the alternative term 'pre-clearing' because European settlement has impacted in many ways on native vegetation – not just through clearing).

Current extent does not include significantly altered areas where the vegetation is now dominated by exotic species. So, for example, areas of a woodland that have lost their native ground cover and are now dominated (>50% cover) by exotic species, would not be included in estimates of the woodland's current extent. However, the fact that scattered trees persist in landscapes would be noted in the current extent comments field in the database because such trees may be important to elements of biodiversity and for vegetation restoration.

Explanation and qualification fields in the database list the main means used to determine the pre-European, current and protected area extent estimates.

Confidence limits

Accuracy levels are attached to pre-European extent, current extent and extent in protected areas. 10% accuracy implies that a relatively reliable source of information was used to derive an extent figure, while a 50% accuracy level implies the source information was of medium quality. The remaining extent statistic is the percentage of the current extent over the pre-European extent. An accuracy estimate for the remaining extent percentage is calculated as the mid-range of the accuracy levels of the pre-European and current extent figures. This results in a conservative accuracy qualification on remaining extent. Data entries on plant community extent and their accuracy estimates are detailed in the database field descriptions in Appendix A. Improved survey and vegetation mapping would improve the accuracy levels for the extent estimates for most plant communities.

Edaphic and physiographic data

The database contains fields that record substrate mass, lithology, Australian Great Soil Groups (Stace et al. 1968), landforms patterns and landform elements (see Appendix A for details). The classifications used in these fields are based on the Australian Field Soil and Land Survey Handbook (McDonald et al. 1990). This handbook is widely used by Australian vegetation, soil and landform field surveyors. Recording these features for each plant community allows queries to be made in the NSWVCA database about physiographic factors and plant communities. For example, it is possible to list all communities with a certain soil type that occurs in a certain landform pattern etc.

Vegetation condition

The average condition of a plant community can be gleaned by examining various information fields in the classification including the list of threatening processes, the weediness index, the fragmentation category and the recoverability category. Appendix A defines each of these variables.

A recoverability level is selected based on an expert judgment about the average condition of a plant community across its range compared to its estimated composition and structure prior to European settlement (1788). Recoverability ranks from 1 (near pristine) to 6 (destroyed) using the scheme developed by McDonald (1996). In most communities condition varies from place to place due to variations in past land uses. Therefore, this assessment is not meant to apply to individual sites but rather to be an average grading over the distribution of a plant community. Some highly degraded communities may be able to recover condition if certain processes are changed, for example, the recovery of a wetland with the provision of water or the recovery of native grassland after excessive grazing is removed. Other communities may not be able to recover quickly, for example where most topsoil has been lost or where key perennial plant species are slow to regenerate or re-colonize sites.

Assessing the protected area status of plant communities

Defining protected areas in NSW

A protected area is defined by the World Conservation Union (IUCN) as '*an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means*' (IUCN 1994). The definition covers areas where biodiversity conservation is the principal purpose of land management and where there

is long-term security for conservation. The JANIS (1997) criteria for forest protection in Australia provide guidance for interpreting the IUCN (1994) term 'legal and effective means' of protection. The Australian Natural Resource Management Ministerial Council (2004) discusses future directions for the Australian national reserve system and the issue of the security of private property agreements.

IUCN (1994) provides that protected areas can be allocated a management category that is defined by the management emphasis (IUCN 1994). The categories are:

I Strict natural reserve / wilderness area
II National park
III Natural monument
IV Habitat / species management area
V Protected landscape / seascape
IV Managed resource protected area

The management category is independent of any formal reserve classification. For example, while most NSW National Parks are Category II, some reserves match IUCN categories I, III, IV or V. A national list of conservation reserves with their agreed IUCN category is maintained on the Collaborative Australian Protected Area Database (CAPAD) by the Commonwealth Department of Environment and Heritage available through the web site: http://deh.gov.au/parks/nrs/capad/index.html.

There are three main types of protected areas in NSW:

1. Secure public conservation reserves that are dedicated over public land and are managed primarily to protect biodiversity and natural features under plans of management;

2. Secure property agreements over private or public land that are not owned by government conservation agencies but where a long term caveat is tied to the title of the land and the area is being managed primarily to protect biodiversity;

3. Private conservation reserves where areas of land have been purchased by private conservation organisations and are being managed for nature conservation. These have a similar security as the secure property agreements.

1. Public conservation reserves

There is inconsistency between Australian States in the level of protection afforded to different types of 'protected areas'. A national park in one state may allow grazing whereas in another this would not be allowed unless to satisfy an ecological requirement under a management plan. Within NSW, there are different levels of protection afforded to different types of conservation reserves. Nature reserves have the highest level of protection whilst state conservation areas permit a wider range of activities, including mineral exploration.

Public reserves can be large in area with the largest national park in NSW (Kosciuszko National Park) being 690 000 ha. Property agreements are usually small in area and less than 500 ha in size although some recent ones in arid zone regions have been over large former pastoral leases. A summary of the size of the different types of conservation reserves and secure property agreements in NSW, as of December 2005, are presented in Table 9 in Benson et al. (2006).

NSW has strong laws on establishing and managing public conservation reserves. NSW public conservation reserves can only be revoked with the agreement of both Houses of the NSW Parliament. NSW public reserves, with the exception of Historic Sites and Aboriginal Areas, meet the IUCN (1994) definition of a protected area.

In NSW, public conservation reserves include:

- National Parks, Nature Reserves, Karst Conservation Reserves, State Conservation Areas and Regional Parks, reserved under the NSW *National Parks and Wildlife Act 1974* managed by NSW DEC. Historic Sites and Aboriginal Areas are also under the NPW Act but do not meet the IUCN definition of a 'protected area' as they are not established for biodiversity conservation (NSW DEC pers. comm.). However, Historic Sites and Aboriginal Areas are included in analyses of vegetation protection if it is considered that native vegetation in them is being managed for conservation;

- Lands outside the NPWS reserves that are Declared Wilderness under *NSW Wilderness Act 1987*;

- Flora Reserves under the *Forestry Act (1916)* managed by NSW State Forests. Most of these reserves are described in Research Note 47, Forestry Commission of New South Wales (1989a). Some new Flora Reserves have been dedicated since Research Note 47 was published. "Forest Preserves" are not included in this assessment because their tenure is not as secure as "Flora Reserves" under the New South Wales Forestry Act 1916 i.e. they can be easily revoked. Some of the Flora Reserves, documented in Research Note 47 (Forestry Commission of NSW 1989a) located in the NSW coast and tablelands have been recently incorporated into DEC reserves under the NSW National Parks and Wildlife Act (1974). This has mainly occurred through Regional Forest Agreements (RFA) covering the forest regions of eastern NSW. As of 2005, most of the Flora Reserves located in the NSW Western Plains and Western Slopes exist as they did in 1989.

2. Secure property agreements

There are several types of caveats of private property ownership that can be considered as secure property agreements in NSW. These agreements are considered to meet the requirements of protected area category VI in IUCN (1994).

2a. Conservation Agreements (VCAs).

Changes to the *NSW National Parks and Wildlife Act 1974* in 1987 allow the NSW Department of Environment and Conservation (DEC) to enter into conservation agreements (VCAs) with landholders. These are bound to the title of the land in perpetuity. Management plans can be drawn up between DEC and the landholder. VCAs are not as secure as some types of the public conservation reserves because mining can take place under certain circumstances and they can be revoked more easily than public reserves (currently by the Minister).

A spreadsheet has been developed that summarises information about each VCA. This includes the following fields: VCA identification code, area of the VCA, the Bioregion in which the VCA occurs and any information on the vegetation protected in the VCA. Most VCAs are located in the eastern third of NSW with only a few in the Western Plains. In order to maintain the confidentiality of landholders, VCAs are recorded in the NSWVCA database by the NSW DEC administrative code rather than by a property or owner name. Where VCAs cover public land, such as a cemetery, the place name may be recorded.

2b. Conservation Agreement in a Wilderness Area.

A conservation agreement can be entered into over Crown lease or freehold land to protect wilderness values. A plan of management may be prepared. Such agreements are rare in NSW to date.

2c. Property Agreements in perpetuity

The *NSW Native Vegetation Conservation Act 1997* and its replacement the *NSW Native Vegetation Act 2003* provide for a range of management or property agreements to be entered into between landholders and the NSW Government.

The information on these agreements is held in two related systems in the NSW Department of Natural Resources (DNR). One is the database PANet that lists information on vegetation, soils and other factors and the other is a GIS system containing shape files of boundaries of property agreements. These two systems are linked by an administrative code. Only the property agreements (PAs) that are bound to the title of the land in perpetuity and contain native vegetation that is being managed for conservation are recorded as protected areas in the NSWVCA assessment.

In order to distinguish 'secure' agreements from those not deemed to be secure, all of the property agreements in the DNR PANet database were sorted by attribute codes that describe the purpose of each property agreement. Of the 57 DNR Condition of Consent codes, those considered to afford the required protection status were: MNF — areas of existing vegetation being managed without fencing; MEV — same with fencing; MCA — management by sustainable grazing without fencing; and MRZ – management of riparian zones. The codes MNR (improvement of existing native vegetation by fencing, destocking and allowing regrowth) and MRP (improvement of existing native vegetation by fencing, destocking, weed control and/or replanting) are not included unless one of the 46 separate 'purpose codes' designates it as native vegetation to be retained. As with conservation agreements under the *NSW National Parks and Wildlife Act 1974*, property agreements in the NSWVCA database are labelled by the DNR administrative code rather than by a property or owner name. Where property agreements cover public land the place name may be recorded in addition to the administrative code.

2d. Property Agreements under the NSW Nature Conservation Trust 2001

Areas of vegetation protected under long term, secure property agreements entered into under the *NSW Nature Conservation Trust Act 2001* may also be listed in the secure property agreements field in the NSWVCA database.

3. Private conservation reserves

There are a number of private organisations in Australia including The Australian Bush Heritage Fund (ABH) and the Australian Wildlife Conservancy that purchase land and manage it for nature conservation. As at 2005 the ABH Fund owned three properties in NSW. Areas of plant communities in these private reserves are registered in the NSWVCA database as a type of secure property agreement.

Areas not qualifying as 'protected areas'

Protection to native vegetation is afforded through conditions imposed on leases under the *NSW Western Lands Act* (covering Western Lands Leases in the NSW Western Division) and on other leasehold land in the Central and Eastern Divisions of NSW. A number of Western Lands Lease lessees in the southern mallee region of NSW (Murray-Darling Depression Bioregion) have de-stocked and fenced off areas of vegetation in exchange for clearing other parts of their leases. These areas are not included as protected areas in the NSWVCA because the lease conditions are not secure. They can be altered relatively easily.

Similarly, Reserves for Flora and Fauna under the *NSW Crown Land Act 1989* are deemed not to be secure enough to warrant listing as a protected area because such reserves are not protected by Parliament. Local Government reserves also play a role in protecting vegetation but these reserves do not meet the protected area security requirements unless they are also protected under a long term property agreement.

Short term property agreements under the *Native Vegetation Conservation Act 1997* and *Native Vegetation Act 2003* also do not qualify as protected areas even though they may achieve some positive conservation outcomes. It is possible

that changes in land ownership or land use could negate any gains in conservation after the short term agreement lapses.

Estimating the extent of plant communities in protected areas

To keep track of information on vegetation in the protected areas in NSW, digital and manual filing systems have been developed that collate information on each protected area including: published, unpublished papers and reports on vegetation, plant species lists, vegetation maps in both GIS and hard copy formats, statistics on the extent of different plant communities or vegetation map units and other relevant information. Notes in the 'Explanation of protected areas' field in the database explain the sources behind the estimates recorded for each protected area for each plant community. References are listed in the Reference field at the end of each database record. When more than one vegetation map or description covers a protected area the one deemed most accurate is adopted. In the absence of information on vegetation in protected areas, estimates are derived from expert advice and field checking.

The size of protected areas is mostly based on GIS shape files rather than field calculations because GIS files facilitate comparison of the protected area boundaries with other types of digitised maps, including vegetation maps. In flat terrain such as the NSW Western Plains there is little difference between GIS and field surveyed areas but discrepancies increase with hillier terrain.

Each protected area plant community extent estimate is qualified by an accuracy code, applied using best judgement. The code 'M' (measured) implies the figure is accurate to within 10%. This is applied when very reliable data exists such as a fine scale vegetation map or detailed estimates from ground checking. The codes E1, E2, E3 and E4 offer a range of less precise estimates of accuracy. These are defined in Appendix A and can be viewed in the database on-screen in the main data entry form through the 'Accuracy' field key.

The steps in calculating the extent of plant communities in protected areas are:

1. Obtain the GIS shape files for the boundaries of all protected areas. For the public reserves managed by NSW Department of Environment and Conservation (DEC), such as national parks and nature reserves, regular updates of shape files are forwarded to the Botanic Gardens Trust by the Parks and Wildlife Division of DEC. Shape files of the NSW Flora Reserve boundaries are obtained from NSW State Forests. Shape files of the boundaries of NPW Conservation Agreements are obtained from DEC. Shape files of the boundaries and database records for all property agreements entered into under the *Native Vegetation Conservation Act 1997* and the *Native Vegetation Act 2003* are obtained from the NSW Department of Natural Resources (DNR);

2. Obtain available and relevant digitised vegetation maps that cover protected areas and interrogate them using the GIS software Arcview (ESRI Inc. 1992–2002). This delivers statistics on the extent of vegetation map units in each protected area. In the absence of digitised vegetation maps, areas of vegetation units in non-digitised vegetation maps are manually calculated for protected areas. Where no mapping exists for a protected area, other sources of information on the vegetation are collated and interpreted. These include published and unpublished descriptions of vegetation, NSW Public Service file notes, expert advice and field checking. Descriptive information from the DNR database PANet for property agreements or DEC files for VCAs are also consulted;

3. Reconcile the NSWVCA plant community classification against the vegetation map units or descriptions available for each protected area. This involves comparing the plant species lists and general descriptions of vegetation map units or floristic communities;

4. Field-check protected areas to check the plant communities in them and the extent of each community;

5. Enter an extent figure in the relevant plant community record(s) in the 'Conservation reserves' and/or 'Secure PAs' fields of the NSWVCA database. Note: the summed extents of plant communities in a protected area may not match the size of that protected area if there is cleared land or if there have been recent boundary changes;

6. Apply an accuracy qualification to this extent data based on the quality of the data used;

7. Note the data source for the estimate in the 'Explanation of protected area' field in the NSWVCA the database.

The NSWVCA database provides for the reporting of a list of plant communities in any NSW protected area through selecting a protected area in either the 'Reserves' or 'Secure PA' report options in the opening menu of the database.

Assigning protected area status

The database registers the number of representations in reserves and secure property agreements and sums the two. It also automatically sums all areas recorded in the reserves and secure PAs fields and sums these to yield a 'total area protected' statistic with an accuracy qualification applied to it. This statistic underpins the assessment of each plant community's protected area status.

Each plant community is assigned one of 15 protected area codes, see below. These codes are based on the percentage of each plant community's pre-European extent in protected areas. This mirrors the methods used for assessing the protected area status of Australia's forests in JANIS (1997). The threshold of the percentage of a community in protected areas alters with the estimated pre-European extent of that community. JANIS (1997) recommended that adequate

representation of 'common in 1750' communities should be 15% of their pre-European extent in protected areas. Higher thresholds are applied to communities that are assessed to have been 'restricted' or 'rare' prior to European settlement. Similar pre-European extent rarity levels are applied to Queensland ecosystems in Sattler & Williams (1999). In the NSWVCA they are labelled: 'common in 1750' i.e. > 10 000 ha, 'restricted in 1750' 1000–10 000 ha or 'rare in 1750' <1000 ha.

The 15 protected area code options grouped within these categories are:

1. 'Common' communities (pre-European extent >10 000 ha in 1750): 1a = >25%, 2a = 15–25%, 3a = 5–15%, 4a = 1–5%, 5a = <1% in protected areas.

2. 'Restricted' communities (pre-European extent 1000–10 000 ha in 1750): 1b = >50%, 2b = 30–50%, 3b = 15–30%, 4b = 5–15%, 5b = <5% in protected areas.

3. 'Rare' communities (pre-European extent <1000 ha in 1750): 1c = >75%, 2c = 50–75%, 3c = 30–50%, 4c = 15–30%, 5c <15% in protected areas.

Communities with protected area codes 1a, 1b, and 1c could be considered to be exceptionally well represented in protected areas. Alternatively, communities with codes 5a, 5b and 5c could be considered to be very poorly represented in protected areas.

The protected area codes are only a guide in assessing the protected area status of each plant community. They should not be used to negate arguments to protect particular sites of well protected communities that are in good condition or are important for other reasons. For many plant communities in the NSW Central Division (including the NSW wheatbelt) where most of the vegetation has been cleared, it will be very difficult to attain a target of sampling 15% of pre-European extent in protected areas. In contrast, many of the plant communities that occur on the rugged and mainly naturally vegetated NSW eastern escarpment already have greater than 15% of their pre-European extent in protected areas.

Assessing the threat status of plant communities

Over the last few decades there have been a number of attempts to classify and assess the conservation status of plant communities in Australia. The first major work was Specht et al. (1974). This used an expert committee approach to subjectively classify the vegetation of Australia and Papua New Guinea using both floristic and structural features. It also assessed the reservation status, at that time, of the listed communities.

Threat categories and threat criteria have been developed for assessing the NSW plant communities. Appendix B describes the threat categories 'critically endangered' (CE), 'endangered' (E), 'vulnerable' (V), 'near threatened' (NT) and 'least concern' (LC). These categories mirror those used for classifying the threat status of species (IUCN 2001). Appendix B also describes six criteria used to allocate each plant community into one of the threat categories. These criteria are based on a number of sources including the guidelines for nominating ecological communities under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. However, unlike previous definitions, the threat categories and criteria described here extend beyond the three threat categories (CE, E, V) to also ascribe definitions for the categories 'near threatened' and 'least concern'.

A summary of the six criteria detailed in Appendix B are:

1. Remaining extent thresholds (with the qualification that there is a continuing decline in extent for CE, E and V threat categories) of CE = <10%, E = 10–30%, V = 31–50%, NT = 51–70% and LC = >70% remaining extent;

2. Loss of area of occupancy combined with the rate of decline of the community;

3. Degree of loss of key species that play a major ecological role in a community;

4. The degree of loss of integrity of a community including loss of species, physical degradation and other factors leading to differing prospects for regeneration or recovery;

5. Rate of continued loss of integrity over time;

6. Quantitative analysis on the probability of destruction or severe degradation (rarely available for plant communities).

Threat criterion 1 categorises the threat status of a plant community based on its estimated (or measured) current extent compared to an estimate of its pre-European extent. The concept of pre-European extent can be adopted in Australia due to an assumed, accelerated degradation of the Australian natural environment since the colonization by Europeans in 1788.

The remaining extent thresholds used in criterion 1 are based on thresholds in habitat fragmentation where there is an apparent accelerated loss of species (Andren 1994, Fahrig 1997, With 1997). For example, once a plant community is highly fragmented and less than 30% remains, there is a likelihood of accelerated loss of species, particularly of mammals (Andren 1994). Accelerated break-up of habitat connection leads to increased barriers to dispersal for many species. Over time, this leads to local, regional and sometimes total extinctions of species. Even bird species, many of which disperse relatively easily, are affected. Empirical evidence on the decline in bird populations on the extensively cleared, northern plains of Victoria, Australia (Bennett & Lord 1997) shows that declines accelerate after the point of 80% loss of habitat is reached. For these reasons, when communities are cleared or severely degraded by more than 70%, and there is continued degradation of what remains, it is suggested that

such communities should be recorded as 'endangered'. When there is less than 10% of a community remaining and there is continuing decline through various threatening processes, it is recorded as 'critically endangered'.

Any of the six threat criteria can be used to allocate a threat category. If the application of different threat criteria delivers options for threat categories, the most threatened category is selected. In some instances, a community could be categorized as 'endangered' or 'vulnerable', even if greater than 50% of its pre-European extent remains. This could happen in cases where the main threats are from threatening processes other than loss of extent. For example, a plant community may be judged to be 'vulnerable' because it is in very poor condition under criterion 4 of the threat criteria due to threatening processes such as lack of regeneration of key species, significant weed invasion or detrimental changes in hydrology.

Threat status may or may not correlate with protected area status. It is conceivable, for example, that a plant community that is totally protected in a national park or other protected area could be 'endangered' if it was threatened by climate change, a pathogen or concentrated human visitation. Consider the threats of climate change on well-reserved alpine communities or root pathogens on well-reserved heaths and forests. Some well-reserved plant communities in the arid and semi-arid areas of NSW remain under threat due to grazing by goats or rabbits (Benson et al. 2006, this volume).

Expert judgment is required when using the threat criteria. The NSWVCA database allows comments to be made in the fields 'Threatening processes' and 'Planning and management' to provide more detail about the threats to each community.

The database contains fields that record the main threatening processes for each listed community (described in Appendix A). The 'Threatening processes' field allows for a description of the main threats to a plant community. The 'Threatening process lookup' field contains a table of 33 threatening processes (eg clearing, salinity, sheet soil erosion, exotic weed invasion etc) from which multiple entries can be recorded. Additionally, the database contains fields in which it is possible to record information on the variation and natural disturbance and fire regimes for each plant community. Key references can be cited in these fields.

The combined threat/protected area code is one of the last fields in the NSWVCA database. It summarises the overall status of a plant community.

Developing a bio-information system: the NSWVCA database

Because many combinations of data on ecological communities are often sought to answer particular ecological or land use questions, the NSWVCA has been produced in a database format. The full version of the database provides access to the query mode at its 'backend'. This allows a wide range of queries to be made using combinations of the fields. To satisfy common queries for listing plant communities in geographical areas such as CMAs or bioregions and under broad vegetation groupings, 39 reports have been developed in MS Access and MS Word formats. These are accessed through the Administration Menu of the database. These report options, are available in the 2006 published version of the database, are described in Appendix A.

The database contains 90 fields of information (Table 5). Data entry for some of these fields relies on selection of options in lookup tables. Other text-based, descriptive fields require manual data entry. There are 47 Tables (Table 6) in the database ranging from a list of all NSW plant species names to a list of all conservation reserves. Some of the fields provide for comparisons with other NSW, interstate or national vegetation classifications. However, most fields deal with aspects of the plant community itself including listing characteristic species, weed species, threatened species, regional distribution, soils, substrate, landforms, threatening processes, threat code and criteria, protected area occurrences, protected area code and photographs and captions. Regional distribution includes recording occurrence in climate zones, CMA area, bioregion, sub-region of bioregions, botanical divisions and local government areas. Options in the reports menu allow the selection of plant communities for a number of types of regions including bioregions and CMAs. Similarly, plant communities can be listed for public reserves and secure property agreement areas and this serves as an audit of the types of vegetation in the NSW protected area system. Considerable effort has gone into programming the database so it can perform actions such as summing areas in protected areas and producing reports.

A read-only version of the database that contains the classification of the vegetation of the NSW Western Plains is on the CD in the back pocket of the journal. This allows viewing of the plant community data and generation of reports from the Reports menu but it prevents access to the backend of the database where the tables and data are held. The concern is to prevent users of the database from changing the data without central coordination or agreement. A drawback is that the read only version does not allow the user to access the query mode and carry out a range of possible queries. Full versions of the database will be made available under a license agreement and at a fee by the Botanic Gardens Trust, Sydney.

Appendix A describes the database in detail covering its software requirements, current software limitations, database reports and the 90 information fields. Appendix A should be consulted by those wishing to use the database. It can be accessed in digital form by selecting the 'Database Descriptions' key located at the top of the data entry screen in the database.

Discussion

The NSWVCA could serve as an information source for NSW plant communities. It links a plant community classification to threatening processes, threatened species, landscape features, broader vegetation and abiotic classifications and the NSW protected area system. Such integration of different data is a prerequisite to applying an ecosystems approach (Shepherd 2004) in landscape management.

The 'plasticity' of the 'community concept' renders any species-based ecological community classification less than perfect. It would be difficult to develop a vegetation classification that caters for species variation through space and time including accounting for successional stages. Although the NSWVCA collates research and expert knowledge into a single classification, it is likely that some vegetation types will not be recorded because of data gaps in botanical sampling and vegetation mapping.

The adjoining States of Queensland and Victoria have developed different ecological classifications. Queensland has produced vegetation-based regional ecosystems (Sattler & Williams 1999, Wilson et al 2002 and Queensland Herbarium 2003). These ecosystems are associated with particular combinations of substrate, soils and landforms and each one is generally confined to one national IBRA Bioregion. The Queensland regional ecosystem database is far more limited in its data compared to the NSWVCA but has the benefit of being supported by a more consistent vegetation mapping base.

Victoria has developed a list of ecological vegetation classes (EVCs) based on major vegetation structure, combinations of plant communities and similar soil and climatic types (DNR 2001). The Victorian EVCs are text-based descriptions making it difficult to conduct queries.

Both of the last mentioned approaches were rejected for use in NSW. The Queensland ecosystem (Sattler & Williams 1999) tends to duplicate listings of virtually the same vegetation community because it adheres to bioregional boundaries as a high level determinant in the classification. Many of the Victorian EVCs are poorly defined and contain many plant species compositions (Burgman et al. 1996). Ecosystem processes appear to take precedence over biotic variation

Table 5. List of fields in the NSW Vegetation Classification and Assessment database.
Notes: All fields are reported in the full query reports in the database. Fields marked with an * are reported in the 'short' reports in the database.

1. Vegetation community ID No.*
2. Common Name*
3. Scientific Name*
4. Original data entry
5. Date of entry
6. Last modified by
7. Last modified date
8. Formation Group
9. State Vegetation Map (Keith 2004)
10. State landscapes (Mitchell 2002)
11. NVIS major sub-groups
12. Forest type (RN 17)
13. Characteristic trees*
14. Characteristic shrubs, vines epiphytes*
15. Characteristic groundcover*
16. Characteristic weed species
17. Weediness
18. Threatened plants
19. Threatened fauna
20. Mean native species richness
21. Characteristic species qualifiers
22. Authority(s):
23. Authority qualifiers
24. Reference list*
25. Interstate equivalents
26. Classification confidence level
27. Level of classification
28. Rainforest structure
29. Structure*
30. Height class
31. Vegetation description*
32. Mapped or modeled
33. Mapping information
34. Adequacy of plot sampling
35. Climatic Zone
36. IBRA Bioregion*
37. IBRA sub-region
38. Botanical Division
39. Local Government Area (LGA)
40. Catchment Management Authority areas (CMAs)*
41. Murray-Darling Basin
42. Substrate mass
43. Lithology
44. Great Soil Group
45. Soil texture
46. Landform pattern
47. Landform elements
48. Land use
49. Impacts of European settlement
50. Pre-European extent (ha)*
51. Pre-European accuracy*
52. Pre-European qualifiers
53. Pre-European comments
54. Current extent (ha)*
55. Current extent accuracy*
56. Current extent qualifiers
57. Current extent comments
58. Percent remaining*
59. Percent remaining accuracy*
60. Degree of fragmentation
61. Recoverability
62. Threatening processes
63. Threatening processes lookup
64. Variation and natural disturbance
65. Adjoining communities
66. Fire regime
67. Conservation reserves (ha)*
68. Total area in reserves (ha)*
69. No. of reps. in reserves
70. Explanation of protected areas
71. Secure property agreements (ha)*
73. Number of reps in secure property agreements
74. Total area protected (ha)*
75. Total area protected accuracy (%)*
76. Protected pre-European extent (%)
77. Protected current extent (%)
78. Total reps in protected areas
79. Protected area code
80. Key sites for protection
81. Threat category*
82. Threat criteria*
83. Threat/protected area code*
84. Planning controls
85. Planning and management
86. Listed under legislation
87. Recovery plan
88. Recovery plan status
89. Photograph fields (1*, 2, 3)
90. References

such as floristic assemblages. This can lead to a confused landscape classification where quite different species assemblages are lumped into the same ecological unit.

In contrast to the classifications in Queensland and Victoria, the NSWVCA concentrates on listing plant communities based on differences in floristic assemblages, generally within one or two structural (canopy cover, height of tallest stratum) classes. Many of the plant communities classified in the NSWVCA occur in more than one Bioregion because their required physical environments extend across bioregional boundaries. Where data is lacking to differentiate occurrences of ubiquitous species-dominated vegetation, such as the inland River Red Gum (*Eucalyptus camaldulensis*) or Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) woodlands, bioregional boundaries may be used as a basis for a classification.

Since vegetation classifications are often used as surrogates for biodiversity and for reserve selection or setting priorities for private land conservation actions, the coarseness of classification is important (Pressey & Bedward 1991, Pressey & Logan 1994). Too coarsely or too finely divided classifications may be poor surrogates for biodiversity, but the scientific literature on this is limited. Analyses of fauna site data with forest ecosystems classified through vegetation mapping in the north east NSW forests (NSW NPWS 1999) indicates that the level of surrogacy of fauna to vegetation type varies with groups of fauna. Rarely do vegetation classifications produce units with similar levels of similarity and this may confound surrogacy assessments (S. Ferrier pers comm.).

Most of the classified plant communities in the NSWVCA are suitable for property planning, regional priority setting and national reporting because it is pitched at reasonably fine scales of classification that if mapped would mostly be discernable at 1:100 000 in the NSW Western Plains, 1:50 000 in the western slopes and tablelands and 1:25 000 in the NSW Coast. Also, floristically distinct, small patch-sized types of vegetation that may contain features important for protection, are often not depicted on vegetation maps but can be described in the NSWVCA. This flexibility is required in natural resource planning and site assessment.

The 1:1.5 million scale map and descriptions of 99 vegetation classes in the book on NSW vegetation by Keith (2004), while highly educational, is less directly relevant to regional or local planning.

Caution is required in applying uniform management practices for any one plant community. For example, prescription for appropriate fire regimes may vary depending on factors such as previous fire history at a site or the presence of certain fire-sensitive species (Morrison & Renwick 2000).

Table 6. List of tables in alphabetical order in the NSWVCA database.
Notes: Single or multiple entry selections are made from drop down lists of these tables in the Main Details data entry form of the database. The tables cannot be viewed or altered in a 'read-only' version of the database. Some tables, such as Reserves (conservation reserves) and Species (current names of NSW plant species), require frequent revision by the administrator of the database.

Accuracy codes for extent estimates	IBRA sub-region	Rare community protected area thresholds 1c-5c
Adequacy of plot data	Impacts of European settlement	Rare community adequacy of sampling across range.
Botanical Divisions of NSW	Landform elements (McDonald et al. 1990)	Recoverability
Climate zone	Landform patterns (McDonald et al. 1990)	References
Catchment Management Authority	Landscapes (McDonald et al. 1990)	Reserves
Common community protected area thresholds 1a-5a	Land uses	Restricted community protected area thresholds 1b-5b
Common community adequacy of sampling across range	Level of classification	Restricted community adequacy of sampling across range
Confidence level of classification	Local Government Areas	Soil texture (McDonald et al. 1990)
Current extent lookup qualifiers	Listed as threatened under legislation	Species (NSW plant species names)
Degree of fragmentation	Lithology	State Map Classes (Keith 2004)
Forest Types (Research Note 17)	Main (this contains all data)	Substrate mass (McDonald et al. 1990)
Forest type qual (part of equal to)	NVIS major sub-groups	Threat category (CE, E, V, NT, LC)
Formation Group	Remaining percent accuracy	Threat criteria (1-6)
Great Soil Group	Pre-European qualifications	Weediness
Height Class (from Walker & Hopkins 1990)	Proportion mapped or modelled	
IBRA Bioregion	Protected in PA/VCA – list of all secure property agreements	

Particular locations of a plant community may contain populations of threatened species of flora or fauna and these may require different management practices to maintain their populations.

Future improvements to the NSWVCA

With feedback on the NSWVCA, changes to the database and the information on plant communities will occur. Some of the existing fields may be deleted and new ones added. New reports may be developed to cater for frequent inquiries. The lists of threatened plant and fauna species in the database will require refinement. Information in fields such as threatening processes, fire regimes and planning and management will improve as more research is done. Also, since part of the maintenance of the database requires updating species names in the database records to match currently accepted names, it would be logical for the Species Table in the database to be linked to the Botanic Gardens Trust's Master Name Index in order to maintain an up to date list of plant species names.

If technically feasible, it would be useful to place the NSWVCA database on the internet and link it to GIS vegetation maps to show a map of a plant community. This would be relevant where there was a correlation between a listed community and a vegetation map unit. However, it would also be relevant if a community was part of a broader map unit. A central internet repository of vegetation maps in NSW has commenced at the NSW natural resources atlas web site www.nratlas.nsw.gov.au/wmc. It would be beneficial if the map units depicted on this web site could be cross-referenced with the plant community ID numbers in the NSWVCA.

Presently, the soil classification recorded in the database is that of the Australian Great Soils Group (Stace et al. 1968). This could be replaced or complemented by correlations with the most recent classification of Australian soils by Isbell (2002).

The NSWVCA database could be transferred to software that overcomes present limitations documented in Appendix A, particularly in respect of incorporating images in reports. Preferably, it would be advantageous to hold an up to date version of the database, the database description document (Appendix A) and some useful database reports on the Botanic Gardens Trust Sydney and/or NSW DEC websites. This would allow users to query the database over the internet as if they had the full version on their personal computer thus negating the need to distribute updated versions.

A key to the Formation Groups and to the plant communities would be worthwhile. Such a key would primarily use characteristic species, vegetation structure, adaphic factors (soils, landscape type etc) and geographic distribution.

A major challenge is to link the results of expert assessments such as the NSWVCA to computer models used in landscape planning. This could be done by listing the plant communities and their protected area and threat status for particular geographical areas where they are recorded, such as CMAs, bioregions or local government areas. A plant community's presence could be predicted by using edaphic or landscape features.

Maintenance of the data and the NSWVCA database

Information systems require maintenance. It is proposed that the following steps should be taken to enhance and maintain the NSWVCA database.

1. Proposed changes to any part of any plant community record in the database should be documented on the feedback proforma in Appendix C and sent by mail to the BGT or emailed to nswvca@rbgsyd.nsw.gov.au. A digital version of this proforma is linked to the database via the 'Feedback' field key.

2. An independent Vegetation Classification and Assessment Scientific Committee (VSC) could be established to vet suggested major changes. It would review proposed major changes to the classification or assessment such as splitting, amalgamating, adding or deleting a community or changing a threat category. It should consult with experts as part of the review process. On-going minor alterations to records and updating tables such as species names, reserves and the various regions can be done by the database administrator.

3. All changes to the database should be made at a central location by a NSWVCA database administrator to ensure that a single, ratified version of the database exists at any one time.

4. Maintenance of software and hardware technical aspects of the NSWVCA database should become a core duty of the NSW Department of Environment and Conservation Information Technology Section. Such maintenance will include maintaining the internet site, hardware, software, programming and transferring the database to other software if required.

Contents of the accompanying CD

The CD is located in the back pocket of this journal and includes:

1. **Read Me CD Contents note:** Describes the files in the three folders on the CD and how to install the database from the CD onto a computer;

2. **Folder 1:** Contains a read only version of the MS Access NSWVCA database containing the 213 plant communities of the Western Plains (future editions will include plant communities of the western slopes, tablelands and coast). The read only version of the database allows access to the data entry form, to the database reports and to the search mode but it prevents access to the query mode and to the data tables at the backend of the database;

3. **Folder 2.** Contains a PDF version of this paper;

4. **Folder 3.** Contains a PDF file of NSWVCA Part 1 – the NSW Western Plains paper (Benson et al. 2006), NSW Western PLainsAll Records Full Report (90 fields), All Records Full Report of the Western Plains communities split into the 19 Formation Groups. Full Report and Short Report for the Lower Murray/Darling and Western CMAs, Short Report (28 fields) of the plant communities classified for the NSW Western Plains, a spreadsheet of the NSW Western Plains bibliography, a spreadsheet list of the NSW Western Plains plant communities with their threat and protected area codes — allowing them to be sorted by threat or protected area status.

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Appendix A. Description of the NSW Vegetation Classification and Assessment MS Access database

(Comments on the database should be forwarded to the NSWVCA database administrator through email nswvca@rbgsyd.nsw.gov.au)

The NSW Vegetation Classification and Assessment database (NSWVCA) is a vegetation classification, threat and protected area status information system to assist with the protection and management of vegetation in New South Wales.

The NSWVCA database contains 90 information fields, 47 tables and 64 forms. A number of standard reports are included to allow for the listing of plant communities by geographical area or by broader vegetation or landscape classifications. Most of the fields could be adapted for use in any jurisdiction of the world. However, some of their names are pertinent to particular landscape classifications or administrative boundaries used in NSW. Programming is in MS Visual Basic. Some of the programming is concerned with exporting reports directly to MS Word (discussed below). Therefore, changes to field names in the database need to be mirrored with changes to field names in the templates used for exporting records to MS Word.

Interrogation of combinations of fields in the database can be achieved by using the query mode of MS Access but this is only available to users who have the full version of the database. In order to maintain a single version of the database, changes to it should be made through a central database administrator. Proposed changes can be sent to the email address on the Feedback form accessible in the database.

A future step in the development of the database is to have it accessible over the internet including a provision for users to access the query mode. This would avoid the need to issue updated versions of the database.

Software requirements

The database runs on Personal Computers not on Macintosh computers. The software required is Microsoft **Access XP 2000** or later versions running under recent versions of **MS Windows**. It will not work on MS Access 1997. MS Access was selected because it is a commonly used database, however, it does have limitations and these are described in the 'Software limitations' section at the end of this document. The MS Word Reports require **MS Word 2002** or later versions. **MS Internet Explorer** is required to access photographs stored in a separate 'Image' folder. The database links to images in the 'Image' folder via shared label names in the 'Photo File Name' field of the database and the image file name. PDF Reports are converted to editable PDF format via pdf 995s.exe writer that is included with the files associated with the database.

Getting started: installing and opening the database

Installing the database

The 15 files required to run the NSWVCA database contain the MS Access database itself, an image folder, pdf995s.exe print driver freeware, ps2pdf995.exe PDF converter freeware, 10 other files and a batch file that can be used to save all of these files to the c:\vegclass folder from the CD. The database reports cannot be run by using the database from the CD.

There are two ways of transferring the files to a computer.

1. Double click on the *vegclass.bat* file to automatically save the files associated with the NSWVCA database to the folder C:\vegclass; or

2. Manually copy and save the files from the CD to an appropriate computer drive and folder. Once the files are transferred, locate and double click on the pdf995s.exe file and follow the instructions for loading it. Then double click on the ps2pdf995.exe file to load the supporting free software. You will require administrative rights to your PC to load this pdf995 print driver.

Do not alter the supplied file names or directories or risk the database not working.

The files are:

1. *NSWvegclass.mdb*: this is the Access 2002 database file containing the plant community records, tables, forms and reports. The read only version does not allow access to its backend – i.e. tables and data;

2. *Vegword.doc*: a MS Word template that facilitates the Word reports that contain all fields in the records;

3. *Vegwordc.doc*: a MS Word template that facilitates Word reports when operating the database from the c:\vegclass folder;

4. *Vegwordd.doc*: a MS Word template that facilitates Word reports when operating the database from the d:\vegclass folder;

5. *Vegshort.doc*: a MS Word template that facilitates Word Reports reports that contain a subset (28) of the fields;

6. *Vegnoref.doc*: a MS Word template that facilitates the production of full records without the text of the references but with the Reference number list. This is useful for reducing the length of a report by eliminating the full-text references. It maintains the reference list field that lists the numerical code of the references that can be looked up in the Excel bibliography on the CD;

7. *Vegquick.doc*: a MS Word template that facilitates the Word Reports Quick Reference Report that contains 8 fields from all records in the database;

8. *Threat.doc*: A MS Word document that includes the descriptions of the threat categories and threat criteria used for assigning each community to a threat category;

9. *Database Description.doc*: this is a digital form of this document that can be used as a reference while using the database. It is retrievable by selecting the 'Database Description' field at the top of the TBL Main Details data entry screen;

10. *Feedback.doc*: a document that contains a proforma for comments on the classification or the database that can be submitted either digitally or in hard copy form to the Database Administrator. Suggested changes can be major such as changing the classification or minor such as changing information in some of the fields. Major changes should be vetted by a NSWVCA Scientific Committee, and after agreement to the change, they should be made by the Database Administrator. The feedback form is accessed through the 'Feedback' field in the top section of the TBL Main Details data entry screen;

11. *Noimage.bmp*: a background file used in reports;

12. The 'Images' folder contains jpeg images that are incorporated in PDF reports. This folder should be saved as a sub-folder in the Vegclass folder. Its title must remain Images due to this name being used in Visual Basic computer code. Within this folder is another folder titled Images_big. This contains larger resolution images for use on-screen with the images being linked to the View Photo fields in the TBL Main Details data form in the database;

13. *pdf995s.exe*: free software that allows Access Reports to be saved in *pdf* format;

14. *ps2pdf995.exe*: free software that allows pdf995s.exe to operate;

15. *Vegclass.bat*: a batch file that automatically saves all 15 files described here to the c:\vegclass folder.

Opening the database

Once the NSWVCA files are saved to an appropriate folder (and perhaps a shortcut made to the database), double click on the file *NSWvegclass.mdb*. An Administration Menu appears with six menu keys:

- *Data Entry*: opens the Main Table Details at the first record. This is the where data is viewed or entered. Once opened, the Veg Comm ID number, Common Name of the plant community and Photo keys remain in the top part of the screen when scrolling down a record;
- *Search*: opens a search option screen for finding a plant community using key words in conjunction several fields such as Scientific Name, Formation Group or Bioregion;
- *PDF Reports*: opens the PDF Report options that are described below;
- *Word Report* : opens the same report options as the PDF Reports key except these are delivered directly to MS Word but without photos;
- *Database details*: raises an explanation note about the database;

- *Exit database* closes the database. It can also be closed through 'X' in the top right corner of the toolbar.

Compacting the database

When exiting or closing the database it automatically compacts. In the full version compaction and repair can be run at any time through 'tools/database utilities/compact and repair' but in the read only version this is not possible. When a series of reports are generated, Access expands in size and this can create faults that may cause it to close. Therefore, it is advisable to close and re-open the database occasionally during extensive use.

Database queries and reports

The prime reason for using a database to record information on ecological classifications is to facilitate queries of combinations of data fields. Such queries are not possible from text-based ecological community descriptions. An example of a simple query would be 'list plant communities in the Riverina Bioregion'. A more complicated query may be: 'list plant communities, that are endangered, that occur on sandplain landform pattern, that are in the Riverina Bioregion and that are under the Formation Group *Grasslands on Fine Texture Soils on the Inland Slopes and Plains*'. The first example can be delivered by one of the standard reports (see below). The second example requires a full version of the database and knowledge of using the MS Access query mode.

39 query reports have been developed and are accessed from the PDF Reports and 'Word Reports' keys in Administration Menu. Most of the reports are available as either full reports (all 90 fields) or short reports (28 fields). For example, if the user wished to list all plant communities in a particular Catchment Management Authority area they would select a CMA from the drop down list for either the full of short CMA report options. The same applies to bioregions, reserves, Formation Groups, Keith (2004) map units etc.

The plant communities that are listed in reports of geographical regions or broad vegetation groups are arranged in alphabetical order of the names of the high order hierarchical unit 'Formation Group' used in the NSWVCA project, thus beginning with *Acacia woodlands and shrublands of the inland slopes and plains* through to *Wetlands: Inland freshwater, swamp and shrubland communities*. This ensures that similar types of plant communities are grouped in the reports (consecutive ID numbers do not necessarily contain similar plant communities).

PDF Reports

PDF Reports are available through the 'PDF Reports' key in the Administration Menu. pdf995s automatically incorporates images into the reports and its text can be searched and copied. The Main Table in the database can be imported to MS Excel. This will exclude images but the text fields and the image file names are searchable and able to be edited.

Hint 1: If you are finding the Access reports and pdf files are overlapping onto extra pages, in Windows go to Start / Printer Settings / pdf995 and make sure its settings are set for A4 sized paper.

Hint 2: Close the pdf995 sponsorship advertisements when saving a report to file.

Hint 3: If a previous report is saved in a PDF Report, re-run and save the report.

Word Reports

Word Reports are available through the 'Word Reports' key in the Administration Menu. They produce text that can be edited and searched for key words – handy if you are looking for a particular community dominated by a particular species for example. They are generated by the Word template files *Vegwordc.doc*, *Vegwordd.doc*, *Vegshort.doc* or *Vegquick.doc* via a merge routine that converts the Access text into MS Word format. To use the 'Word Report select a report option from the menu then wait as MS Word is 'reading the records', then wait while MS Word is 'merging the records'. The user can observe these two processes happening in the bottom left hand corner of the screen which also shows how many records are being processed. Once complete, the report can be saved as a Word file. The advantage of Word reports is that they contain searchable text and can be cut, pasted and edited. However, images have to be manually transferred into Word reports from the 'image' folder and this can be tedious if the report contains many records.

Full and short reports and reports with or without full text references or images

Within both the PDF Reports and Word Reports, there are options for producing different length reports depending on requirements. These are:

- *Full Reports* include all 90 database fields and are generally, three to four A4 pages in length per plant community;
- *Full Report Without References* are selected from a question that appears on the screen asking 'Do you want full reference to print?' By selecting 'yes' the report will include the text of all references. By selecting 'no' the report will not list the text of the references. Selecting the report without references saves considerable space. Note: this option still lists the Reference List field i.e. the numbers of the references, the names of which can be correlated via the References Report in the PDF Reports Menu or in the *Bibliography NSW Western Plains.xls* file on the CD accompanying the *Cunninghamia* journal where this Database Description is published;

- *All Records Report* and the four section reports *Western Plains, Western Slopes, Tablelands, Coast and Escarpment* contain an option '*without images*';
- *Short Reports* contain 28 of the 90 fields and are normally one A4 page in length per plant community. The fields are: Veg. Comm. ID No, Common Name, Scientific Name, Characteristic Trees, Characteristic Shrubs/Vines/Epiphytes, Characteristic Groundcover, Structure, Vegetation Description, IBRA Bioregion, Catchment Management Authority, Pre-European Extent (ha), Pre-European Accuracy (%), Current Extent (ha), Current Extent Accuracy (%), Percent Remaining, Percent Remaining Accuracy, Conservation Reserves, Total Area in Reserves, Area in Secure Property Agreements, Total Area in Reserves (ha), Secure Property Agreements, Total Area in Secure PAs, Total Area Protected, Total Area Protected Accuracy %, Threat Category, Threat Criteria, Threat/Protection Area Code, Photo 1 label, Photo 1 caption and Reference List.

Database Report Options

Currently, the NSWVCA database contains 39 report options for listing plant communities. These are:

1. **Vegetation ID:** This report is useful for selecting a single record or several sequential records. It lists all 90 fields of information for one or a sequence of plant communities in order of their ID Number listing in the database. Type the required ID Number into the first data entry box. Using the tab key or clicking the mouse raises the same number in the next box. If a range of ID numbers is sought, type in a second ID number in the second entry box;

2. **Vegetation ID Short Report**: Same as for 1. above except this report lists 28 fields only;

3. **All Records:** Lists all 90 fields for all plant communities in the database. This report is very long with the NSW Western Plains section alone being over 700 pages in length;

4. **All Records Short Report:** Lists all plant communities in the database with 28 fields of information including name, characteristic plant species, occurrences in protected areas and threat/protected area code;

5. **Quick Reference Report**: Lists 8 fields of each record in the database arranged by Formation Group name by alphabetical order. This can be used to quickly review records in the database. An example is:

ID Number: **26**

Scientific Name: *Acacia pendula/Rhagodia spinescens — Maireana decalvans/Austrodanthonia caespitosa — Atriplex semibaccata — Alternanthera denticulata — Austrostipa aristiglumis*

Common Name: **Weeping Myall open woodland of the Riverina and NSW South-western Slopes Bioregions**

Char. Trees: *Acacia pendula; Casuarina cristata; Eucalyptus largiflorens; Eucalyptus camaldulensis; Eucalyptus melliodora*

Char. Shrubs/Vines: *Rhagodia spinescens; Maireana decalvans; Atriplex nummularia; Chenopodium nitrariaceum; Maireana aphylla; Muehlenbeckia florulenta; Acacia stenophylla; Acacia oswaldii; Acacia salicina; Hakea tephrosperma; Santalum lanceolatum; Amyema quandang*

Char. Ground Cover: *Austrodanthonia caespitosa; Atriplex semibaccata; Alternanthera denticulata; Austrostipa aristiglumis; Atriplex spinibractea; Atriplex leptocarpa; Enchylaena tomentosa; Austrostipa nodosa; Austrodanthonia setacea; Sporobolus caroli; Einadia nutans* subsp. *Nutans.*

Formation Group: Acacia Woodlands and Shrublands of the Inland Including the Semi-Arid Zone;

6. **Scientific Name Report**: Lists all plant communities with a particular species name in the scientific name field. This is useful for seeking records where a particular dominant species is of interest. For example, selecting '*Acacia pendula*' from the drop down list of all NSW plant species names lists all the communities where *Acacia pendula* is part of the scientific name;

7. **Scientific Name Report Short Report**: Short report of 6. above;

8. **Formation Group Report:** Lists plant communities under any Formation Group selected from the Formation Group Table drop down list. This is useful for listing similar structural and floristic communities;

9. **Formation Group Short Report**: Short report of 8. above;

10. **State Map (Keith 2004):** Lists plant communities in any of the 99 Vegetation Classes covering NSW mapped and described in Keith (2004);

11. **State Map (Keith 2004) Short Report**: Short report of 10. above;

12. **NVIS Major Veg. Sub-groups:** Lists plant communities in order of the Formation Groups correlated with any of the Native Vegetation Information System vegetation sub-groups for Australia developed in the National Land and Water Resources Audit (2001);

13. **NVIS Major Veg. Sub-groups Short Report:** Short report of 12. above;

14. **Catchment Management Areas:** Lists plant communities in order of the Formation Groups for any of the 13 Catchment Management Authority areas in NSW as described under the NSW Catchment Management Act 2003. CMAs are key areas for planning and natural resource funds expenditure in NSW;

15. **Catchment Management Areas Short Report:** Short report of 15. above;

16. **IBRA Bioregion:** Lists plant communities in order of the Formation Groups for any of the 18 IBRA Bioregions (Version 6.0) in NSW;

17. **IBRA Bioregion Short Report:** Short report of 16. above;

18. **IBRA sub-regions:** Lists plant communities for any of the 129 IBRA sub-regions which are divisions of the IBRA Bioregions (Version 6.0) in NSW;

19. **IBRA sub-regions Short Report:** Short report of 18 above;

20. **Local Government Areas (LGA):** Lists plant communities for any of the Local Government Areas in NSW;

21. **Local Government Areas (LGA) Short Report:** Short report of 20 above;

22. **Reserves:** Lists plant communities in any public conservation reserve in NSW;

23. **Reserves Short Report:** Short report on 22 above;

24. **Secure Property Agreements (SPAs):** Lists plant communities for any secure property agreements under the Native Vegetation Conservation Act 1998, Native Vegetation Act 2003 or Conservation Trust in NSW 2001, Voluntary Conservation Agreements under the National Parks and Wildlife Act 1974 and private secure reserves including those owned by the Australian Bush Heritage Fund and the Australian Wildlife Conservancy;

25. **Secure Property Agreements (SPAs) Short Report:** Short report of 24 above;

26. **Western Plains Section:** Lists plant communities in the area defined as the 'NSW Western Plains' being the eight western-most IBRA Bioregions (Version 6.0) in NSW: Darling Riverine Plains, Riverina, Cobar Peneplain, Mulga Lands, Murray-Darling Depression, Broken Hill Complex, Simpson-Strzelecki Dunefields and Channel Country Bioregions;

27. **Western Plains Section without images:** Same as 26 above but without images thus saving space and avoiding limitations of memory in some computers;

28. **Western Plains Section Short Report:** Short report of 26 above;

29. **Western Slopes Section:** Lists all records in the area defined as the 'NSW Western Slopes' being the three central IBRA Bioregions (Version 6.0) in NSW: Brigalow Belt South, Nandewar and NSW South Western Slopes Bioregions;

30. **Western Slopes Section without images:** Same as 29 above but without images thus saving space and avoiding limitations of memory in some computers;

31. **Western Slopes Section Short Report:** Short Report of 29 above;

32. **Tablelands Section:** Lists all records in the area defined as the 'NSW Tablelands' being the three IBRA bioregions (Version 6.0) in NSW: New England Tablelands, Southern Eastern Highlands and Australian Alps Bioregions;

33. **Tablelands Section without images:** Same as 32 above but without images thus saving space and avoiding limitations of memory in some computers;

34. **Tablelands Section Short Report:** Short report of 32 above;

35. **Coast and Escarpment Section:** Lists plant communities in the area defined as the 'NSW Coast and Escarpment' being the four coastal IBRA Bioregions (Version 6.0) in NSW: NSW North Coast, Sydney Basin, South-Eastern Corner and South-East Queensland Bioregions;

36. **Coast and Escarpment Section without images:** Same as 35 above but without images thus saving space and avoiding limitations of memory in some computers;

37. **Coast and Escarpment Section Short Report:** Short report of 35 above;

38. **Murray-Darling Basin:** Lists plant communities in the Murray Darling Basin;

39. **References:** Available in the 'Reports' menu, it lists the references in the database in order of their data entry. This can be exported to Excel and re-arranged by author name.

Reports from the Search routine

An alternative means of producing reports to using the PDF Reports or Word Reports menu options, described above, is to generate reports from the Search screen. This is done by highlighting the Search screen through the 'Search' key on the Administration Menu. Once a search has been made using the fields available, the plant communities selected can be written to a report via the report button on the screen. Options allow for generating short or full reports in PDF or MS Word formats. This is useful for grouping all plant communities with, for example, the same species name in their scientific name. For example, if you want a report listing all plant communities that have *Eucalyptus microcarpa* in their scientific name you would type this species name into the 'scientific name' field and then save the report. Similarly, you could use the common name field to generate a report for common name usage – in this case 'Inland Grey Box'. However, some communities have no common species names in their title and rarely do they contain more than two.

Note: You must ' Clear' the screen between queries.

Using the 'species' key

Users of the database will not need to use the 'species' key. It is located in the toolbar on the data entry screen. It links to the Species Table which contains a list of current NSW plant species names. The species key is useful when entering species names in some fields in the database, for example, the 'vegetation description' field. This ensures the proper spelling of the name. The Species Table is kept up to date with taxonomic name changes but it lists only the latest accepted names, not synonyms. Should previous species names need to be replaced or altered, a *find/replace* procedure can be applied, by the database administrator, to the Main Table at the backend of the database.

Description of NSWVCA database fields

(Notes: the fields are described as they appear in the data entry screen not in the reports. Some of the descriptions of the fields apply to data entry and are not relevant to general users of the database).

1. **ID Number**: This number as assigned automatically by MS Access and cannot be changed. If a community is deleted this number cannot be re-used. If in the future a community is split into more communities this number will be used by one of the new communities. Changes to consecutive versions of the database should trace the history of vegetation community number changes;

2. **Common Name:** A colloquial description of the plant community that can be understood by non-botanists. It may include common names of dominant plant species, names of a geographical region, a substrate, a soil type or a climatic zone. For example the common name of the scientific name example in 3 below could be called *Ribbon Gum—Mountain Gum Grassy Forest of the New England Basalt Plateau*;

3. **Scientific Name:** This includes up to 12 scientific names of species that are deemed to be dominant or characteristic of the community. The species are selected from quantitative analyses or qualitative descriptions. Up to four species can be used for each of three layers and are listed in descending order of dominance or indicator value to each layer. Layer 1 lists trees. Layer 2 includes shrubs above 0.5 in height, robust vines, epiphytes in may include tall grasses in grasslands. Layer 3 includes the dominant ground cover species including small shrubs less than 0.5 m high, grasses, weak climbers, sedges, forbs, ferns and bryophytes. A dash ('—') between species implies they are from the same layer. A slash ('/') indicates they are from different layer. An example is *Eucalyptus viminalis — Eucalyptus dalrympleana* subsp. *heptantha /Acacia dealbata /Poa sieberiana* tall open forest on the basalt plateau, New England Bioregion;

4. **Original data entry**: Name of person who first entered a record;

5. **Date of entry**: Date of first data entry;

6. **Last modified by**: Name of person who made the last modification;

7. **Last modified date**: Date of last modification;

8. **Formation Group:** Formation Groups are a high order hierarchy useful for grouping similar plant communities. They are based on the major group of Australian vegetation described in Beadle (1981) and contain plant communities with similar life forms and growth forms and often occur in similar ecological environments. There are currently 63 Formation Groups in the NSWVCA. For each data entry, a Formation Group is selected from a lookup table. Plant communities can be listed in any Formation Group through the 'Formation Group' report options in the reports menu of the database. Most of the reports generated in the database list plant communities in alphabetical order by Formation Group name;

9. **State Vegetation Map (Keith 2004):** Select from a drop down table one of the broad Vegetation Classes depicted on a State vegetation compilation map produced by Keith (2004). Through the reports menu it is possible to list all plant communities that are grouped under any of the Keith (2004) vegetation classes;

10. **State landscapes (Mitchell 2002):** These landscapes are based on land-systems, soils maps and geological maps. Over 500 cover NSW. As of 2006 the database had not recorded these landscapes but it is anticipated this will be done over the next few years;

11. **NVIS major sub-groups:** The Australian Government through its Department of Environment and Heritage (DEH) has developed a list of major vegetation sub-groups covering Australia (ESCAVI 2003). This is part of a program to describe the vegetation of Australia (NLWRA 2001). For each data entry one of the NVIS sub-groups is selected from a lookup table. Using the report menu it is possible to report all NSWVCA communities for any of the NVIS sub-groups;

12. **Forest type (RN 17):** A typology of NSW forest types was published in Research Note 17 by the NSW Forestry Commission of NSW (1989). Forest types had been developed over 50 years, mainly aimed at classifying and mapping commercial tree species for forestry purposes. For each data entry in the database, one or more forest types are selected from the list of 235 forest types in Research Note 17. A qualifying attachment to each community data entry records whether the community is considered to be equivalent (E) to the forest type or is part (P) of a number of communities that would comprise the forest type. In most cases the communities in this classification are more finely classified than forest types, especially for inland NSW;

13. Characteristic trees: Trees are woody plants that are generally single stemmed and greater than 2 m high (Walker & Hopkins 1990). Eucalypt 'mallee trees' are included in this field if they contain a main stem that often develops in mallee that has not been burnt for decades or mallee growing on clayey soils. Up to 15 tree species can be listed for each community. The species are selected from a drop down table of all current plant species names in NSW in the Species Table in the database. The selected species are derived from the best available quantitative or qualitative data. They include dominant species or species with high fidelity to the community;

14. Characteristic shrubs/vines/epiphytes: Shrubs/vines and epiphytes are defined in (Walker & Hopkins 1990). For the purposes of this classification shrubs listed in this mid-layer are woody plants >0.5 m high, often multi-stemmed at the ground or if singled stem less than 2 m high. Woody vines such as Wonga Vine (*Pandorea pandoreana*) are listed in the same stratum as shrubs because they usually occupy mid-level space in vegetation structure. Up to 20 species can be listed in this field for each community. The species are selected from a drop down table of all current plant species names in NSW in the Species Table in the database. The selected species are derived from the best available quantitative or qualitative data. They include dominant species or species with high fidelity to the community;

15. Characteristic groundcover: Ground cover includes low shrubs less than 0.5 m in height along with most grasses, sedges, rushes, forbs, ferns (see life form definitions in Walker & Hopkins 1990) and decumbent climbers such as species of *Convolvulus* or *Glycine*. Up to 30 species can be listed in this field for each community. The species are selected from a drop down table of all current plant species names in NSW in the Species Table in the database. The selected species are derived from the best available quantitative or qualitative data. They include dominant species or species with high fidelity to the community;

16. Characteristic weed species: Up to 10 major exotic weed species or non-indigenous native weed species, documented from a listed community, can be recorded. They are selected from a drop down list of the Species Table that contains current NSW plant species names. The selected weed species are derived from the best available quantitative or qualitative data. A weed species may be any life form and occur in any layer of the vegetation;

17. Weediness: Select from a drop down table the average estimated degree of weediness per sample point for each community. This table combines percentage cover with proportion of the total flora. The options for selection are:

- Low (<5%) with <10% cover
- Low (<5%) with 10–30% cover
- Low (<5%) with >30 % cover
- Medium (5–15%) with <10% cover
- Medium (5–15%) with 10–30% cover
- Medium (5–15%) with >30% cover
- High (15–30%) with <10% cover
- High (15–30%) with 10–30% cover
- High (15–30%) with >30% cover
- Very high (>30%) with <10% cover
- Very high (>30%) with 10–30% cover
- Very high (>30%) with >30% cover
- Data deficient
- Not accessed

Weed species numbers vary considerably in many communities with the seasons (e.g. flushes of spring annual weeds). This listing should take all seasons into account. Note that weed species are defined as species that are not indigenous to a plant community. They are mainly exotic species but may include native species that have become weeds outside their normal range. The so called 'native woody weeds' of the inland plains are not considered weed species because they are within their natural range but for undetermined reasons have increased in abundance;

18. Threatened plants: List of plant species listed under the NSW Threatened Species Conservation Act 1995 or species that are otherwise considered to be regionally significant are documented for each community from the literature or expert advice. The data will improve over time.

19. Threatened fauna: List of species of fauna that are listed under the NSW Threatened Species Conservation Act 1995 or other species that are otherwise considered to be regionally significant that occur in the community. Such lists are derived from the literature, expert advice or predictive modeling. The data will improve over time. Unlike with threatened plant species, vertebrate fauna are listed by common name due to the standard of world-wide common name naming systems available for such taxa.

20. Mean native species richness: A figure is recorded if quantitative plot data allows mean native species richness to be calculated from plots sampled in a community. This is often determined in vegetation surveys. The plot size used in this analysis is also noted;

21. Characteristic species qualifiers: An attached lookup table has three qualification options: 'based on quantitative data', 'based on qualitative estimate', 'based on a combination of quantitative data and qualitative estimate'. One of these is selected based on the origin of the information used to list the characteristic species;

22. Authority(s): This field records sources of information used to define the classified plant community. These sources also provide much of the information on the species composition, distribution and extent of the

community. It is analogous to the authorship of species except in this community classification there are often many references. These references include regional botanical surveys, maps, site-specific project reports or papers. Comment is provided as to whether a listed community is equivalent to or part of a particular map unit or floristic group in a referenced source;

23. Authority qualifiers: Depending on the nature of the source data, select one of the following qualifications: 'based on quantitative data', 'based on expert opinion', 'based on a combination of expert opinion and quantitative data';

24. References: There are two fields in the database titled 'Reference'. The first reference field is the reference list field. It is adjacent to the 'Authority' field in the main screen because most references for each record relate to the Authority field. Selecting the 'Reference' key raises the Reference Table as a drop down file. This table increases as new references are typed into it as the classification proceeds or is revised. A relevant reference in the Reference Table can be selected and its number will appear in this reference field while the full text of the reference (linked to this number) appears in the Reference field at the end of the data entry screen. These full text references are therefore positioned as the last paragraph in reports generated from the database. New references can be added to the Reference Table at this point by typing them into the screen provided. Each additional reference is automatically assigned a sequential number. References that are pertinent to other fields in the database (e.g. Fire Regime or Planning and Management) are also entered here. MS Access cannot order references into alphabetical order. However, this can be done through an export/import routine from Access to Excel and return to Access that has been developed for maintaining the database;

25. Interstate equivalents: This field lists ecological communities, vegetation map units or floristic groups in other Australian States or Territories, that appear from floristic descriptions, to correspond to a listed NSW plant community. Key sources of interstate classifications include Sattler & Williams (1999) for Queensland ecosystems, Ecological Vegetation Classes for Victoria and South Australian vegetation map units. In some cases there is no interstate equivalent – e.g. for restricted communities or communities in central NSW. Inter-jurisdictional comparison requires expert judgment. If plot data were available it may be possible to refine this through cross-border data compilations and data analyses of data;

26. Classification confidence level: Lookup table with descending scale of confidence – high (1), medium (2) and low (3). These confidence ratings relate to the completeness of the data on the listed community (for example, only part of its range may have been mapped or surveyed), the level of analyses that were undertaken on the available data and the degree of expert agreement on the classification. An example of a high confidence level (1) is where floristic survey and/or fine scale vegetation mapping have defined a plant community. A medium confidence level (2) would include a situation where a plant community has been consistently mapped and referred to in several publications but may be under-supported by plot data or fine scale mapping. A low confidence level (3) is assigned to a plant community that has no or little plot data and or mapping covering it, and is ill-defined in the literature, but enough is known about it to suggest it may prove to be definable with more investigation;

27. Level of classification: In addition to listing vegetation structure classes (see fields 28 and 29 below), the database contains an option to list one of three levels of classification: *sub-formation, association, sub-association.* Selecting the 'Details' key adjacent to this field raises a lookup table that provides definitions of these categories. The three classification levels are based on the definitions in Beadle & Costin (1952) and the National Vegetation Information System developed under the vegetation theme of the National Land and Water Resources Audit (NLWRA 2001). Assigning a community to a level of classification takes into account the overall species variation in the community in all strata. If the described community contains a high degree of consistency in all strata it will be listed as a sub-association or association. If the community contains significant species variation, often over a large geographical area, it will be assigned a sub-formation level. The aim of this project is to list vegetation to the 'association' level as defined. It is anticipated that communities listed as 'sub-formation' will be split into two or more 'associations' in the future with floristic data analysis and finer scale mapping.

The definitions to guide the three levels of classification are:

Sub-formation: *A group of floristically related associations of similar structure ('alliance' in Beadle & Costin 1952), or, a community with shared dominant growth form, cover, height and broad floristic code usually dominant Genus and Family for the three traditional strata (upper, mid and ground) (NLWRA 2001).*

Association: *A community of which the dominant stratum has a qualitatively uniform floristic composition and which exhibits a uniform structure ('association' Beadle & Costin 1952), or, a community with shared dominant growth, height, cover and species (3 species) for the three traditional strata (upper, mid and ground) (NLWRA 2001).*

Sub-association: *A sub-division of an association determined by a variation in the most important subordinate stratum of the association, without significant qualitative changes in the dominant stratum ('sub-association' in Beadle & Costin 1952), or, a community with shared dominant growth form, height, cover and species (5 species) for all layers/strata (NLWRA 2001).*

28. Rainforest structure: This field only applies to plant communities that are deemed to be rainforest. This is a text field that summarises the structural typologies outlined in Webb (1968), summarized and coded in Walker & Hopkins (1990). These typologies include forest complexity, leaf size, floristic composition of the tallest stratum, indicator growth forms, height and crown cover classes (as per fields on 'Structure' and 'Height class' below), emergent species and sclerophyll species in upper stratum;

29. Structure: This uses the growth form and canopy crown separation ratio definitions in Walker & Hopkins (1990) to define structural classes. For example, if the vegetation is dominated by shrubs that are 'clearly separated' (crown separation ratio of 0.25–1), and the shrubs are generally 1–3m high, then the vegetation structure is 'tall open shrubland'. Structural description is often used in the common name description of the plant community (see field 2 above). The structural classes are set out in Tables 14a and 14b in Walker & Hopkins (1990) which are reproduced as tables A and B in the database that are accessed by entering the 'Structure' field key. In some cases, floristically similar vegetation can contain more than one type of structural class due to natural variation or disturbance in the community. For example, a community may exhibit denser but shorter re-growth after a disturbance such as fire, flood or clearing. This variation in structure is accommodated by selecting multiple entries from the Structure Tables A and B;

30. Height class: Enter one or multiple entries from the lookup table of height classes in the database for the life form of the highest stratum in the listed plant community. Height classes can only be selected by examining table 15 in Walker & Hopkins (1990) that lists height classes for the different life-forms. So a 'tall' entry for a community dominated by trees requires a different average height than a 'tall' entry for a shrubland or grassland;

31. Vegetation description: This is a concise one paragraph summary of the plant community. It summarizes the plant species composition, structure, physiographic features, distribution, threats and conservation status of the community. It is compiled after the other fields of database are completed. It is envisaged that this vegetation summary would be suitable for use in summary reports or educational literature especially if it were accompanied by a photograph and caption of a community;

32. Mapped or modeled: A selection is entered from a lookup table that contains the following options:

a. Current extent mapped or modelled;

b. Current extent mapped or modelled as part of a broader type;

c. Current extent not mapped or modelled;

d. Current extent partly mapped or modelled;

e. Current and pre-European extent mapped or modelled;

f. Current extent and part of pre-European extent mapped or modelled;

g. Pre-European extent and part of current extent mapped or modelled;

h. Pre-European extent partly mapped or modelled;

i. Pre-European extent mapped or modelled as part of a broader type;

j. Pre-European extent mapped or modelled.

33. Mapping information: This field allows for a text description of vegetation mapping information. It also allows for 'map ability' for each community to be discussed. Some listed plant communities are not easily mapped due to scale or problems in their definition using remote sensing — examples being narrow riparian vegetation and grassland communities. In the future, links to vegetation maps on geographical information systems could be attached to either this field or the previous field so the user could display maps containing a particular plant community;

34. Adequacy of plot sampling: Select one of the following options:

N = no sampling known;

I = inadequate sampling: less than 70% of the range of the community has been sampled and/or sampling is considered to be too scattered to cover major variations in the community;

A = adequately sampled; sampling covers >70% of range of community and the plots are of sufficient density to cover major variations in the community;

NA = not assessed.

Selection is dependent on expert opinion based on the number of plot samples in the community, the quality of the sampling and the coverage of the sampling;

35. Climatic Zone: From a drop down list of their names, select one or more of the nine climate zones covering NSW (see Figure 3) that overlap with the distribution of the community. These climatic zones have been derived from combinations of rainfall and temperature,

36. Interim Biogeographic Regionalisation for Australia (IBRA): Select one or more IBRA Bioregions from a lookup table that lists the 18 IBRA Bioregions (Thackway & Cresswell 1995, Version 6.0) occurring in NSW. Multiple entries of bioregions are often required because some plant communities occur in more than one bioregion. In addition to listing the bioregions where a community occurs, it is possible to qualify the extent its current extent in each bioregion by applying a tag to the data entry of >70% or 30–70% or 1–30%;

37. IBRA sub-region: The 18 IBRA Bioregions that occur in NSW have been subdivided into 129 sub-regions by the NSW Department of Environment and Conservation (2004). This provides a finer scale breakup of the State

that can be useful in describing the distribution of plant communities. Plant communities may occur in more than one sub-region, therefore multiple entries of sub-regions are possible. A proportion of current extent >70% or 30–70% or 1–30% is attached to each entry;

38. Botanical Division: These divisions of NSW are based on Anderson (1961). They have long been used by botanists and the National Herbarium of NSW to describe plant species distributions. Select one or more of the Botanical Divisions from a lookup table. A proportion of current extent >70% or 30–70% or 1–30% is attached to each entry;

39. Local Government Area (LGA): Select one or more LGAs from lookup table that lists all Local Government Areas in NSW. A proportion of current extent >70% or 30–70% or 1–30% is attached to each entry;

40. Catchment Management Authority areas (CMAs): Select one or more CMA from a lookup table that lists the 13 CMAs in NSW. A proportion of current extent >70% or 30–70% or 1–30% is attached to each entry. The catchment boundaries are those listed in the 2003 revision of the NSW Catchment Management Act. It is likely these boundaries will remain for some time. A majority of natural resource management funding is being directed towards meeting actions and targets set in CMA management plans;

41. Murray-Darling Basin: Tick the field in the database if the community occurs in the Murray- Darling Basin in NSW. Leave field blank if the community does not occur in the MD Basin. The reports state 'yes' or 'no'. This data entry facilitates the report of all communities in the MD Basin;

42. Substrate mass: Select one or more substrate mass types from a lookup table that contains the generic classification of Australian substrate masses from Table 29 in Speight & Isbell (1990);

43. Lithology: Select one or more lithological types from a lookup table that contains a list of lithological type of rock material and unconsolidated material from Table 27 in Speight & Isbell (1990);

44. Great Soil Group: Select one or more Great Soil Groups (GSG) from a lookup table that contains a list of Australian Great Soil Group categories from *The Handbook of Australian Soils* (Stace et al. 1968). Modifications have been made to this classification since it was produced but it is recorded because of its history of application in the field by soil scientists and botanists;

45. Soil texture: Select one or more soil texture classes from a lookup table containing soil texture grades as described in McDonald & Isbell (1990);

46. Landform pattern: Select one or more landform patterns from a lookup table containing the list of landform patterns described in Speight (1990);

47. Landform elements: Select one or more landform elements from a lookup table containing the list of landform elements described in Speight (1990);

48. Land use: Select one or more options from a lookup table containing the terms: grazing, cropping and horticulture, timber production, urban, water storage, nature conservation. The rule for selection is that it is measured or estimated that >10% of the pre-European extent is now used for one or more of these land uses;

49. Impacts of European settlement: Multiple selection from lookup table containing the options:

a. Major reduction (>70%) in extent and /or range
b. Medium reduction (30–70%) in extent and/or range
c. Minor reduction (<30%) in extent and/or range
d. Increased extent/range
e. Dieback due to disease or senescence
f. Older age class over most of distribution
g. Younger age class over most of distribution
h. Major alteration of species composition
i. No significant impacts known

50. Pre-European extent (ha): Record a measured or estimated pre-European extent in hectares of the plant community based on the best available information including mapping, modeling or expert advice;

51. Pre-European accuracy: This applies an accuracy rating to the pre-European extent figure. Select an accuracy level from a lookup table containing the accuracy options of 10%, 30% 50%, 70% or 90% that applies. For example, a 30% accuracy about 1000 ha implies a range of 700 to 1300 ha;

52. Pre-European qualifiers: This gives an indication how the pre-European extent figure was derived with the options being:

- Estimated from extant vegetation maps: full range
- Estimated from extant vegetation maps: part range
- Estimated from pre-European map: full range
- Estimated from pre-European map: part range
- Expert estimate not based on any mapped vegetation
- Modelled from sound plot or polygon data

53. Pre-European comments: Comments on the pre-European extent figure describing any qualifications about the figure;

54. Current extent (ha): Record a measure or estimate for the current extent in hectares of a plant community based on the best available information including mapping, models and expert advice;

55. Current extent accuracy: This applies an accuracy rating to the current extent figure. Select an accuracy level from a lookup table containing the accuracy options of 10%, 30% 50%, 70% or 90% that applies. For example, 10% accuracy about 1000 ha implies a range of 900 to 1100 ha;

56. Current extent qualifiers:

- Measured from map of extant vegetation
- Estimated from mapped extant vegetation: full range
- Estimated from mapped extant vegetation: part range
- Estimated from broadly classified current extant vegetation map
- Estimated from pre-European map: full range
- Estimated from pre-European map: part range
- Expert estimate
- Modelled from sound plot data over unclassified map of extant vegetation

57. Current extent comments: Comments on the current extent figure describing any qualifications about the figure;

58. Percent remaining: The database automatically calculates this percentage by dividing the 'Current extent' (field 54) by the 'Pre-European extent' (field 50);

59. Percent remaining accuracy: This places an accuracy level around the percent remaining statistic. It is derived from the mid-points of the accuracy ranges that are calculated from the pre-European and current extent estimates. The results are a conservative accuracy calculation;

60. Degree of fragmentation: Using mapping data or expert opinion, select one of five options from a lookup table:

- Contiguous stands with high connectivity with >60% extent remaining and low edge to area ratio
- Human induced fragmented stands with 30–60% extent remaining and moderate edge to area ratio
- Human induced highly fragmented small stands with <30% extent remaining and high edge to area ratio
- Naturally fragmented, disjunct stands of variable patch sizes with >50% extent remaining
- Naturally fragmented, disjunct stands of variable patch sizes with <50% extent remaining;

61. Recoverability: Select one of six options from a lookup table by considering the average recoverability of a plant community. These categories range from 1 near pristine to 6 ecosystem totally destroyed (based on McDonald 1996):

1. Healthy, structure and composition intact. Insignificant indicators of degradation. Likely to continue in good health if maintained;

2. Moderate health as structure and/or composition altered. Likely to recover considerably if causal factors and secondary impacts removed;

3. Poor health as structure and/or composition significantly altered. But sufficient biota remain for natural regeneration if causal factors and their secondary impacts removed and dynamic processes reinstated;

4. Very poor health as structure and/or composition severely altered. Insufficient biota remain for natural regeneration except some ruderal species;

5. Nil native vegetation remaining but substrate conditions still suitable (or able to be amended) for pre-existing plant community;

6. Nil native vegetation and substrate conditions no longer suitable (or able to be amended) for pre-existing plant community.

Factors that should be taken into account in ranking recoverability are:

- Degree of fragmentation;
- Regeneration success of a range of plant or animal species;
- Loss of structural complexity in overstorey and understorey due to grazing, logging or other impacts;
- Estimate of relative species richness compared to what it may have been before European settlement;
- Condition of ground litter and lichen crust layer;
- Degree of senescence of vegetation due to age, dieback, salinity or other factors.

In some areas the only native vegetation that remains is in "poor condition". This may have the potential to improve in condition with management. It may also play key roles in maintaining ecological processes such as reducing saline water tables and forming links between remnants in better condition.

An example of vegetation in category 1 would be a Sydney sandstone plant community that is well protected in reserves, contains few weeds and is being managed with appropriate fire regimes to maintain its species richness over time.

An example of vegetation in category 3 would be an inland box woodland plant community that has been extensively cleared and is highly fragmented, contains many weed species, has a depleted floristic composition due to grazing pressures but where regeneration of many species could occur if there were controls over some key threatening processes;

62. Threatening processes: A text description of the most important threatening processes that affect the community;

63. Threatening processes lookup: Select one or more types from a lookup table containing these options:

- Acid soils due to fertilizer use;
- Acid sulphate soil pollution;
- Age class of woody vegetation;
- Clearing for agriculture;
- Clearing for pine plantations;
- Clearing on small lots: hobby farms;
- Climate change;
- Disease and/or dieback (abnormal);
- Dryland cropping;
- Firewood collection;

- Herbicides, pesticides or other chemical pollution;
- Hydrology: disruption of natural flooding regimes;
- Hydrology: drainage;
- Hydrology: impoundment;
- Inappropriate fire regimes;
- Irrigated cropping;
- Major impacts on structure due to logging;
- Mining or quarrying;
- Nutrient changes through fertilizers or runoff;
- Over harvesting or collecting of key species;
- Phytophthora dieback;
- Recreation over-use;
- Salinity;
- Sedimentation;
- Soil erosion, water: gully, tunnel, landslips;
- Soil erosion, water: sheet erosion;
- Soil erosion, wind;
- Unsustainable grazing and trampling by stock;
- Unsustainable grazing by introduced animals;
- Unsustainable grazing by native animals;
- Urban or industrial expansion;
- Weed (exotic) invasion;
- Woody shrub (native) invasion.

64. Variation and natural disturbance: Description of floristic variation in the community and natural disturbances that affect successional stages and species composition;

65. Adjoining communities: Description of communities that adjoin the listed community;

66. Fire regime: Description of known or postulated fire regimes for the appropriate management of the community and comments on the impacts of fire on the community. In most cases appropriate fire regimes are unknown. However, aspects of fire ecology may be documented in the literature. References to the literature should be entered in the Reference field. General guidelines on fire management for broad vegetation classes in NSW is provided in Kenny et al. (2003);

67. Area in conservation reserves (ha): Conservation reserves are defined as areas that meet the World Conservation Union (IUCN) criteria as Protected Area categories I to IV (see http://www.ea.gov.au/parks/iucn.html for the IUCN protected area definitions). In NSW this is interpreted to include reserves managed by the NSW Department of Environment and Conservation (DEC) being National Parks, Nature Reserves, Karst Conservation Areas, State Conservation Reserves, Aboriginal Areas, Historic Sites, Declared Wilderness, Regional Parks and lands purchased by and held by the NSW DEC with the anticipation of them becoming reserves. It also includes all NSW State Forests Flora Reserves. With the exception of the acquired lands, these reserves cannot be revoked without the consent of the NSW Parliament.

All NSW conservation reserves are listed in the Reserves Table in the database that also includes their gazette area and GIS calculated area (these often vary by a small percent for a number of reasons). The NSW DEC reserves are kept up to date through regular GIS editions exchange with the Parks and Wildlife Division of DEC. Alterations to the Reserves Table are made when there are new reserves, amalgamation of reserves or reserves that have name changes. The extent of plant communities in reserves is derived from GIS inquires if there are digitized vegetation maps, the literature or field checks. The literature includes vegetation maps, survey reports or expert knowledge. Most reserves contain more than one plant community, with many containing over 10. After determining that a community occurs in a reserve, its measured or estimated area is entered into the database in the following way: select the reserve name from the table of conservation reserves on the screen, add the extent (hectares), then tag the data entry with an accuracy code M to E4 depending on the reliability of the data. Entering the 'Code Accuracy' key highlights the definitions of the accuracy code tag assigned to each data entry. These are:

M: measured from detailed mapping or ground checking with >90% accuracy;
E1: estimated from mapping or ground checking with 90–70% accuracy;
E2: estimated from mapping or observations with 70–50% accuracy;
E3: estimated from mapping or reports with 50–30% accuracy;
E4: estimated from poor information with <30% accuracy.

An example of M is where a reserve's vegetation has been plot sampled, classified and mapped in detail at a fine scale. An example of E4 is where no, very coarse or unreliable survey data or vegetation mapping covers a reserve but where anecdotal evidence suggests a community occurs there. Such evidence may include expert opinion or uncorroborated field notes. E1 to E3 range between these extremes. It is up to the data entry person to make a judgement on reliability depending on the quality of information available for the reserve or secure property agreement.

Note: changing areas previously recorded in conservation reserves (and secure property agreements, see below) should only be done by the database administrator. This is done by either pressing the 'clear' key adjacent to the conservation reserves lookup table and re-entering all areas again (after noting them down separately), or by going to the Main Table in the database and manually adjusting several fields associated with the areas recorded. One needs to then return to the Main Details form and press the two sum keys to calculate the new percentages protected.

68. Total area reserved: The database automatically sums the areas protected in all reserves to deliver a total area reserved figure;

69. Number of representations in reserves: The database automatically calculates the number of representations of reserves for each plant community;

70. Explanation of protected areas: A text description of the sources supporting the data entries in the protected area fields (reserves, secure property agreements). This may include references to the literature. Sometimes this may explain why one extent estimate or measurement, for a particular plant community in a protected area, was favoured over another;

71. Area in secure property agreements (ha): The area in hectares protected under secure 'non-reserve' property agreements. These qualify as IUCN protected area category VI (see definitions at http://www.ca.gov.au/parks/iuen.html) and include:

1. Property Agreements entered into under the NSW Native Vegetation Conservation Act 1998 or under the NSW Vegetation Management Act 2003 that are bound to the title of the land, protect native vegetation and are in perpetuity (legally this implies running for 99 years);

2. Conservation Agreements (VCLs) entered into between landholders and the NSW Department of Environment and Conservation (DEC) under the NSW National Parks and Wildlife Act 1974;

3. Long term property agreements entered into under the NSW Nature Conservation Trust Act 2001;

4. Properties owned and appropriately managed for nature conservation by private conservation organizations such as the Australian Bush Heritage Fund or the Australian Wildlife Conservancy.

Short term property agreements or lease conditions under certain NSW Government leasehold land (such as Western Lands Leases) are not considered to meet the IUCN (1994) criteria as secure protected areas

The extent of plant communities in each secure property agreement was calculated by interrogating information on NSW DEC and NSW DNR databases and/or overlaying digitized GIS vegetation maps over the property agreement boundaries. As with data entries for conservation reserves each entry is tagged with a reliability code.

Note. In order to maintain confidentiality, the names of private properties under property agreements are not entered into the database. Rather, the codes used by NSW Department of Natural Resources, NSW DEC or the NSW Nature Conservation Trust are used to identify the agreement. However, place names may be used where property agreements cover public land, such as a cemetery or a roadside reserve;

72. Total area under secure property agreements (ha): The database automatically sums the areas entered for listed property agreements to deliver a total area protected under secure property agreements;

73. Number of representations in secure property agreements: The database automatically calculates the number of representations in secure property agreements for each plant community;

74. Total area protected (ha): The database automatically sums the areas in reserves (field 68) with the areas in secure property agreements (field 72). This yields a sum in hectares of all protected area occurrences for each listed plant community;

75. Total area protected accuracy (ha): A separate key allows for the recording of an accuracy assessment to the total area protected figure. The options are 10%, 30%, 50%, 70%, 90% accuracy;

76. Protected pre-European extent (%): This percentage is calculated automatically in the database by dividing the total area protected (field 74) by the pre-European extent (field 50);

77. Protected current extent (%): This percentage is calculated automatically in the database by dividing the total area protected (field 74) by the current extent (field 54);

78. Total representations in protected areas: The database automatically calculates this by adding the total representations in reserves (field 69) to the total representations in secure property agreements (field 73);

79. Protected area code: Select one of 15 codes provided in tables on screen by using two pieces of information. Firstly, from the 'pre-European extent field' (field 50) determine whether, at the time before European settlement (1750), the community was 'common' (>10 000 ha), 'restricted' (1000–10 000 ha) or 'rare' (<1000 ha). This determines whether to use the codes 'a', 'b' or 'c' below. Apply the percentage calculated in the 'Protected pre-European extent' field (field 76) to select one of 15 options (1a–5a, 1b – 5b or 1c – 5c) from the lookup table in the database. The rarer the community the greater the proportion needs to be protected to achieve a protected area adequacy target. The 'A' for adequate or 'I' for inadequate qualifications are selected to reflect the adequacy of sampling in protected areas of the community across its distribution. The 15 protected area adequacy codes are:

a. Common communities (>10 000 ha in 1750)

* 1a = >25% in protected areas
* 2a = 15–25% in protected areas
* 3a = 5–15% in protected areas
* 4a = 1–5% in protected areas
* 5a = <1% in protected areas

and either

A = adequately represented in protected areas across range
I = inadequately represented in protected areas across range.

b. Restricted communities (>1000 <10 000 ha in 1750)

* 1b = >50% in protected areas
* 2b = 31–50% in protected areas
* 3b = 15–30% in protected areas
* 4b = 5–15% in protected areas
* 5b = <5% in protected areas

and either
A = adequately represented in protected areas across range
I = inadequately represented in protected areas across range.

c. Rare communities (<1000 ha in 1750)

* 1c = >75% in protected areas
* 2c = 50–75% in protected areas
* 3c = 30–50% in protected areas
* 4c = 15–30% in protected areas
* 5c = <15% in protected areas

and either
A = adequately represented in protected areas across range
I = inadequately represented in protected areas across range.

Notes: The Protected Area Code provides only a summary of the protected area status of a community. It is not a threat code – that is provided in Field 81 below. The JANIS (1997) criteria on assessing the protected area status of ecological communities could be applied to the proportion protected compared to pre-European extent. This would imply that a 'moderate' protected area status would only be achieved at percentage protected levels 3a, 3b or 3c in the tables above. However, even if a community is relatively well represented in protected areas, there may be justifiable reasons to protect more sites from disturbance because they may be in sound condition in terms of their floristic composition, structure and degradation indicators. Such patches of vegetation may be important for landscape protection such as mitigating salinity or soil erosion, contain variations in floristic variation or because they contain habitat of a threatened species;

80. Key sites for protection: Text description of documented or predicted areas or sites considered to be important to improve the protection status of a plant community. Often this will be based on expert knowledge or recommendations in botanical survey reports;

81. Threat category: Select one category from a lookup table with the following options:

* X = presumed extinct (totally destroyed);
* CE = critically endangered;
* E = endangered;
* V = vulnerable;
* NT = Near threatened;
* LC = least concern (common and generally well conserved);

These threat categories mirror those applied by the World Conservation Union to species (IUCN 2001). They are defined in Appendix B of this paper and are available to users of the database through the 'Full Details' key adjacent to the Threat Criteria field. The 'Full Details' key raises a MS Word document which contains descriptions of the threat categories and a table listing six threat criteria that are used for ranking each community into one of the threat categories.

82. Threat criteria: Multiple entries of the threat criteria 1–6 are recorded based on the descriptions of these criteria in Appendix B of this paper. The adjacent Full Details key raises the Word file that describes the threat criteria; The threat criteria include: remaining extent relative to estimated pre-European extent thresholds; original rarity; rate of decline of extent; loss of key species; relative condition; and, if analysis is available, predicted loss of area and condition. The user needs to read the threat criteria before applying a threat category to community;

83. Threat/protected area adequacy code: This is a summary code of the threat and reservation status of each community that is automatically generated by combining the 'Threat category' field (field 81) with the 'Protected area adequacy' field (field 79). For example, a threat/protected area code of E/5a implies the community is Endangered and <1% of its pre-European extent is in protected areas and that it covered >10 000 ha in pre-European times. A LC/3b implies a community is of Least Concern in terms of threats, 15–30% of its pre-European extent is in protected areas and it was a 'Restricted' community that occupied 1000–10 000 ha in pre-European times. Once a user of the database is familiar with the 'Threat status' and 'Protected area adequacy' codes, the combined 'threat/protected area adequacy' code yields a summary about the status of a plant community;

84. Planning controls: The database contains keys for the NSW State Environmental Planning Policies SEPP 26 (littoral rainforest) and SEPP 14 (coastal wetlands). Additions could be made to this list;

85. Planning and management: Descriptive text field wherein planning regulations and management issues are discussed relating to the conservation of the plant community. This is the appropriate field in the database to discuss whether Catchment Management Plans or Local Environmental Plans are affording protection to the listed plant community. A general discussion on management of the plant community can also be inserted here;

86. Listed under legislation: Select one or more options from a lookup table if the community is listed, preliminary listed or nominated for listing as a threatened community under the Australian Government's Environmental Protection and Biodiversity Conservation Act (EPBC

Act 1999) or the New South Wales Threatened Species Conservation Act (TSC Act 1995);

87. Recovery plan: If a recovery plan exists for a plant community this is recorded by selecting the 'yes' key. An 'Add Plan' key is highlighted and pressing this highlights the Reference field (field 24) where the title of the recovery plan can be entered and saved to the Reference Table. The reference is automatically copied to the reference list that appears at the end of each record.

88. Recovery plan status: Select from a lookup list of options: 'exists', 'in preparation', 'not required', 'required'. If a plant community is critically endangered or endangered it is considered that a recovery plan should be required to be prepared to focus attention on it.

89. Photograph fields: Up to three images of each plant community can be accessed via the three keys View Photo 1, View Photo 2 and View Photo 3 situated at the top of the Main Details form in the database. MS Access functions poorly when images are embedded in it. To overcome this problem a file titled 'Images' has been established in parallel with the database. Where photography is available, up to three photographs are scanned for each plant community. Each image is labeled in the field titled 'Photo file name'. The labels of each image reflect the origin of that image in a master catalogue of images and information on each image held at the Botanic Gardens Trust. This allows the original digital photo or colour slide to be traced if necessary. For example, ID71a_img343pc.jpg is the label in Photo 1 of the community ID71 Carbeen woodland. The 'img343' section of this label indicates the original photograph was a colour slide that was scanned as number 343 scan. Most jpg images have been derived from high resolution TIFF images for use in publications. A caption is provided for each image linked to the database. The 'Photo caption' fields contain the captions for each image. This caption contains the vegetation community number, main species, location, latitude/longitude if known, date of photograph and photographers name. Some plant community records may not have photos, or less than three. If a photo button is selected and there is no photo linked to it a message appears stating 'there isn't a (first, second or third) photo attached to this record';

90. References: This last field contains the full text of all the references that have been entered via the Reference field (field 24).

Software limitations

Exporting from MS Aecess to MS Excel results in the truncation of fields with more than 255 characters displayed in the Exeel cells, however the data is aetually there and can be retrieved. It is best to use MS Exeel to import the Main Table from the MS Aecess database rather than export to Excel. Importing from MS Excel imports all data.

The best means of exporting records generated in the PDF Reports is to use the PDF995 writer software supplied. These PDF reports can be searched but unless you have access to pdf editing sotware, the document can not be edited and copied. If the PDF document is not correctly formatted and produces an extra page at the end of each record, try changing the PDF995 page size by going to Printers in Control Panel or Printers and Faxes in Start/Settings and select the 'PDF995' printer driver. Select Printer/Properties/ Printing Preferences.../Advanced... and change Paper Size: to A4 and select OK.

The MS Word reports are accessed through the 'Word Reports' option on the Administration Menu. This report option does **not** automatically include images. Images have to be manually transferred into documents from the Images folder. Also, there is a software limitation to MS Word reports. Records larger than about 17,000 characters fail to report in the 'Word Reports' due to limitations in the size of document that MS Word can merge. This applies to long records when selecting 'yes' to list full references. If the database is loaded into any directory other than either the C:\vegclass or D: \vegclass directories, some references will be truncated to keep the reports below the MS Word merge limit and a comment 'References Truncated' is printed at the end of each record. Due to a bug in Microsoft Service Pack 3, PCs using this Service Pack will need to load the database into either the C:\vegclass or D: \vegclass directories, otherwise the Word Reports will fail to operate. Therefore, Microsoft Service Pack 3 users using the 'Word Reports' will only be able to report the first 2,500 Reference characters when generating any of the full reports that include full references.

Italic font: While it is possible to apply italic font to all text in a field in MS Access (e.g. to the characteristic species fields), it is not possible to mix italic and standard fonts in fields where both are required (e.g. the Vegetation Description field that includes scientific names). Therefore, the scientific names of plants are not italicized in the Reports from the database for some fields.

Read only version of NSWVCA

To ensure that different users do not change the data, tables, forms, reports or the programming in the database, most issued CD copies of the database will be a 'read only' version. This allows the user to view all of the plant community records in the data entry screen, use the report options and use the search module, but it restricts access to the database's 'backend', preventing the use of the query mode to generate queries involving combinations of fields. Full versions of the database that allow access to the query mode will be issued by the Botanic Gardens Trust, Sydney under license conditions and for a fee (see Botanic Gardens Trust web site for details www.rbgsyd.gov.au). Over the longer term, the database may be plaeed on the internet in such a eonfiguration that users will be able to use the query mode. Any changes that users of

the vegetation classification and the database consider should be made should be submitted to the Database Administrator using the *Feedback.doc* proforma that is accessed from the top of the data entry screen in the database or from the file *feedback.doc* that is one of the files that comprises the NSWVCA database system.

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Appendix B. Threat Categories and Threat Criteria Guidelines for Assessing the Threat Status of Plant Communities in NSW

The NSW Threatened Species Conservation Act 1995 (TSC Act 1995) and the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) are able to list ecological communities as critically endangered, endangered or vulnerable.

Comprehensive threat categories and threat criteria guidelines have been developed to assess the status of ecological (particularly plant) communities. They are similar to the EPBC Act 1999 regulations 7.06 2e and 7.02 and associated guidelines for nominating ecological communities. However, two threat categories, Near Threatened and Least Concern, have been added to the Critically Endangered, Endangered and Vulnerable categories used in the EPBC and TSC Acts. This five category system reflects the threat categories used for species in IUCN (2001). Besides EPBC 1999 guidelines, the main sources used in developing these threat criteria were IUCN (2001); the criteria used to assess the status of Queensland ecosystems (Sattler & Williams 1999); and the criteria used to assess the status of the Ecological Vegetation Classes of Victoria (Victorian Department of Natural Resources 2001). The remaining extent thresholds in criterion 1 are based on the habitat reduction and fragmentation thresholds at which there is an apparent acceleration of species extinction as described in fragmentation theory (Andren 1994, Simberloff 1992, Fahrig 1997, With 1997). Much of this theory is based on declines of vertebrate species.

These criteria are designed to apply to plant communities and may not be transferable to mobile fauna assemblages. Criterion 4 deals with intactness of ecological integrity that is often labelled 'condition'. In many cases, this is difficult to judge due to the problem of establishing a pre-major disturbance (i.e. in Australia pre-European) benchmark for species assemblage, vegetation structure and edaphic factors for each classified ecological community.

The threat categories are defined in Section A. The criteria for each threat category are listed in the table in Section B. A description of the criteria and of the terms used in them is given in Section C.

Section A: Threat Categories

* **Presumed extinct (X)**

An ecological community is eligible to be included in the **presumed extinct** category if it has been totally destroyed, or so modified throughout its range, that it is unlikely to recover its species composition and/or structure in the *very long term*.

* **Critically Endangered (CE)**

An ecological community is eligible to be included in the **critically endangered** category, at a particular time if, at that time, it is facing a high risk of becoming extinct in the *immediate term*, as determined in accordance with the prescribed criteria.

* **Endangered (E)**

An ecological community is eligible to be included in the **endangered** category at a particular time if, at that time:

(a) it is not critically endangered; and

(b) it is facing a very high risk of becoming extinct in the *near term*, as determined in accordance with the prescribed criteria.

* **Vulnerable (V)**

An ecological community is eligible to be included in the **vulnerable** category at a particular time if, at that time:

(a) it is not critically endangered or endangered; and

(b) it is facing a high risk of becoming endangered in the *medium-term*, as determined in accordance with the prescribed criteria.

* **Near Threatened (NT)**

An ecological community is eligible to be included in the **Near Threatened** category at a particular time if, at that time:

(a) it is not critically endangered, endangered or vulnerable; and

(b) it is facing a high risk of becoming vulnerable in the *long-term* future, as determined in accordance with the prescribed criteria.

* **Least Concern (LC)**

An ecological community is eligible to be included in the **Least Concern** category at a particular time if, at that time:

(a) it is not critically endangered, endangered, vulnerable or of least concern; and

(b) it is **NOT** facing a high risk of becoming vulnerable in the *very long-term* future, as determined in accordance with the prescribed criteria.

Section B: Criteria for Assessing Status of Ecological Communities

The relevant consideration for a particular ecological community is whether any one criterion is met, not whether more than one or all criteria are met.

The definitions of terms provided in Section C should be used to assist with interpreting the criteria.

No.	Criterion	Threat Category And Definitions				
	Presumed Extinct	Critically Endangered	Endangered	Vulnerable	Near Threatened	Least Concern
1 Its decline in *geographical distribution* is:	**Total :** 100% decline in decline geographical distribution	**Very severe:** >90% decline in geographical distribution	**Severe:** 70–90% decline in geographical distribution	**Substantial:** 50–70% decline in geographical	**Moderate:** 30–50% decline in geographical distribution	**Minor:** less than 30% in geographical distribution
2 Its *area of occupancy* is:	**Eliminated:** totally destroyed from original area of occupancy.	**Very restricted:** total area of occupancy of < 1000 ha and significant degradation or destruction is continuing.	**Restricted:** total area of occupancy of 1000–10 000 ha and significant degradation or destruction is continuing.	**Limited:** total area of occupancy of 10 000–50 000 ha and significant degradation or destruction is continuing.	**Common:** total area of occupancy of 50 000–500 000 ha and only minor degradation or destruction is occurring.	**Widespread:** total area of occupancy of >500 000 ha and no significant degradation or destruction is occurring.
And the combination of depletion, degradation and continued threatening processes makes it likely that it could be lost in the:	NA (already lost)	immediate term	Near term	medium term	long term	very long term
3 For a population of a native species that is likely to play a major role in the community, there is on a regional basis a:	**Total decline:** demonstrated or estimated a total loss of the key species, with no regeneration occurring, and that the natural recovery of the species is unlikely to occur. Artificial revegetation is the only means of re-establishing the species.	**Very severe decline:** demonstrated or estimated a decline of >90% in the pre-European abundance of key species and no or very little recruitment is occurring, and recovery is unlikely over the *very long-term* unless the threatening processes are	**Severe decline:** demonstrated or estimated a decline of 70–90% of the pre-European abundance of key species, and little recruitment is occurring and that natural recovery is unlikely over the *long-term* unless the threatening eliminated.	**Substantial decline:** demonstrated or estimated a decline of 50–70% of the pre-European abundance of key species, and little recruitment is occurring and that natural recovery is likely over the *medium term* unless the threatening processes are substantially reduced or eliminated.	**Minor decline:** demonstrated or estimated a decline of 30–50% of the pre-European abundance of key species, and moderate recruitment is occurring and natural recovery is likely over the *near term* if the threatening processes are reduced. processes are reduced.	**Insignificant decline:** demonstrated or estimated a decline of <30% of the pre-European abundance of key species, and vigorous recruitment is occurring and there is no apparent threat of major decline in the key species or the community.

No.	Criterion	Threat Category And Definitions				
	Presumed Extinct	**Critically Endangered**	**Endangered**	**Vulnerable**	**Near Threatened**	**Least Concern**
4 The reduction in its integrity (condition and recoverability) across most of its *geographic distribution*, as indicated by loss of species and/or habitat structure, degradation of soils, changes in nutrient levels, or disruption of important community processes is:	**Destroyed:** integrity totally lost, community structure destroyed, a few species may survive as isolated individuals.	**Very severe:** many species extinct at most occurrences; major structural change including loss of some strata; edaphic processes severely degraded, exotic species abundant. *Regeneration* of substantial areas unlikely within the *long term* without the control of threatening processes.	**Severe:** many species extinct at some occurrences; structural change including loss or near loss of some strata; edaphic processes degraded, exotic species common. *Regeneration* of substantial areas is unlikely within the *medium term* without the control of threatening processes.	**Serious:** some species extinct from some occurrences; moderate structural change but most strata remain; edaphic processes often degradation, exotic species common. *Regeneration* is unlikely within the *near term* without the control of threatening processes.	**Minor:** few species extinct over its distribution; minor structural change with most of the strata remaining; edaphic processes near normal, exotic species uncommon and if present are not threatening the community. *Regeneration* of disturbed areas is likely within the *near term* with the control of threatening processes.	**Insignificant:** very few species extinct over its distribution; no or minor structural changes to strata and all of the original strata remain; edaphic processes functioning well, exotic species mostly absent or if present not a threat to the community. *Regeneration* not necessary as most of the community is relatively intact.
5 Its rate of continuing detrimental change is: As indicated by: (a) a rate of continuing decline in its *geographic distribution*, or populations of a native species that are believed to play a major role in the community, or (b) intensification, across most of its *geographic distribution*, of degradation, leading to disruption of important ecological processes.	**Destroyed:** rate of decline not applicable as the community is totally destroyed and not able to naturally regenerate.	**Very rapid:** an observed, estimated, inferred or suspected detrimental change of at least 30% projected in the *immediate term*.	**Rapid:** an observed, estimated, inferred or suspected detrimental change of at least 30% projected in the *near term*.	**Moderate:** an observed, estimated, inferred or suspected detrimental change of at least 30% projected in the *medium term*.	**Slow:** an observed, estimated, inferred or suspected detrimental change of at least 30% projected in the *long term*.	**No change or improvement:** an observed, estimated, inferred or suspected detrimental change of less than 10% projected for the *very long term* or improvement in condition.
6 A quantitative analysis shows that its probability of extinction, or extreme degradation over all of its *geographic distribution*, is:	100% already extinct	at least 50% in the *immediate term*	at least 50% in the *near term*	at least 50% in the *medium term*	at least 30% in the *long term*	less than 10% in the *very long term*

Section C: Definitions of Terms

C1. Definitions of time scales used in threat criteria 2, 3, 5 and 6

- **Immediate term**: the next 10 years, or 3 generations of any long-lived species believed to play a major role in sustaining the community, whichever is the longer up to a maximum of 60 years.
- **Near term:** the next 20 years, or 5 generations of any long-lived species believed to play a major role in sustaining the community, whichever is the longer up to a maximum of 100 years.
- **Medium-term**: the next 50 years, or within 10 generations of any long-lived species believed to play a major role in sustaining the community, whichever is the longer up to a maximum of 200 years.
- **Long-term**: the next 100 years, or within 20 generations of any long-lived species believed to play a major role in sustaining the community, whichever is the longer up to a maximum of 400 years.
- **Very long term**: the next 200 years, or within 40 generations of any long-lived species believed to play a major role in sustaining the community, whichever is the longer up to a maximum of 800 years.

Generation length is set at 20 years. This covers the time it takes for most long-living species (including plants such as *Eucalyptus* or *Acacias*) to reach reproductive maturity and reproduce. Re-sprouting plant species are not taken into account in defining generation length.

C2. Definitions of 'geographic distribution' including 'extent of occurrence' and 'area of occupancy' used in criteria 1, 2, 4 and 5

Geographic distribution of an ecological community can be considered as a combination of *extent of occurrence* and *area of occupancy* in the sense defined in the IUCN (2001) red list criteria for species.

Extent of occurrence (sometimes called range) is the total area contained within the shortest continuous boundary that can be drawn to encompass all the areas where the ecological community occurs.

Area of occupancy is defined as the area within its *extent of occurrence* that is actually occupied by the community. The distinction reflects the fact that a community will not usually occur throughout its extent of occurrence, which may, for example, contain areas of unsuitable habitats. *Area of occupancy* is the more precise measure, but the size of the area of occupancy is a function of the scale at which it is measured, which should be relevant to the attributes of the particular community being considered. Ecological communities have a range of patch size that reflects the nature of the habitat and is relevant to their assessment

For assessing a community's change in *geographic distribution*, it is important to demonstrate the decline to its current state from a defined former state, usually set at 1750 (onset of the Industrial Revolution and prior to European settlement of Australia).

Where possible, a measurable contraction in distribution should be demonstrated by an appropriate scale of mapping. Where it is not possible to provide precise spatial information on the distribution of an ecological community, particularly at the map scale available, other supporting evidence demonstrating a contraction in distribution is considered. This includes expert opinion.

C3. Descriptions of threat criteria

Criterion 1: Decline in geographical distribution

This criterion deals with the degree to which a community has lost its *geographical distribution* (*area of occupancy* and *extent of occurrence*) compared to pre-European times.

Criterion 2: Area of occupancy coupled with demonstrable threat

This criterion deals with *areas of occupancy* coupled with degree of degradation or destruction. Communities with small areas of occupancy that are also declining are likely to be threatened (CE, E or V).

Criterion 3: Decline in functionally important species

This criterion refers to native species that are critically important in the processes that sustain or play a major role in the ecological community, and whose removal has potential to precipitate change in community structure or function sufficient to lead to the community's eventual extinction. Examples of species that are functionally important in some ecological communities include:

- dominant species that play a major role in controlling light or other aspects of the micro-climate. Examples may include a dominant canopy tree or shrub, or a species of seagrass.
- a species that is the principle source of nutrition or host for reproduction of other species in a community.

The risk of loss of such species from the community should be assessed against the IUCN (2001) Red List Species Criteria and be applied at a regional scale commensurate with the distribution of the ecological community. For example, if a critically important species to an ecologieal community is assessed as being endangered using the IUCN (2001) criteria (within the region in which the community occurs), this may lead to an assessment of the whole ecological community as being endangered. Such a decision would have to be weighed up against the other threat criteria.

It is not expected that this criterion will be used as often as criteria 1, 2, 4 and 5.

Criterion 4: Reduction in community integrity: condition and recoverability ***(threat category in brackets)***

This criterion recognises that an ecological community can be threatened through on-going modifications that do not necessarily lead to total destruction (eg clearing) of all elements of the community. It is intended to capture detrimental changes in species composition and abundance and the state of the abiotic environment that supports them. It includes irretrievable loss of native species and invasion by non-native species, as well as changes in the physical environment sufficient to lead to ongoing change in biota.

This criterion also recognises that ecological processes are important to maintain an ecological community (eg fire regimes or flooding) and that disruption to those processes can lead to the decline of the ecological community. This criterion could apply where disruption of processes is evident or imminent (eg altered hydrology leading to rising water tables and/or dryland salinity) prior to a measurable decline in the ecological community. It could also apply where recruitment of species to the community is known to be disrupted but where long lived species mask immediate community breakdown (eg when seedlings of a dominant tree species are not able to persist in the face of grazing by exotic herbivores). Such a criterion allows for recognition of a problem at an early stage.

Regeneration is defined as the re-establishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community; and the *indicative time frames* associated with extinction risk are defined above.

In order apply this criterion, expert opinion should be sought to judge the condition and recoverability of communities over their distribution.

Criterion 5: Rate of continuing detrimental change

A continuing change refers to a recent, current or projected future change whose causes are either not known or not adequately controlled, and so is liable to continue unless remedial measures are taken. Natural fluctuations will not normally count as a continuing change, but an observed change should not be considered to be part of a natural fluctuation unless there is evidence for this.

This criterion contains two alternative expressions of the indication of rate of detrimental change: (a) reductions of geographic distribution or populations of critically important species and (b) degradation or disruption of important ecological processes.

The rate of continuing detrimental change occurring in a community is relevant to its risk of extinction independently of any pre-European data. It is difficult to quantify because detrimental change can be manifest in many different ways and adequate data for monitoring change may not be available. 'Ecological judgement' will need to be applied to these criteria.

Criterion 6: Quantitative analysis showing probability of extinction

The probabilities for each threat category are presented in the table in Section B above.

This criterion is intended to include any form of analysis that estimates the extinction probability of an ecological community based on known characteristics of important species or other components, habitat requirements, ecological processes, threats and any specified management options. This is an emerging area of science and will require acceptable modelling based on sound data.

Population Viability Analysis (PVA) is an example of such a technique appropriate for species, but no formal equivalent has been developed for ecological communities. Regardless of their form, quantitative analyses should make full use of all relevant available data. In a situation in which there is limited information, such data as are available can be used to provide an estimate of extinction risk (for example, estimating the impact of stochastic events on habitat). In presenting the results of quantitative analyses, the assumptions (which must be explicitly stated) and the data used must be documented.

References to Appendix B

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Botanic Gardens Trust
SYDNEY

APPENDIX C: NSW VEGETATION CLASSIFICATION AND ASSESSMENT DATABASE:

Proposed changes to Database

Please complete this form and return it to NSWVCA database administrator, Botanic Gardens Trust (part of Department of Environment and Conservation) Mrs Macquaries Road, Sydney, 2000, NSW.
Or email to nswvca@rbgsyd.nsw.gov.au, Phone 02 9231 8111, Fax 02 9251 7231

PROPONENTS NAME AND/OR ORGANISATION			DATE
ADDRESS			
SUBURB		STATE	POST CODE
PHONE	FAX	MOBILE	EMAIL
VEG. COMM. ID NO.	COMMON NAME		
DATABASE FIELD NAME			
PROPOSED CHANGES			
EXPLANATION			
REFERENCES			
SIGNATURE			

New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains

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Abstract: For the Western Plains of New South Wales, 213 plant communities are classified and described and their protected area and threat status assessed. The communities are listed on the NSW Vegetation Classification and Assessment database (NSWVCA). The full description of the communities is placed on an accompanying CD together with a read-only version of the NSWVCA database.

The NSW Western Plains is 45.5 million hectares in size and covers 57% of NSW. The vegetation descriptions are based on over 250 published and unpublished vegetation surveys and maps produced over the last 50 years (listed in a bibliography), rapid field checks and the expert knowledge on the vegetation. The 213 communities occur over eight Australian bioregions and eight NSW Catchment Management Authority areas. As of December 2005, 3.7% of the Western Plains was protected in 83 protected areas comprising 62 public conservation reserves and 21 secure property agreements. Only one of the eight bioregions has greater than 10% of its area represented in protected areas. 31 or 15% of the communities are not recorded from protected areas. 136 or 64% have less than 5% of their pre-European extent in protected areas. Only 52 or 24% of the communities have greater than 10% of their original extent protected, thus meeting international guidelines for representation in protected areas. 71 or 33% of the plant communities are threatened, that is, judged as being 'critically endangered', 'endangered' or 'vulnerable'.

While 80 communities are recorded as being of 'least concern' most of these are degraded by lack of regeneration of key species due to grazing pressure and loss of top soil and some may be reassessed as being threatened in the future. Threatening processes include vegetation clearing on higher nutrient soils in wetter regions, altered hydrological regimes due to draw-off of water from river systems and aquifers, high continuous grazing pressure by domestic stock, feral goats and rabbits, and in some places native herbivores — preventing regeneration of key plant species, exotic weed invasion along rivers and in fragmented vegetation, increased salinity, and over the long term, climate change.

To address these threats, more public reserves and secure property agreements are required, vegetation clearing should cease, re-vegetation is required to increase habitat corridors and improve the condition of native vegetation, environmental flows to regulated river systems are required to protect inland wetlands, over-grazing by domestic stock should be avoided and goat and rabbit numbers should be controlled and reduced. Conservation action should concentrate on protecting plant communities that are threatened or are poorly represented in protected areas.

Cunninghamia **(2006) 9(3): 383–450**

Introduction

This paper describes the plant communities recorded on the NSW Vegetation Classification and Assessment database (NSWVCA) for the NSW Western Plains and analyses their protected area and threat status. The vegetation classification, plant community database entries, assessment of protected area status, assessment of threat status and specifications of the database were compiled by J.S. Benson. The other authors assisted with technical aspects of the work.

The CD in the back pocket of this journal issue contains a read-only version of the NSWVCA database, appendices to the Introductory paper (Benson 2006, this volume) and this Part of the NSWVCA project. The full description of the 213 classified NSW Western Plains plant communities, with 90 information fields, runs to about 700 pages, rendering it too long to print in a journal. Therefore, it is presented in Folder 3 on the CD as Appendix A of this paper (NSWVCA Part 1) The communities are also presented in 19 broadly-defined vegetation Formation Groups. A shorter version of the NSW Western Plains plant community descriptions, containing 28 information fields, is in Appendix B in Folder 3 on the CD. Reports on 8 IBRA Bioregions and two Catchment Management Authorities areas are also provided in Folder 3 on the CD.

The Introductory paper (this volume) describes the vegetation classification, the threat and protected area status assessment and uses of the vegetation classification. The NSWVCA aims to assist with setting regional planning targets and with assessments at the site or property scale. While it is important to manage species populations, there is a world-wide trend towards landscape or 'ecosystem' management. One of the aims of the NSWVCA is to meet the goals of Convention on Biological Diversity (CBD) ecosystem approach to land use management and nature conservation (Shepherd 2004) to reduce biodiversity loss throughout the world by 2010.

The study area: the NSW Western Plains

The NSW Western Plains is 45 493 666 ha in size and covers 56.7% of NSW (Table 1, Figure 1). It is defined by the boundaries of the eight western-most IBRA Bioregions in NSW defined in Version 6 of Thackway & Cresswell (1995). Each classified plant community is recorded in a number of planning regions covering the NSW Western Plains including eight catchment management authority areas (CMAs) shown on Figure 1, the eight bioregions (Figure 4 in Benson 2006) and 41 sub-regions of these bioregions defined by NSW Department of Environment and Conservation (2004) (Figure 2) and Local Government Areas (LGAs).

The Western Plains contains four major climatic zones defined and mapped in Stern (2000): Arid Zone, Semi Arid (hot, persistently dry), Semi-Arid (warm, winter rainfall), Temperate (hot summers) and Dry Subtropical (moderately dry winter) (Figure 3 in Benson 2006). Rainfall varies from about 500 mm in the east in the wheatbelt to less than 200 mm in the far north-west corner of NSW.

The main landforms include sand dunes, sandplains, floodplains, alluvial plains, stagnant alluvial plains, peneplains, scarps, hills and rises. Most of the area is composed of unconsolidated aeolian or alluvial sediments with rocky outcrops occurring on hills and ranges. The Barrier Range near Broken Hill contains metamorphic and sedimentary rocks and the Cobar Peneplain is predominantly composed of sandstone, outwash sandsheets with small areas of granite. Silcrete outcrops occur on scarps on the Grey Range and in Sturt National Park in the far north-corner of NSW. Gypsum, limestone, and gravels occur over small areas. Soils vary from various types of clay and loam on floodplains and alluvial plains to loams and sands on sand dunes and sandplains. A variety of other soil types occur on rocky outcrops on hills and ranges. Features of the eight bioregions that comprise the NSW Western Plains are described in NSW National Parks and Wildlife Service (2003).

Table 1. Size of the eight IBRA Bioregions (Version 6) that define the NSW Western Plains.

IBRA Bioregion	Bioregion Area (ha)	% of NSW
Broken Hill Complex	3,762,674	4.7
Channel Country	2,337,383	2.9
Cobar Peneplain	7,369,692	9.2
Darling Riverine Plains	9,397,269	11.7
Mulga Lands	6,582,934	8.2
Murray Darling Depression	7,922,534	9.9
Riverina	7,023,267	8.8
Simpson Strzelecki Dunefields	1,097,913	1.4
Total for Western Plains	45,493,666	56.7

Previous botanical studies

Beadle (1945) produced the first map of the vegetation of the NSW Western Plains, one of the first vegetation maps published in Australia. This was followed by Moore (1953a, b) who mapped and described the vegetation of the South Western Slopes and eastern Riverina. Both Beadle's and Moore's maps were broad-scale but identified major vegetation patterns. Beadle's (1981) book *The Vegetation of Australia* describes the vegetation of western NSW in the context of a vegetation classification for Australia.

An early quantitative study of regional vegetation was conducted by Noy-Meir (1971). It contains an ordination, by principal component analysis, of 193 sites (of 383 sampled) covering part of south-western NSW, north-western Victoria and eastern South Australia to define 20 main floristic groups.

The Royal Botanic Gardens (Botanic Gardens Trust Sydney) initiated a program of mapping the vegetation of the Western Plains in the early1970s with a view to producing broad-scale vegetation maps of all of NSW. Pickard & Norris (1994) map the vegetation of the north western quarter of the state at a scale of 1:1 million. Fox (1991), Scott (1992), Porteners (1993) and Porteners et al. (1997) map and describe the vegetation of south-western NSW at 1:250 000 scale. Norris & Thomas (1991) document vegetation on rocky outcrops in south-western NSW. With the exception of Porteners et al. (1997) and Norris & Thomas (1991), these surveys were not supported by published quantitative plot data, though part of the Riverina Bioregion in south-western NSW mapped by Porteners (1993) was remapped at 1:100 000 scale with intensive plot sampling by Horner et al. (2002).

Other key vegetation descriptions include Milthorpe (1991) who describes the plant communities of the far north western corner of NSW; Westbrooke et al. (1998) who map the Scotia mallee in the far south-western NSW at 1:100 000 scale; Benson et al. (1997) who classify the native grasslands in the Riverina Bioregion; the NSW Soil Conservation Service (many authors) that mapped land systems in the western two-thirds of the Western Plains from the 1970s to the 1990s. The

land systems maps contain information on vegetation but are not vegetation maps *per se*. A major achievement was the publication of the book *Plants of Western New South Wales* by Cunningham et al. (1981) documenting the plant species in the Western Plains.

Wetlands have been variously surveyed and mapped:– Biddiscome (1963) mapped the Macquarie Marshes region in the northern NSW wheatbelt, there was more detailed mapping of the Macquarie Marshes by Paijmans (1981) and Johnson & Wilson (1990); Kingsford & Porter (1999) documented the wetlands of the Paroo River system; Margules & Partners (1990) and Smith & Smith (1990) mapped and surveyed the vegetation on the inner floodplain of the Murray River; Pressey et al. (1984) mapped and surveyed the Great Cumbung Swamp at the confluence of the Lachlan and Murrumbidgee Rivers; and McCosker (2000) mapped the Gingham watercourse on the Gwydir River.

The north-eastern part of the Western Plains, covering the NSW central and northern wheatbelt, have been surveyed and mapped by Sivertsen & Metcalfe (1995), Sivertsen & Metcalfe (2001) and Metcalfe et al. (2003). Parts of the wheatbelt are intensively sampled and mapped at 1:100 000 scale by Lewer et al. (2002) and Cannon et al. (2002). In the northern part of the wheatbelt, McGann & Earl (1999) sampled and described the grasslands of the Moree region. Peasley (2001) produced a detailed vegetation dominant canopy species type map of the Moree Plains Shire and the eastern section of the Walgett Shire (Peasley 2000). To the immediate west of the eastern Walgett Shire mapping, the Northern Floodplains Planning Committee (2004) used

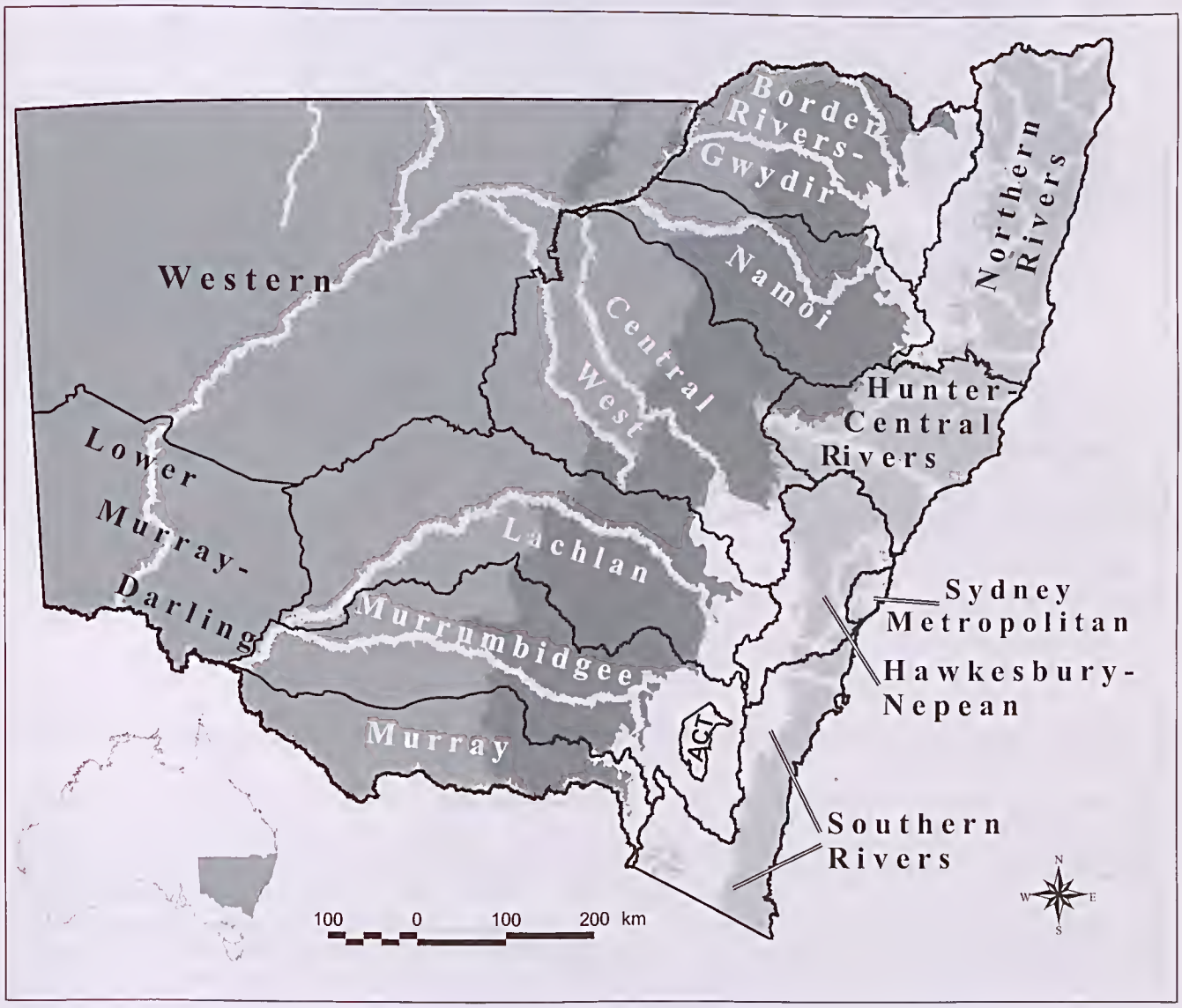

Fig. 1. The Western Plains section of New South Wales (mid-grey area on left) in relation to the boundaries of NSW Catchment Management Authority areas (named and defined by black lines) and major rivers (white lines). Other sections of NSW are: dark grey = Western Slopes; white = Tablelands; light grey = Coast and Eastern Escarpment. The Western Plains covers 57% of New South Wales.

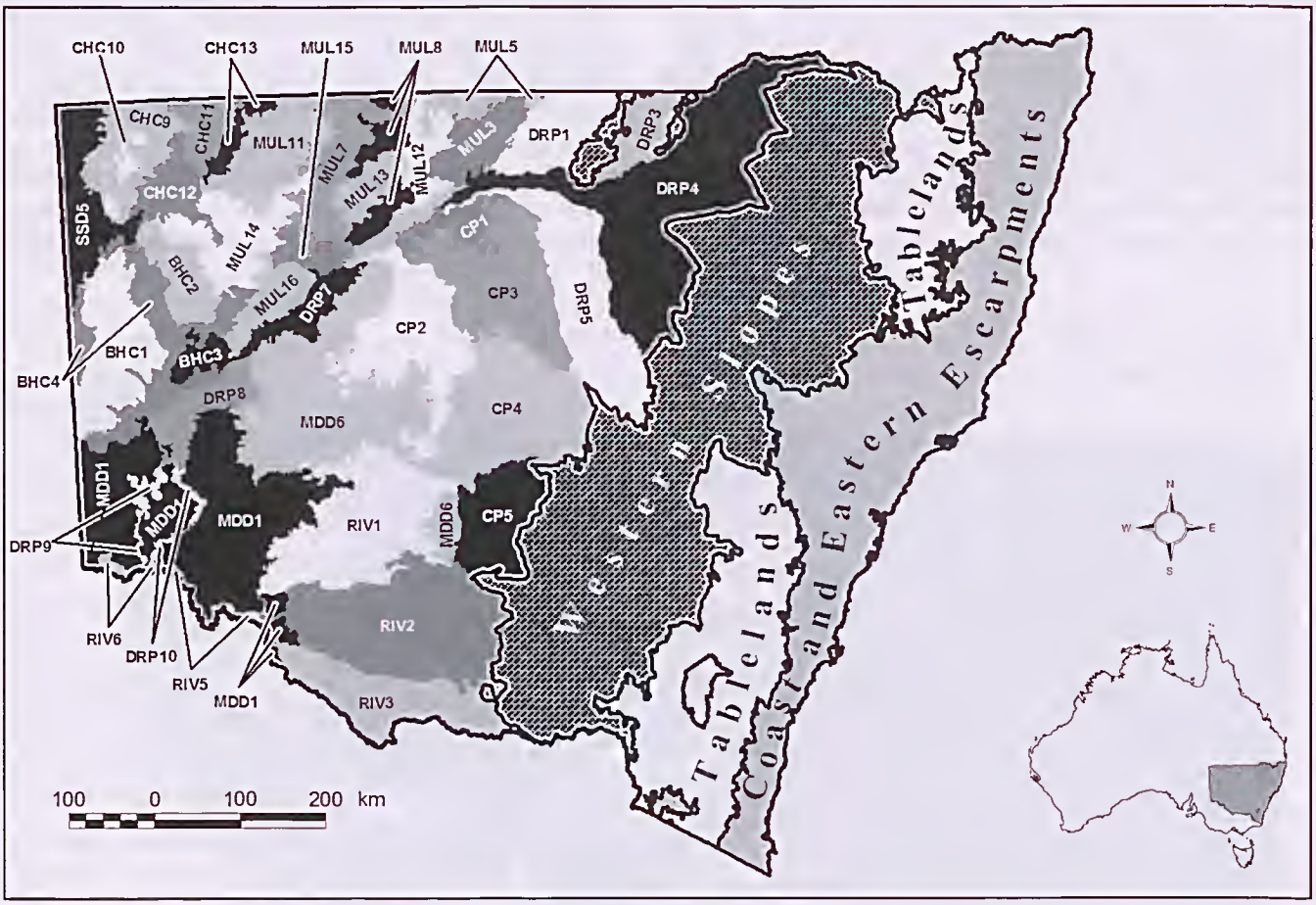

Fig. 2. IBRA Bioregions and sub-regions in the NSW Western Plains based on Version 6.0 of IBRA. Plant communities in the NSWVCA are recorded in these sub-regions.

BHC = Broken Hill Complex Bioregion with sub-regions BHC1 = Barrier Range, BHC2 = Mootwingee Downs, BHC3 = Seopes Range, BHC4 = Barrier Range Outwash, Fans and Plains; CHC = Channel Country Bioregion with sub-regions: CHC9 = Central Downs - Fringing Tablelands and Downs, CHC10 = Core Ranges, CHC11 = Bulloo Overflow, CHC12 = Central Depression, CHC13 = Bulloo Dunefields; CP = Cobar Peneplain Bioregion with sub-regions: CP1 = Boorindal Plains, CP2 = Barnato Downs, CP3 = Canbelego Downs, CP4 = Nymagee-Rankins Springs, CP5 = Lachlan Plains; DRP = Darling Riverine Plains Bioregion with sub-regions: DRP1 = Culgoa-Bokhara, DRP3 = Warrambool-Moonie, DRP4 = Castlereagh-Barwon, DRP5 = Bogan-Macquarie, DRP6 = Louth Plains, DRP7 = Wilcannia Plains, DRP8 = Menindee, DRP9 = Great Darling Anabranch, DRP10 = Pooncarie-Darling; MUL = Mulga Lands Bioregion with sub-regions: MUL3 = Nebine Plains, Block Range, MUL5 = Warrego Plains, MUL7 = Paroo Sand Sheets, Cuttaburra-Paroo, MUL8 = West Warrego - Tablelands and Downs MUL11 = Urisino Sandplains, MUL12 = Warrego Sands, MUL13 = Kerribree Basin, MUL14 = White Cliffs Plateau, MUL15 = Paroo Overflow, MUL16 = Paroo-Darling Sands; MDD = Murray Darling Depression Bioregion with sub-regions: MDD1 = South Olary Plains, Murray Basin Sands, MDD2 = Darling Depression; RIV = Riverina Bioregion with sub-regions: RIV1 = Lachlan, RIV2 = Murrumbidgee, RIV3 = Murray Fans, RIV5 = Robinvale Plains, RIV6 = Murray Scroll Belt; SSD = Simpson-Strzelecki Dunefields Bioregion with sub-region: SSD5 = Strzelecki Desert, Western Dunefields.

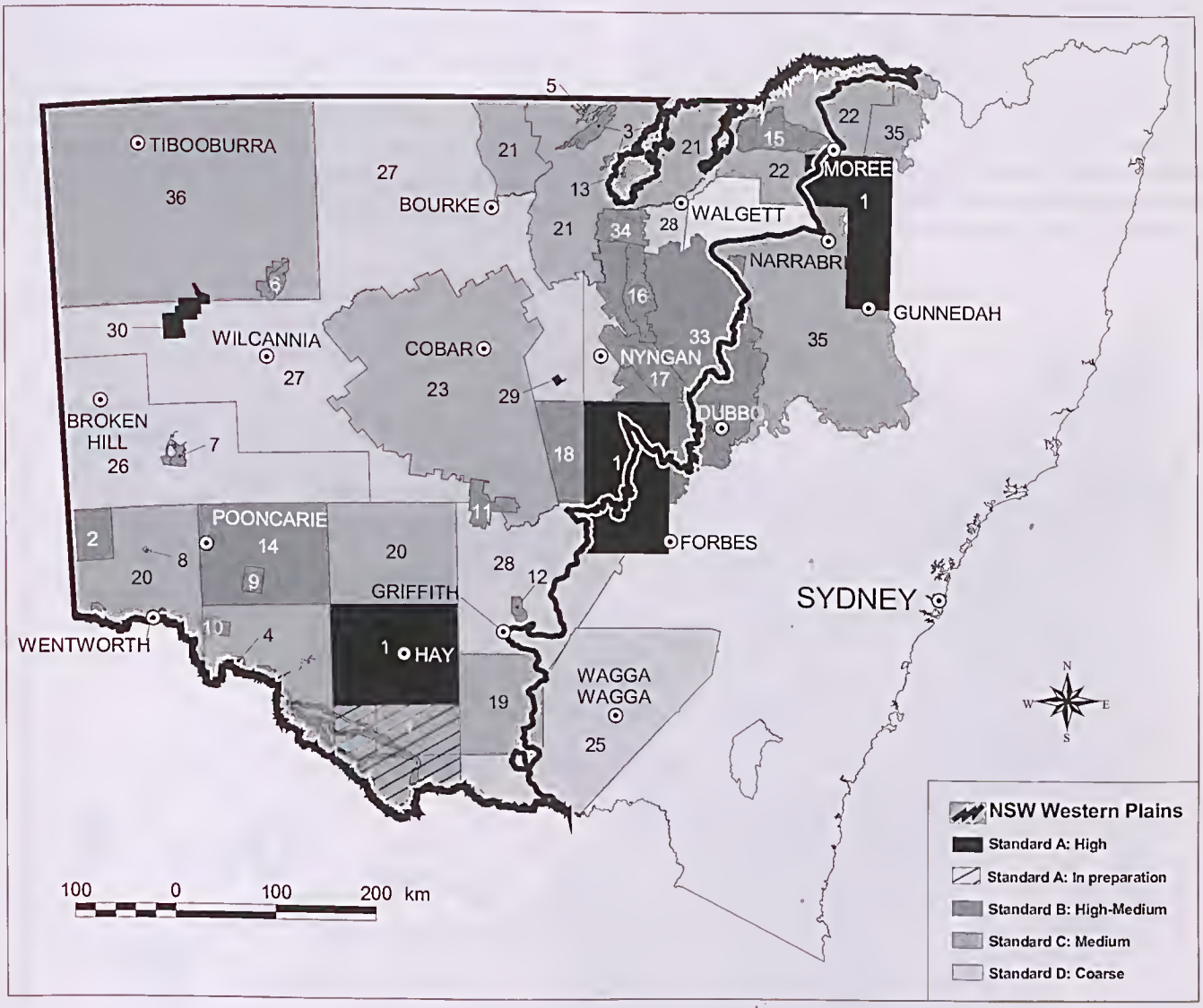

Fig. 3. Major vegetation maps covering the NSW Western Plains ranked into four levels of quality based on Benson (1995) depending on the level of supporting field data and the resolution of the vegetation mapping.

1 (DLWC, 2002) and (DIPNR in prep). 2 (Westbrooke et al. 1998); 3 (Diek 1993); 4 (Margules & Partners, 1990 and 2nd edition 1996); 5 (Hunter & Earl 2002); 6 (Westbrooke et al. 2003); 7 (Westbrooke et al. 2001); 8 (Westbrooke et al. 1997); 9 (Westbrooke et al. 1995); 10 (Moreom & Westbrooke 1990); 11 (Cohn 1995); 12 Whiting (1997); 13 (McGann et al. 2001); 14 (Porteners et al. 1997); 15 (McCosker 2000); 16 (Johnson & Wilson 1991); 17 (Steenbeeke 1996); 18 (Sivertsen & Metcalfe 2001 and Sivertsen & Metcalfe 1995); 19 (Roberts & Roberts 2001); 20 (Fox 1991, Scott 1992, Porteners 1993); 21 (NFPC 2004); 22 (Peasley 2001); 23 (Dykes 2002); 24 (Biddiscombe 1963); 25 (Moore 1953a); 26 (Kerr et al. 2000); 27 (Pickard & Norris 1994); 28 (Beadle 1945); 29 (Porteners 2003); 30 (Porteners 2003a); 33 (Kerr et al. 2003); 34 (Witts 1995); 35 (RACAC 2004); 36 (Milthorpe 1980). See Appendix C *NSW Western Plains bibliography.xls* in Folder 3 on the CD for details of these references.

satellite imagery and field checking to produce a series of 1:100 000 scale vegetation maps covering the Western Division section of Walgett Shire, Brewarrina Shire and north-eastern part of Bourke Shire. The Wombeira Land System that covers part of this region was previously mapped for its vegetation by Diek (1990). In central-west NSW, Dykes (2002) used satellite imagery and ground checking to map the vegetation of the Cobar Shire in the Cobar Peneplain Bioregion. In contrast with Dykes' qualitative approach, Austin et al. (2000) surveyed and modeled the vegetation of the central Lachlan River region in central-western NSW.

The vegetation abutting the NSW borders to the adjoining States of South Australia, Queensland and Victoria has been surveyed and mapped at various scales (see references in Appendix C, the bibliography in Folder 3 on the CD).

Vegetation surveys, maps and descriptions are also available for many of the conservation reserves in western NSW including: Mallee Cliffs, Mungo, Kinchega, Paroo-Darling and Gundabooka National Parks; Nombinnie, Round Hill, Yathong, Tawari, Ledknapper, Narran Lake, Nearie Lake, Quanda, Woggoon, Macquarie Marshes, Midkin and other Nature Reserves (see Appendix C, the bibliography in Folder 3 on the CD). Most of the vegetation classifications derived in reserve surveys and mapping projects are supported by sample data and data analysis and the vegetation maps are at a finer scale than regional mapping. The major reserves requiring botanical survey and detailed vegetation mapping as of December 2005 were Sturt National Park, Nocoleche Nature Reserve and Pindara Downs Aboriginal Area in the arid zone of far north-western NSW.

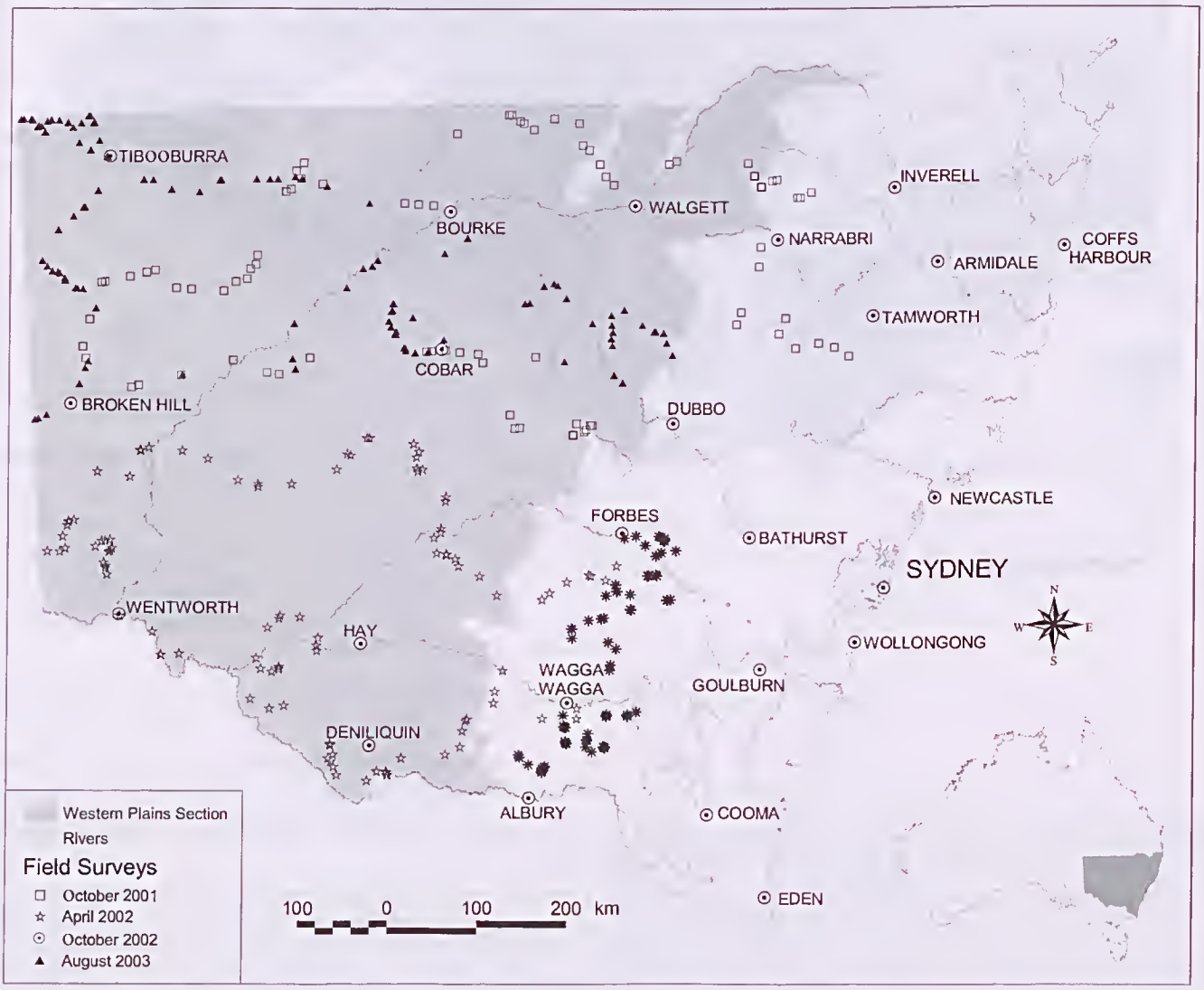

Fig. 4. Locations in western NSW checked for their vegetation and landscape features and photographed during field traverses.

Most vegetation mapping in the Western Plains has been of current vegetation, however Fox (1991) and Pickard & Norris (1994) mapped pre-European vegetation. Broadly classified, pre-European modeled vegetation maps have been produced for the Moree Plains Shire (White 2002a) and for the western section of the Riverina Bioregion (White 2002b).

Considering the 1:1.5 million scale State Vegetation Map in Keith (2004), 32 of the 99 broadly defined and mapped Vegetation Classes are located in the NSW Western Plains.

Key vegetation maps completed in the western two thirds of NSW are shown on Figure 3 and graded by the mapping standards set out in Benson (1995). Different standards have been used to map and survey the vegetation, ranging from coarse scale mapping based on aerial photos or satellite imagery with minimum descriptions of the vegetation, to detailed stratified plot sampling with precise mapping and detailed vegetation descriptions. The latter standard has covered only small parts of the Western Plains.

A number of studies of plant species dynamics have been produced on plant species that occur in Australia's semi-arid or arid rangelands. These include Preece (1971a, 1971b) on *Acacia aneura* (Mulga), Noble & Whalley (1978) on the genus *Nitraria* and Eldridge et al. (1990) on several Chenopodiaceae species. The fire ecology of most plant species in Western NSW is poorly understood with the exception of some mallee species (Noble 1989, Bradstock 1990), lichen crusts (Eldridge & Bradstock 1994) and some species of *Acacia* (Hogkinson & Oxley 1990, Hogkinson

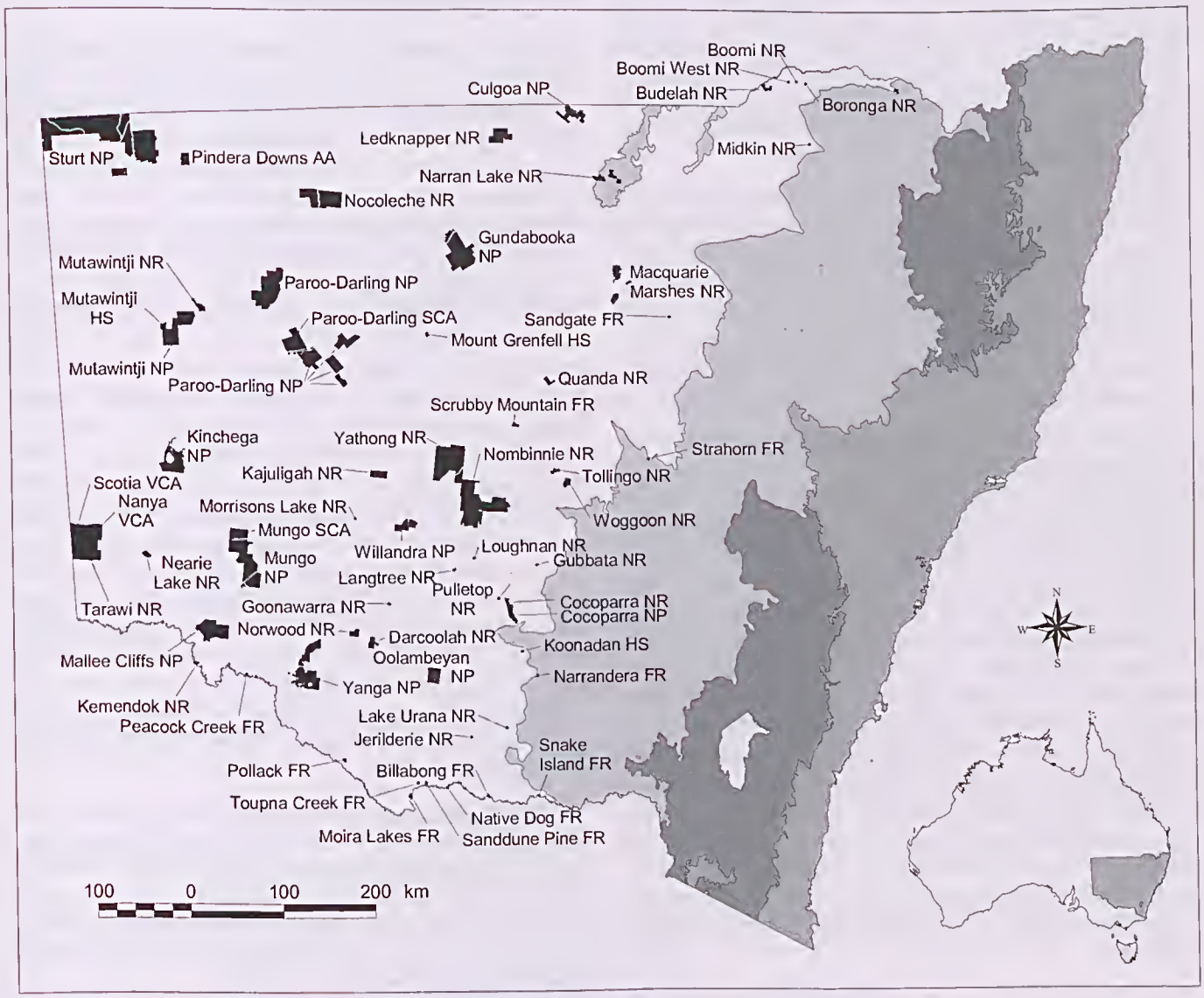

Fig. 5. Public conservation reserves in the NSW Western Plains, December 2005. This also shows the Nanya and Scotia properties that were purchased through the National Reserves System to be protected as conservation agreements. 19 small, secure property agreements are not shown. Generated from the NSW Department of Environment and Conservation Reserves GIS layer, December 2005, DEC Acquired Lands GIS layer, November 2005 and NSW State Forests Flora Reserves GIS layer, October 2003.

2002). Broad guidelines on fire regimes in major vegetation types in NSW are outlined in Kenny et al. (2003).

A spreadsheet list of over 250 vegetation surveys, vegetation mapping and related documents is presented in Appendix C, Part 2 titled *NSW Western Plains Bibliography.xls* in Folder 3 on the CD.

Degradation of the native vegetation

Beadle (1948) presents a comprehensive analysis of the impacts of 100 years of land use up to that time. He documents wind, gully and sheet soil erosion; overstocking; timber removal; drought; and problems with establishing perennial plants from seed. He discusses the loss of chenopod shrub cover due to high domestic stock rates, and the loss of Mulga (*Acacia aneura*) shrubs due to over-cutting for fodder. This reduction in biomass and ground cover led to frequent dust storms and soil erosion over large sections of the Western Plains but since the 1960s, stocking rates have declined and erosion control measures have reduced soil erosion. However, current grazing regimes are still leading to degradation of native vegetation and lack of regeneration of palatable species (Pickard & Norris 1994).

Denny (1992) compared present-day vegetation structure to that described by early explorers — Sturt in 1833, Mitchell in 1848 — at sites across western NSW. The comparisons reveal there has been a significant loss of vegetation biomass in most types of native vegetation, particularly in the ground and mid-layers of the vegetation. Denny points to a consistent pattern of loss of saltbush (*Atriplex*) shrubs in regions where they were once abundant.

In contrast to Denny's findings, there are some regions in the Western Plains where there has been an increase in shrub growth since the middle of the 20th Century. This is colloquially referred to as 'woody regrowth'. Explanations include a loss of topsoil due to 150 years of grazing, selective grazing of herbaceous species, altered fire regimes, pulses of growth during decades of high rainfall or increased atmospheric carbon dioxide levels (Pickard & Norris 1994, Oliver et al. 2001). Regrowth particularly affects the south-eastern section of the Cobar Peneplain Bioregion west of Nyngan, although other parts of inland NSW are also affected. Most of the shrubby regrowth is of non-palatable shrub species in the genera *Senna*, *Eremophila* and *Dodonaea*. White Cypress Pine (*Callitris glaucophylla*) also forms dense regrowth stands on the Cobar Peneplain but this species has threatened status in the Riverina Bioregion to the south, where its recruitment is poor due the grazing of seedlings by stock and rabbits (Porteners 1993, J. Benson pers. obs.).

Recent and current land clearing in the NSW Western Plains is concentrated in the northern wheatbelt in an arc from Moree in the east to Brewarrana in the west and Nyngan in the central west. Areas are also being cleared in the Western Division for grazing or opportunistic cropping. Bedward et al. (2001) reports on clearing of mapped woody vegetation types from 1985 to 2000 in the northern wheatbelt from Dubbo to the Queensland border. They reveal a significant decline in woody native vegetation. For example, in 1985, about 27% of the Moree region was covered with native woody vegetation but 17% of this was cleared by 2000 representing a clearing rate of 1.1% per year. If this rate is extrapolated into the future it implies that most native vegetation would be removed on private land in the NSW wheatbelt within seven decades unless clearing is checked.

River regulation for irrigation crops is increasingly impacting on floodplain vegetation including riparian forests and woodlands and sedge or herbaceous wetlands. The Paroo River in far north western NSW is the only major western NSW river that is not regulated.

The vegetation classification

Vegetation classification involved the collation and comparison of over 250 surveys, mapping or other documentation on the native vegetation of the Western Plains (Appendix C, the bibliography in Folder 3 on the CD). Key vegetation survey and mapping projects formed the starting point of the classification. However, most vegetation mapping is very coarse, particularly in the north-western quarter of NSW, where the main map source is Pickard & Norris (1994). Other references, expert advice, the author's knowledge and extensive field checking expanded the classification. Most broad map units were split into a number of plant communities. Plant species records in plot data were used to list characteristic species for some communities. However, as of 2006, floristic plot data were absent from most of the Western Plains, exceptions being some conservation reserves and the northern wheatbelt. Therefore, qualitative descriptions of vegetation were relied on for defining and describing many plant communities. For example, the classification includes most of the plant communities described by Milthorpe (1972, 1991) for the far north-west corner of NSW but most of these are not mapped in Pickard & Norris (1994) due to the scale of that mapping. Interstate vegetation surveys and maps assisted with cross-border comparisons of vegetation and for classifying the vegetation near to the borders of South Australian, Victoria and Queensland.

The classification was checked in the field through four field traverses totaling over 14 000 km between 2000 and 2004. The traverses sampled the major vegetation maps in western NSW and major environmental gradients across that section of the State from north to south and east to west. Over 400 field stops were made (Figure 4). At each stop, dominant plant species were recorded or collected for identification, photographs were taken, a GPS reading was recorded and physiographic features including soil and geological type were noted. Due to the size of the study area, the intent of the field checking was not to sample the vegetation for

quantitative analysis. The field surveys checked existing vegetation mapping, vegetation descriptions and helped to populate the characteristic species fields in the database for plant communities that lacked species data or descriptions in the literature. It also assisted in correlating vegetation types with landscape features and provided an opportunity to photograph the vegetation. Field checking of poorly mapped areas such as Sturt National Park and the NSW — South Australian border realized a number of plant communities not described in the literature. These have been incorporated into the database with a medium or low confidence level due to lack of ground data.

The vegetation of most NSW Western Plains conservation reserves has been mapped or documented in reports. Most of this reserve information was checked in the field. While the location of conservation reserves is often biased toward rugged terrain or low nutrient soils (Pressey et al. 2000), vegetation descriptions of western reserves sample landscapes that extend beyond reserve boundaries. Therefore, mapping and descriptions of vegetation in reserves, such as by Westbrooke et al. (1995, 2003, 2004), helped to define a number of plant communities in the classification as well as assisting in estimating the extent of plant communities in protected areas, and assessing the overall threat status of the communities.

The extent of each plant community in protected areas was determined through GIS or manual overlays of vegetation maps, from descriptions in reports, field checks and expert advice (see Benson 2006 for details). Statistics on the area of plant communities in protected areas, compared to pre-European and current extent estimates, are calculated in the NSWVCA database. These guide the allocation of plant communities into one of the 15 protected area adequacy categories described in Benson (2006). The rarer the former extent of a plant community (Table 2) the larger the proportion required to be sampled in protected areas in order for it to be considered adequately protected.

Threat criteria (Appendix B of Benson 2006) were used to assign a threat category to each classified plant community. The plant community threat categories mirror the World Conservation Union (IUCN) codes for species and are: 'critically endangered' (CE), 'endangered' (E), 'vulnerable' (V), 'near threatened' (NT) and 'least concern' (LC).

Table 2: Number of plant communities that are estimated to have been Originally Common >10 000 ha, Originally Restricted 1000–10 000 ha and Originally Rare <1000 ha before European settlement.

Estimated pre-European Extent	**Community ID Numbers**	**Number of plant communities**
RARE (<1,000 ha)	19, 65, 66, 86, 140, 151, 188, 190, 196, 220, 226, 239, 240, 261	**14**
Restricted (1,000 - <2,000 ha)	22, 121, 169, 183, 224, 229, 236, 250	8
Restricted (2,000 - <5,000 ha)	21, 122, 133, 138, 162, 200, 213, 231, 235, 253, 271	11
Restricted (5,000 - <10,000 ha)	20, 48, 63, 115, 132, 136, 191, 205, 208, 210, 211, 216, 225, 227, 228, 230, 242, 249, 254, 262	20
TOTAL RESTRICTED (1,000 - <10,000 ha)		**39**
Common (10,000 - <20,000 ha)	5, 23, 64, 68, 142, 146, 163, 197, 234, 237, 241, 256, 263	13
Common (20,000 - <50,000 ha)	2, 8, 9, 12, 29, 41, 54, 71, 74, 77, 83, 110, 127, 129, 130, 137, 139, 149, 150, 152, 165, 166, 180, 181, 182, 189, 193, 198, 199, 214, 215, 218, 221, 232, 233, 243, 251, 252, 257, 264	40
Common (50,000 - <100,000 ha)	10, 11, 38, 47, 50, 60, 62, 117, 131, 160, 161, 164, 168, 174, 175, 176, 194, 204, 206, 212, 217, 222, 248, 258	24
Common (100,000 - <200,000 ha)	7, 31, 35, 53, 75, 100, 106, 143, 145, 167, 184, 185, 186, 192, 201, 245, 246	17
Common (200,000 - <500,000 ha)	13, 16, 17, 18, 28, 36, 39, 43, 44, 45, 46, 49, 55, 56, 57, 67, 69, 70, 72, 82, 88, 108, 144, 155, 158, 172, 195, 207, 247	29
Common (≥500,000 ha)	15, 24, 25, 26, 27, 37, 40, 52, 58, 59, 61, 76, 80, 87, 98, 103, 104, 105, 109, 118, 119, 120, 123, 124, 125, 128, 134, 153, 154, 156, 157, 159, 170, 171, 173, 238, 244	37
TOTAL COMMON (≥10,000 ha)		**160**

Table 3. List of 213 plant communities in the NSW Western Plains by alphabetical order of formation group acronym showing their ID number; protected area/threat code; common name; pre-European, current and protected areas and ranges based on accuracy estimates; proportion in bioregions; proportion in Catchment Management Authority areas (CMAs); and extent in protected areas with an accuracy code.

Notes: The formation group acronyms are correlated to formation group names in Table 4. The Protected Area/Threat code and the protected area extent accuracy codes M, E1-E4 are explained in Benson (2006). Appendix A, in Folder 3 on the CD, lists full records (90 information fields) of all plant communities in the NSW Western Plains. Appendix B, in Folder 3 on the CD, contains the "All Records Short Report" (28 information fields) of all Western Plain communities. *indicates communities that extend eastwards into the Western Slopes Section of NSW.

Formation Group Acronym	Veg ID: Threat/Protected Area Code Plant Community Common Name	ESTIMATED EXTENT: pre-European (range) Current Range (% pre-European) Protected Range (% pre-European)	% of Community in Bioregion	% of Community in CMA	Protected Area Name and Size (ha) (* = also on Western Slopes)		Veg Area (ha) % of Pre-European & Accuracy Code		
ASI	023: E/5b Yarran shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones	12,000 (6,000 - 18,000) ha 2,500 - 7,500 ha (14 - 130 %) 230 - 660 ha (1.3 - 11 %)	<30% CP 30-70% MDD <30% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee <30% Western	Kajuligah NR Mungo NP Willandra NP Yanga NP	13,826 111,842 18,835 70,581	10 60 5 370	0.08 0.5 0.04 3.08	E3 E3 E3 E2
ASI	026: CE/5a Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	1,600,000 (1,200,000 - 2,000,000) ha 120,000 - 200,000 ha (6 - 17 %) 740 - 890 ha (0.037 - 0.074 %)	<30% CP 30-70% NSS 30-70% RIV	<30% Central West <30% Lachlan <30% Murray 30-70% Murrumbidgee	Lake Urana NR Oolambeyan NP DE9905 PA	302 21,839 663	10 715 88	0 0.04 0.01	E3 M M
ASI	027: E/5a Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions	1,000,000 (700,000 - 1,300,000) ha 70,000 - 130,000 ha (5.4 - 19 %) 110 - 190 ha (0.0085 - 0.027 %)	30-70% BBS 30-70% DRP <30% NAN	<30% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Careunga NR* Culgoa NP Kirramingly NR* Maequarie Marshes NR	492 24,965 1,329 19,465	9 100 5 37	0 0.01 0 0	M E3 E1 M
ASI	029: NT/5a Brigalow open woodland on red earth and clay plains mainly in the Mulga Lands Bioregion	45,000 (41,000 - 49,000) ha 27,000 - 33,000 ha (55 - 80 %) 8 - 22 ha (0.015 - 0.054 %)	<30% CP >70% MUL	<30% Lachlan >70% Western	Ledknapper NR Yathong NR	30,759 108,768	10 5	0.02 0.01	E3 E3
ASI	031: NT/5a Brigalow-Gidgee open woodland on clay plains west of the Culgoa River, Mulga Lands Bioregion	100,000 (70,000 - 130,000) ha 38,000 - 70,000 ha (29 - 100 %) 250 - 750 ha (0.19 - 1.1 %)	>70% MUL	>70% Western	Culgoa NP	24,965	500	0.5	E3
ASI	035: CE/5a Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion.	150,000 (110,000 - 190,000) ha 9,800 - 18,000 ha (5.2 - 16 %) 370 - 440 ha (0.19 - 0.4 %)	30-70% BBS <30% DRP <30% NSS	30-70% Border R/Gwydir <30% Central West 30-70% Namoi <30% Western	Brigalow Park NR* VCA041 VCA*	453 33	370 33	0.25 0.02	E2 E1
ASI	077: E/4a Yarran shrubland on peneplains and alluvial plains of central-northern NSW	40,000 (20,000 - 60,000) ha 5,000 - 15,000 ha (8.3 - 75 %) 390 - 700 ha (0.65 - 3.5 %)	<30% BBS 30-70% CP <30% DRP <30% NSS	<30% Central West 30-70% Lachlan <30% Murray <30% Murrumbidgee	Cocoparra NP Coeoparra NR Yathong NR	8,364 4,775 108,768	1 42 500	0 0.11 1.25	M M E2

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ASI	118: NT/5a Gidgee chenopod woodland on red-brown clays in the semi-arid (hot) climate zone mainly in the Mulga Lands Bioregion.	500,000 (350,000 - 650,000) ha 210,000 - 390,000 ha (32 - 110 %) 2,400 - 4,300 ha (0.37 - 1.2 %)	<30% DRP 30-70% MUL	<30% Central West >70% Western	Culgoa NP Narran Lake NR* Nocoleche NR Paroo-Darling NP	24,965 21,830 71,068 176,427	700 5 2,600 25	0.14 0 0.52 0.01	E3 E2 E3 E1
ASI	119: NT/4a Sandplain Mulga tall open shrubland of the semi-arid and arid climate zones	2,200,000 (1,600,000 - 2,800,000) ha 840,000 - 1,500,000 ha (30 - 94 %) 25,000 - 46,000 ha (0.89 - 2.9 %)	<30% BHC <30% CHC <30% CP <30% DRP <30% MUL <30% MDD <30% SSD	<30% Lower MD >70% Western	Kinchega NP Ledknapper NR Mallee Cliffs NP Mungo NP Narran Lake NR* Nocoleche NR Pindera Downs AA Sturt NP Tarawi NR Scotia AWC VCA	44,441 30,759 57,956 111,842 21,830 71,068 11,790 338,232 33,445 64,528	10 580 10 20 30 14,000 100 20,600 2 50	0 0.03 0 0 0 0.64 0 0.94 0 0	E1 M E2 E2 M E3 E3 E2 E2 E3
ASI	120: NT/4a Mulga on stony rises in the arid and semi-arid climate zones, particularly the Mulga Lands Bioregion	1,000,000 (500,000 - 1,500,000) ha 300,000 - 900,000 ha (20 - 180 %) 24,000 - 44,000 ha (1.6 - 8.8 %)	<30% BHC 30-70% MUL <30% SSD	>70% Western	Nocoleche NR Paroo-Darling NP	71,068 176,427	3,600 30,360	0.36 3.04	E3 E2
ASI	121: LC/1b Umbrella Mulga - Beefwood open shrubland on Peery Hills, Mulga Lands Bioregion	1,000 (500 - 1,500) ha 500 - 1,500 ha (33 - 300 %) 700 - 1,300 ha (47 - 260 %)	>70% MUL	>70% Western	Paroo-Darling NP	176,427	1,000	100	E3
ASI	123: NT/4a Mulga - Dead Finish on stony hills mainly of the Channel Country and Broken Hill Complex Bioregions	600,000 (420,000 - 780,000) ha 350,000 - 650,000 ha (45 - 150 %) 19,000 - 34,000 ha (2.4 - 8.1 %)	30-70% BHC <30% CHC <30% CP <30% MUL	<30% Lower MD 30-70% Western	Mutawintji HS Mutawintji NP Paroo-Darling NP Sturt NP	597 67,581 176,427 338,232	440 12,370 7,400 6,000	0.07 2.06 1.23 1	E1 E2 E1 E3
ASI	124: LC/2a Sandhill Wattle tall open shrubland on sand ridges in the arid zone	600,000 (300,000 - 900,000) ha 250,000 - 750,000 ha (28 - 250 %) 65,000 - 110,000 ha (7.2 - 37 %)	<30% BHC <30% CHC <30% DRP 30-70% SSD	<30% Lower MD >70% Western	Kinchega NP Sturt NP	44,441 338,232	153 91,500	0.03 15.25	M E2
ASI	125: NT/5a Mulga - Ironwood shrubland on loams and clays mainly of the Cobar Peneplain Bioregion	800,000 (560,000 - 1,000,000) ha 420,000 - 780,000 ha (42 - 140 %) 4,500 - 8,300 ha (0.45 - 1.5 %)	>70% CP <30% MDD	<30% Central West >70% Western	Gundabooka NP Kajuligah NR Yathong NR	64,282 13,826 108,768	5,000 100 1,300	0.63 0.01 0.16	E2 E3 E2
ASI	127: LC/1a Bastard Mulga - Mulga tall open shrubland of the semi-arid (hot) and arid climate zones	25,000 (18,000 - 32,000) ha 14,000 - 26,000 ha (44 - 140 %) 13,000 - 23,000 ha (41 - 130 %)	30-70% BHC 30-70% CHC <30% MUL	>70% Western	Mutawintji NP Mutawintji NR	67,581 6,711	14,300 3,400	57.2 13.6	E2 E1

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ASI	128: E/4a Nelia tall open shrubland of semi-arid sandplains	500,000 (350,000 - 650,000) ha 140,000 - 260,000 ha (22 - 74 %) 14,000 - 25,000 ha (2.2 - 7.1 %)	<30% BHC <30% DRP 30-70% MDD	30-70% Lower MD 30-70% Western	Kinchega NP Mungo NP Mutawintji NP Paroo-Darling NP Scotia AWC VCA	44,441 111,842 67,581 176,427 64,528	50 500 130 18,750 80	0.01 0.1 0.03 3.75 0.02	E2 E3 E3 E2 E3
ASI	129: NT/4a Cabbage-tree Wattle shrubland of the inland plains and drainage lines	35,000 (25,000 - 45,000) ha 22,000 - 40,000 ha (49 - 160 %) 250 - 750 ha (0.56 - 3 %)	<30% BHC 30-70% MUL	>70% Western	Sturt NP	338,232	500	1.43	E3
ASI	130: NT/4a Horse Mulga - Umbrella Mulga shrubland on ranges in the arid and semi-arid climate zones	30,000 (21,000 - 39,000) ha 18,000 - 32,000 ha (46 - 150 %) 460 - 840 ha (1.2 - 4 %)	<30% BHC 30-70% CP <30% DRP <30% MDD	>70% Western	Mutawintji NP Mutawintji NR Sturt NP	67,581 6,711 338,232	100 50 500	0.33 0.17 1.67	E3 E3 E3
ASI	131: LC/1a Gidgee of the intermittent watercourses or the arid zone (mainly Channel Country and SSD Bioreions)	80,000 (40,000 - 120,000) ha 33,000 - 97,000 ha (28 - 240 %) 13,000 - 39,000 ha (11 - 98 %)	>70% CHC <30% SSD	>70% Western	Sturt NP	338,232	26,000	32.5	E3
ASI	132: LC/1b Mulga - Rock Fuchsia-bush sparse shrubland of silcrete scarps and mesas of the Channel Country Bioregion	5,000 (2,500 - 7,500) ha 2,500 - 7,500 ha (33 - 300 %) 1,500 - 4,500 ha (20 - 180 %)	30-70% CHC	>70% Western	Sturt NP	338,232	3,000	60	E3
ASI	134: LC/3a Ironwood woodland of the semi-arid plains	600,000 (420,000 - 780,000) ha 350,000 - 650,000 ha (45 - 150 %) 18,000 - 51,000 ha (2.3 - 12 %)	<30% CP <30% DRP 30-70% MUL <30% MDD	<30% Central West <30% Lachlan 30-70% Western	Gundabooka NP Nocoleche NR Paroo-Darling NP Yathong NR	64,282 71,068 176,427 108,768	28,000 2,000 4,200 170	4.67 0.33 0.7 0.03	E2 E4 E2 E2
ASI	136: LC/5b Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone	5,000 (2,500 - 7,500) ha 2,000 - 6,000 ha (27 - 240 %) 0 - 0 ha (0 - 0 %)	>70% BHC	>70% Western	Not Protected				
ASI	139: V/3a Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid regions	30,000 (15,000 - 45,000) ha 11,000 - 19,000 ha (24 - 130 %) 2,900 - 5,300 ha (6.4 - 35 %)	<30% CP <30% DRP <30% MUL >70% MDD <30% RIV	>70% Lower MD <30% Murrumbidgee <30% Western	Kinchega NP Nocoleche NR Paroo-Darling NP Yanga NP	44,441 71,068 176,427 70,581	1,510 1,000 1,500 100	5.03 3.33 5 0.33	M E4 E1 E3
ASI	199: NT/3a Hooked Needlewood - Needlewood - Mulga - Turpentine Bush open shrubland of the semi-arid and arid plains	20,000 (10,000 - 30,000) ha 7,500 - 22,000 ha (25 - 220 %) 1,400 - 4,100 ha (4.7 - 41 %)	<30% CHC <30% DRP 30-70% MUL 30-70% MDD	<30% Lower MD >70% Western	Gundabooka NP Mungo NP Nocoleche NR Paroo-Darling NP	64,282 111,842 71,068 176,427	200 50 1,000 1,500	1 0.25 5 7.5	E3 E3 E3 E2

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ASI	220: CE/5c Purple Wood wattle shrubland of the arid zone sandplains	500 (250 - 750) ha 130 - 370 ha (17 - 150 %) 35 - 65 ha (4.7 - 26 %)	<30% BHC <30% DRP 30-70% MDD	30-70% Lower MD 30-70% Western	Kinchega NP	44,441	50	10	E1
CCI	020: CE/5b Buloke - Moonbah - Black Box open woodland on sandy rises of semi arid (warm) climate zone	8,000 (4,000 - 12,000) ha 500 - 1,500 ha (4.2 - 38 %) 3 - 9 ha (0.025 - 0.23 %)	>70% RIV	<30% Lower MD >70% Murray	Lake Urana NR Wicsners Swamp NR*	302 102	5 1	0.06 0.01	E2 E2
CCI	022: E/5b Semi-arid shrubby Buloke - Slender Cypress Pine woodland	1,000 (500 - 1,500) ha 150 - 450 ha (10 - 90 %) 0 - 0 ha (0 - 0 %)	>70% MDD	>70% Lower MD <30% Murray <30% Murrumbidgee	Not Protected				
CCI	054: E/4a Buloke - White Cypress Pine woodland mainly in the NSW SW Slopes Bioregion	20,000 (10,000 - 30,000) ha 2,000 - 6,000 ha (6.7 - 60 %) 430 - 790 ha (1.4 - 7.9 %)	<30% DRP >70% NSS	<30% Central West 30-70% Lachlan	Goobang NP* GE9902 PA* GE9903 PA*	42,352 8 4	600 8 4	3 0.04 0.02	M E2 E2
CCI	055: E/5a Belah woodland on alluvial plains in central-north NSW	450,000 (320,000 - 580,000) ha 49,000 - 91,000 ha (8.4 - 28 %) 370 - 680 ha (0.064 - 0.21 %)	<30% BBS <30% CP 30-70% DRP	<30% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Boronga NR Budelah NR Careunga NR* Kirramingly NR* Macquarie Marshes NR Wilbertroy FR* VCA008 VCA*	198 4,049 492 1,329 19,465 136 400	20 1 440 5 30 6 25	0 0 0.1 0 0.01 0 0.01	E1 M E1 E2 M M M
CCI	057: NT/3a Belah/Black Oak - Western Rosewood - Wilga woodland of central NSW including Cobar Peneplain Bioregion	350,000 (250,000 - 450,000) ha 140,000 - 260,000 ha (31 - 100 %) 14,000 - 25,000 ha (3.1 - 10 %)	30-70% CP 30-70% MDD	<30% Central West >70% Lachlan <30% Murrumbidgee	Kajuligah NR Langtree NR Mount Grenfell HS Nombinnie NR Nombinnie SCA Oolambeyan NP Round Hill NR Scrubby Mountain FR Yathong NR	13,826 232 1,365 72,128 53,261 21,839 13,642 1,704 108,768	6,000 200 380 3,900 1,000 1 251 500 7,200	1.71 0.06 0.11 1.11 0.29 0 0.07 0.14 2.06	E3 M E3 E1 E2 M M E3 E2
CCI	058: NT/4a Black Oak - Western Rosewood open woodland on deep sandy loams of Murray-Darling Depression and Riverina Bioregions	1,000,000 (500,000 - 1,500,000) ha 250,000 - 750,000 ha (17 - 150 %) 32,000 - 58,000 ha (2.1 - 12 %)	<30% CP 30-70% MDD <30% RIV	<30% Lachlan >70% Lower MD <30% Murray <30% Murrumbidgee <30% Western	Mallee Cliffs NP Morrisons Lake NR Mungo NP Tarawi NR Willandra NP Nanya Ballarat Uni VCA Scotia AWC VCA	57,956 319 111,842 33,445 18,835 28,849 64,528	16,000 17 10,000 6,000 600 3,120 9,000	1.6 0 1 0.6 0.06 0.31 0.9	E2 E3 E2 E1 E3 E2 E2

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CCI	059: NT/3a Belah/Black Oak - Western Rosewood - Leopardwood low open woodland on sandplain and sandy flats in semi arid (hot) and arid climate zones	800,000 (560,000 - 1,000,000) ha 390,000 - 710,000 ha (39 - 130 %) 41,000 - 75,000 ha (4.1 - 13 %)	<30% BHC 30-70% CP 30-70% DRP 30-70% MUL	>70% Western	Gundabooka NP Ledknapper NR Nocoleche NR Paroo-Darling NP Paroo-Darling SCA	64,282 30,759 71,068 176,427 41,457	500 950 10,000 22,000 25,000	0.06 0.12 1.25 2.75 3.13	E3 E1 E3 E2 E2
CCI	060: NT/3a Black Oak - Western Rosewood - bluebush/saltbush low sparse woodland on gravelly downs in the arid climate zone	50,000 (25,000 - 75,000) ha 15,000 - 45,000 ha (20 - 180 %) 2,600 - 4,600 ha (3.5 - 18 %)	30-70% BHC 30-70% MUL	>70% Western	Mutawintji NP Mutawintji NR	67,581 6,711	3,300 300	6.6 0.6	E1 E1
CCI	221: NT/5a Black Oak - Pearl Bluebush open woodland of the sandplains of the semi-arid warm and arid climate zones	20,000 (10,000 - 30,000) ha 6,000 - 18,000 ha (20 - 180 %) 0 - 0 ha (0 - 0 %)	<30% BHC >70% MDD	>70% Lower MD	Not Protected				
CCI	228: NT/5b Semi-mesic woodland on basalt hills of the dry subtropical climate zone, north western slopes of NSW	6,000 (3,000 - 9,000) ha 1,300 - 3,700 ha (14 - 120 %) 0 - 0 ha (0 - 0 %)	30-70% BBS 30-70% DRP	30-70% Border R/Gwydir <30% Central West	Not Protected				
CCI	254: LC/5h Black Oak - Bladder Saltbush on light clays in the arid zone	5,000 (2,500 - 7,500) ha 2,300 - 6,700 ha (31 - 270 %) 0 - 0 ha (0 - 0 %)	>70% MDD	>70% Lower MD	Not Protected				
CHS	152: NT/3a Lunette chenopod shrubland mainly of the Murray-Darling Depression Bioregion	22,000 (11,000 - 33,000) ha 8,000 - 24,000 ha (24 - 220 %) 1,700 - 4,900 ha (5.2 - 45 %)	<30% DRP 30-70% MDD <30% RIV	>70% Lower MD <30% Western	Mungo NP VCA105 VCA	111,842 38	3,300 8	15 0.04	E2 E1
CHS	153: NT/4a Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	1,500,000 (1,100,000 - 1,900,000) ha 630,000 - 1,100,000 ha (33 - 100 %) 48,000 - 58,000 ha (2.5 - 5.3 %)	<30% BHC <30% CHC <30% CP <30% DRP <30% MUL <30% MDD 30-70% RIV	<30% Central West <30% Lachlan 30-70% Lower MD <30% Murrumbidgee <30% Western	Kalyarr NP Kinchega NP Mallee Cliffs NP Morrisons Lake NR Mungo NP Nearie Lake NR Nocoleche NR Paroo-Darling NP Paroo-Darling SCA Willandra NP Yanga NP Yathong NR	14,936 44,441 57,956 319 111,842 4,354 71,068 176,427 41,457 18,835 70,581 108,768	2,920 10,800 800 10 18,000 1,170 500 10,000 3,500 100 5,220 10	0.19 0.72 0.05 0 1.2 0.08 0.03 0.67 0.23 0.01 0.35 0	E1 E1 E2 E2 E2 M E4 E4 E3 E4 E2 E2

Formation Group Aeronym	Veg ID: Threat/Proteeted Area Code Plant Community Common Name	ESTIMATED EXTENT: pre-European (range) Current Range (% pre-European) Proteeted Range (% pre-European)	% of Community in Bioregion	% of Community in CMA	Protected Area Name and Size (ha) (* = also on Western Slopes)		Veg Area (ha) % of Pre-European & Aceuraey Code		
CHS	154: NT/4a Pearl Bluebush low open shrubland of the arid and semi-arid plains	700,000 (490,000 - 910,000) ha 280,000 - 520,000 ha (31 - 110 %) 5,000 - 9,100 ha (0.55 - 1.9 %)	<30% BHC <30% CP <30% DRP <30% MUL 30-70% MDD <30% RIV	<30% Lachlan >70% Lower MD <30% Murrumbidgee <30% Western	Kinchega NP Mallee Cliffs NP Mungo NP Tarawi NR Yanga NP	44,441 57,956 111,842 33,445 70,581	5,000 600 940 15 500	0.71 0.09 0.13 0 0.07	E1 E3 E2 E1 E3
CHS	155: NT/3a Bluebush shrubland on stony rises and downs of the arid zone	300,000 (210,000 - 390,000) ha 110,000 - 190,000 ha (28 - 90 %) 22,000 - 39,000 ha (5.6 - 19 %)	30-70% BHC <30% MUL <30% SSD	<30% Lower MD 30-70% Western	Mutawintji HS Mutawintji NP Mutawintji NR Paroo-Darling NP	597 67,581 6,711 176,427	3 18,700 2,000 9,900	0 6.23 0.67 3.3	M E1 E1 E3
CHS	156: NT/5a Bladder Saltbush shrubland on stony plains and downs of the arid zone	1,000,000 (700,000 - 1,300,000) ha 350,000 - 650,000 ha (27 - 93 %) 4,500 - 8,100 ha (0.35 - 1.2 %)	30-70% BHC <30% CHC <30% MUL <30% MDD <30% SSD	<30% Lower MD 30-70% Western	Mutawintji NP	67,581	6,300	0.63	E2
CHS	157: V/5a Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone	1,500,000 (1,100,000 - 1,900,000) ha 420,000 - 780,000 ha (22 - 71 %) 6,900 - 12,000 ha (0.36 - 1.1 %)	<30% DRP <30% MUL <30% MDD 30-70% RIV	<30% Central West 30-70% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee	Kalyarr NP Mungo NP Willandra NP Yanga NP Nanya Ballarat Uni VCA Scotia AWC VCA	14,936 111,842 18,835 70,581 28,849 64,528	2,500 6,700 10 500 78 3	0.17 0.45 0 0.03 0.01 0	E2 E2 E4 E2 E1 E1
CHS	158: E/5a Old Man Saltbush shrubland of the semi-arid hot (persistently dry) and arid climate zones (north-western NSW)	250,000 (180,000 - 320,000) ha 15,000 - 45,000 ha (4.7 - 25 %) 830 - 2,400 ha (0.26 - 1.3 %)	30-70% CHC <30% CP <30% DRP <30% MUL	<30% Border R/Gwydir <30% Central West >70% Western	Kinchega NP Paroo-Darling NP Pindera Downs AA	44,441 176,427 11,790	154 1,000 500	0.06 0.4 0.2	M E2 E3
CHS	159: CE/5a Old Man Saltbush shrubland mainly of the semi-arid (warm) climate zone (south western NSW)	500,000 (350,000 - 650,000) ha 28,000 - 52,000 ha (4.3 - 15 %) 190 - 540 ha (0.029 - 0.15 %)	<30% DRP 30-70% MDD 30-70% RIV	<30% Lachlan >70% Lower MD <30% Murray <30% Murrumbidgee	Kalyarr NP Kemendok NR Willandra NP Yanga NP	14,936 1,063 18,835 70,581	275 50 1 40	0.06 0.01 0 0.01	E2 E3 E3 E3
CHS	160: LC/3a Nitre Goosefoot shrubland on clays of the inland floodplains	50,000 (25.000 - 75,000) ha 50,000 - 150,000 ha (67 - 600 %) 2,200 - 4,000 ha (2.9 - 16 %)	<30% BHC <30% CHC <30% DRP 30-70% MDD <30% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee 30-70% Western	Goonawarra NR Kalyarr NP Kemendok NR Kinchega NP Morrisons Lake NR Oolambeyan NP Willandra NP Yanga NP	410 14,936 1,063 44,441 319 21,839 18,835 70,581	25 470 200 667 15 49 1,400 300	0.05 0.94 0.4 1.33 0.03 0.1 2.8 0.6	E1 E2 E3 M E3 M E4 E3

Formation Group Acronym	Veg ID: Threat/Proteeted Area Code Plant Community Common Name	ESTIMATED EXTENT: pre-European (range) Current Range (% pre-European) Proteeted Range (% pre-European)	% of Community in Bioregion	% of Community in CMA	Proteeted Area Name and Size (ha) (* = also on Western Slopes)		Veg Area (ha) % of Pre-European & Aceuraey Code		
CHS	163: LC/1b Dillon Bush (Nitre Bush) shrubland/grassland of the semi-arid and arid zones	10,000 (7,000 - 13,000) ha 170,000 - 310,000 ha (1310 - 4430 %) 17,000 - 29,000 ha (130 - 410 %)	<30% MDD >70% RIV >30% SSD	<30% Lachlan <30% Lower MD <30% Murray <30% Murrumbidgee <30% Western	Kalyarr NP Mungo NP Nearie Lake NR Oolambeyan NP Willandra NP Yanga NP	14,936 111,842 4,354 21,839 18,835 70,581	115 10,000 965 50 300 11,500	1.15 100 9.65 0.5 3 115	E2 E3 M M E3 E3
CHS	164: LC/1a Cotton Bush open shrubland of the semi-arid (warm) zone	50,000 (35,000 - 65,000) ha 190,000 - 730,000 ha (290 - 2090 %) 11,000 - 19,000 ha (17 - 54 %)	<30% MDD >70% RIV	30-70% Lachlan <30% Lower MD <30% Murray 30-70% Murrumbidgee	Kalyarr NP Oolambeyan NP Willandra NP Yanga NP	14,936 21,839 18,835 70,581	150 1,000 6,000 8,000	0.3 2 12 16	E2 E2 E4 E3
CHS	166: LC/1a Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW	20,000 (10,000 - 30,000) ha 75,000 - 220,000 ha (250 - 2200 %) 5,100 - 15,000 ha (17 - 150 %)	<30% DRP <30% MUL <30% MDD 30-70% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee <30% Western	Kinchega NP Mungo NP Paroo-Darling NP	44,441 111,842 176,427	1,640 1,000 7,400	8.2 5 37	M E2 E2
CHS	168: NT/5a Copperburr shrubland of the NSW northern inland alluvial floodplains	50,000 (25,000 - 75,000) ha 65,000 - 190,000 ha (87 - 760 %) 93 - 270 ha (0.12 - 1.1 %)	<30% BBS >70% DRP	<30% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Kirramingly NR*	1,329	185	0.37	E1
CHS	195: E/5a Bladder Saltbush chenopod shrubland on alluvial soils mainly in the Darling Riverine Plain Bioregion.	200,000 (140,000 - 260,000) ha 21,000 - 39,000 ha (8.1 - 28 %) 0 - 0 ha (0 - 0 %)	>70% DRP <30% MUL	<30% Border R/Gwydir <30% Central West <30% Namoi 30-70% Western	Not Protected				
CHS	196: LC/5e Australian Boxthorn open shrubland	300 (150 - 450) ha 150 - 450 ha (33 - 300 %) 4 - 7 ha (0.78 - 4.3 %)	>70% MDD	>70% Lower MD	Mungo NP	111,842	5	1.67	E4
CHS	210: LC/1b Shrubby Twinleaf - saltbush open shrubland on silerete scarps of the arid zone	5,000 (2,500 - 7,500) ha 2,500 - 7,500 ha (33 - 300 %) 2,500 - 7,500 ha (33 - 300 %)	>70% CHC	>70% Western	Sturt NP	338,232	5,000	100	E3
CHS	211: V/5b Slender-fruit Saltbush - Black Roly Poly low open shrubland of the Darling Riverine Plain	8,000 (4,000 - 12,000) ha 1,500 - 4,500 ha (13 - 110 %) 0 - 0 ha (0 - 0 %)	>70% DRP	<30% Border R/Gwydir <30% Central West 30-70% Namoi	Not Proteeted				
CHS	216: LC/2b Black Roly Poly low open shrubland of the Riverina and Murray-Darling Depression Bioregions	5,000 (2,500 - 7,500) ha 50,000 - 150,000 ha (670 - 6000 %) 790 - 2,300 ha (11 - 92 %)	<30% MDD 30-70% RIV	<30% Lachlan <30% Lower MD <30% Murray <30% Murrumbidgee	Kalyarr NP Morrisons Lake NR Nombinnie NR Nombinnie SCA	14,936 319 72,128 53,261	1,300 30 240 10	26 0.6 4.8 0.2	E3 E2 E1 E1

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CHS	222: LC/5a Low Bluebush - Bladder Saltbush open shrubland of the arid zone	60,000 (30,000 - 90,000) ha 25,000 - 75,000 ha (28 - 250 %) 0 - 0 ha (0 - 0 %)	>70% BHC	>70% Western	Not Protected				
CHS	224: LC/5b Cotton Bush - copperburr open shrubland of the arid climate zone	1,000 (500 - 1,500) ha 5,000 - 15,000 ha (330 - 3000 %) 0 - 0 ha (0 - 0 %)	>70% BHC	>70% Western	Not Protected				
CHS	225: LC/5b Bladder Saltbush low open chenopod shrubland of the Strzelecki dunefields of the arid climate zone	5,000 (2,500 - 7,500) ha 2,000 - 6,000 ha (27 - 240 %) 0 - 0 ha (0 - 0 %)	>70% SSD	>70% Western	Not Protected				
CHS	236: LC/1b Giant Redburr low shrubland on alluvial plains of the semi-arid (warm) climate zone	1,000 (100 - 1,900) ha 75,000 - 220,000 ha (3950 - 220000 %) 920 - 1,700 ha (48 - 1700 %)	>70% RIV	30-70% Lachlan 30-70% Murrumbidgee	Goonawarra NR Kalyarr NP	410 14,936	10 1,300	1 130	E3 E3
CPW	019: E/5c Cypress Pine woodland of source-bordering dunes mainly on the Murray River floodplain.	800 (400 - 1,200) ha 280 - 520 ha (23 - 130 %) 16 - 28 ha (1.3 - 7 %)	>70% RIV	>70% Murray	Sanddune Pine FR AL9913 PA* DE9906 PA	60 16 43	8 8 6	1 1 0.75	M E1 M
CPW	021: CE/5b Slender Cypress Pine - Sugarwood - Western Rosewood open woodland on sandy rises of the semi-arid (warm) and arid climate zones	4,000 (2,000 - 6,000) ha 560 - 1,000 ha (9.3 - 50 %) 35 - 100 ha (0.58 - 5 %)	>70% MDD <30% RIV	30-70% Lower MD <30% Murray <30% Murrumbidgee	Mungo NP Yanga NP	111,842 70,581	20 50	0.5 1.25	E3 E3
CPW	028: V/4a White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	300,000 (210,000 - 390,000) ha 56,000 - 100,000 ha (14 - 48 %) 3,100 - 5,700 ha (0.79 - 2.7 %)	30-70% MDD 30-70% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee	Kalyarr NP Mallee Cliffs NP Mungo NP Oolambeyan NP Tarawi NR Willandra NP DE9905 PA VCA006 VCA	14,936 57,956 111,842 21,839 33,445 18,835 663 18	15 200 2,150 1,540 10 1 462 16	0.01 0.07 0.72 0.51 0 0 0.15 0.01	M E3 E2 M E3 E3 M M
CPW	048: CE/5b White Cypress Pine-Drooping Sheoak grassy open woodland of the Riverine Plain	5,000 (2,500 - 7,500) ha 250 - 750 ha (3.3 - 30 %) 0 - 0 ha (0 - 0 %)	<30% NSS >70% RIV	30-70% Murray <30% Murrumbidgee	Not Protected				
CPW	068: NT/3a White Cypress Pine - Mulga low open woodland on the stony ranges of the arid zone (far north western NSW).	15,000 (7,500 - 22,000) ha 5,000 - 15,000 ha (23 - 200 %) 980 - 1,800 ha (4.5 - 24 %)	<30% BHC <30% MUL	>70% Western	Mutawintji NP Mutawintji NR	67,581 6,711	1,000 400	6.67 2.67	E3 E3

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CPW	069: NT/5a White Cypress Pine - Mulga shrubland on plains and sandplains in the arid and semi-arid (hot summer) climate zones.	300,000 (150,000 - 450,000) ha 60,000 - 180,000 ha (13 - 120 %) 500 - 1,500 ha (0.11 - 1 %)	<30% BHC <30% CHC <30% CP <30% DRP 30-70% MUL <30% SSD	>70% Western	Narran Lake NR*	21,830	1,000	0.33	E2
CPW	070: V/5a White Cypress Pine woodland of central NSW	200,000 (100,000 - 300,000) ha 35,000 - 100,000 ha (12 - 100 %) 120 - 210 ha (0.04 - 0.21 %)	<30% BBS <30% CP <30% DRP <30% MDD 30-70% NSS	<30% Border R/Gwydir 30-70% Central West 30-70% Lachlan <30% Namoi	Boomi NR Midkin NR Strahorn FR*	157 374 72	37 90 40	0.02 0.05 0.02	M E1 E2
CPW	072: NT/3a White Cypress Pine - Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion	200,000 (100,000 - 300,000) ha 60,000 - 180,000 ha (20 - 180 %) 8,300 - 15,000 ha (2.8 - 15 %)	>70% CP	30-70% Lachlan <30% Western	Kajuligah NR Nombinnie NR Nombinnie SCA Round Hill NR Scrubby Mountain FR Yathong NR WE9905 PA	13,826 72,128 53,261 13,642 1,704 108,768 819	50 2,800 7,000 27 500 1,300 129	0.03 1.4 3.5 0.01 0.25 0.65 0.06	E3 E2 E2 M E3 E2 M
CPW	106: LC/4a White Cypress Pine - Mulga low woodland on siliceous rocky ranges mainly of the Cobar Peneplain	150,000 (110,000 - 190,000) ha 84,000 - 150,000 ha (44 - 140 %) 3,700 - 6,700 ha (1.9 - 6.1 %)	>70% CP <30% MDD	<30% Central West <30% Lachlan <30% Western	Gundabooka NP Nombinnie NR Yathong NR	64,282 72,128 108,768	3,000 600 1,600	2 0.4 1.07	E2 M E1
CPW	245: LC/3a Pine - Belah low open woodland of the western Cobar Peneplain and northern Murray-Darling Depression Bioregions	155,000 (110,000 - 200,000) ha 98,000 - 180,000 ha (49 - 160 %) 12,000 - 21,000 ha (6 - 19 %)	30-70% CP 30-70% MDD	>70% Western	Paroo-Darling NP Yathong NR	176,427 108,768	5,000 11,800	3.23 7.61	E2 E3
CPW	246: LC/5a Pine shrubland of the western Cobar Peneplain Bioregion	180,000 (170,000 - 190,000) ha 160,000 - 180,000 ha (84 - 110 %) 0 - 0 ha (0 - 0 %)	>70% CP <30% MDD	>70% Western	Not Protected				
EBWP	056: V/5a Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW	450,000 (180,000 - 720,000) ha 84,000 - 150,000 ha (12 - 83 %) 160 - 280 ha (0.022 - 0.16 %)	30-70% BBS <30% CP 30-70% DRP <30% NSS	30-70% Border R/Gwydir 30-70% Central West <30% Lachlan <30% Namoi	Boronga NR Macquarie Marshes NR	198 19,465	20 200	0 0.04	E3 M

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EBWP	075: E/5a Yellow Box - White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW S/W Slopes Bioregions	100,000 (50,000 - 150,000) ha 5,600 - 10,000 ha (3.7 - 20 %) 250 - 460 ha (0.17 - 0.92 %)	30-70% NSS 30-70% RIV	30-70% Murray 30-70% Murrumbidgee	Lake Urana NR Wilbertroy FR*	302 136	271 86	0.27 0.09	M E1
EBWP	076: CE/5a Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	500,000 (350,000 - 650,000) ha 28,000 - 52,000 ha (4.3 - 15 %) 80 - 140 ha (0.012 - 0.04 %)	30-70% NSS <30% RIV	<30% Lachlan <30% Murray <30% Murrumbidgee	Flagstaff Memorial NR* Wiesners Swamp NR* AL9913 PA* HE9901 PA* NA9904 PA* VCA108 VCA*	18 102 16 33 43 4	10 20 8 33 38 4	0 0 0 0.01 0.01 0	E2 E1 E1 E2 E2 M
EBWP	080: E/5a Inland Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South-western Slopes and Riverina Bioregions	800,000 (560,000 - 1,000,000) ha 98,000 - 180,000 ha (9.8 - 32 %) 280 - 510 ha (0.028 - 0.091 %)	<30% NSS 30-70% RIV	<30% Lachlan <30% Murray <30% Murrumbidgee	Buckingbong FR* Gubbata NR Wilbertroy FR* AL9907 PA AL9908 PA AL9909 PA AL9910 PA AL9921 PA*	163 151 136 19 22 30 134 19	155 5 22 14 17 30 134 19	0.02 0 0 0 0 0 0.02 0	M E1 E1 E1 E1 M M E1
EBWP	082: E/5a Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	400,000 (280,000 - 520,000) ha 70,000 - 130,000 ha (13 - 46 %) 1,300 - 1,500 ha (0.25 - 0.54 %)	30-70% CP <30% MDD <30% NSS	30-70% Central West 30-70% Lachlan <30% Western	Cocoparra NP Cocoparra NR Strahorn FR* Woggoon NR CD9910 PA* WE9902 PA*	8,364 4,775 72 6,113 36 57	710 417 30 200 36 15	0.18 0.1 0.01 0.05 0.01 0	M M E3 E1 E1 E1
EBWP	083: E/5a Yellow Box woodland on sandy loam soils on alluvial plains mainly in the upper Darling Riverine Plain Bioregion	30,000 (15,000 - 45,000) ha 3,000 - 9,000 ha (6.7 - 60 %) 0 - 0 ha (0 - 0 %)	>70% DRP <30% NSS	30-70% Central West <30% Namoi	Not Protected				
EBWP	086: E/5c Yellow Gum tall woodland of the Murray River floodplain, Riverina Bioregion	800 (560 - 1,000) ha 140 - 260 ha (14 - 46 %) 0 - 0 ha (0 - 0 %)	>70% RIV	>70% Murray	Not Protected				
EBWP	087: V/5a Poplar Box - Coolabah floodplain woodland on light clay soil mainly in the Darling Riverine Plain Bioregion	600,000 (300,000 - 900,000) ha 120,000 - 360,000 ha (13 - 120 %) 1,300 - 2,300 ha (0.14 - 0.77 %)	>70% DRP	30-70% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Boomi West NR Budelah NR Culgoa NP Narran Lake NR*	148 4,049 24,965 21,830	2 25 1,100 665	0 0 0.18 0.11	M M E3 E2

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EBWP	088: E/5a Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone	200,000 (100,000 - 300,000) ha 30,000 - 90,000 ha (10 - 90 %) 63 - 110 ha (0.021 - 0.11 %)	>70% BBS <30% DRP	<30% Border R/Gwydir <30% Central West 30-70% Namoi	Brigalow Park NR* VCA088 VCA*	453 96	85 4	0.04 0	E2 E3
EBWP	098: NT/5a Poplar Box - White Cypress Pine shrubby woodland on red sandy loam soils mainly on stagnant alluvial plains	500,000 (350,000 - 650,000) ha 210,000 - 390,000 ha (32 - 110 %) 3,300 - 5,900 ha (0.51 - 1.7 %)	30-70% DRP <30% MUL	30-70% Border R/Gwydir <30% Central West <30% Namoi	Boronga NR Culgoa NP Narran Lake NR*	198 24,965 21,830	75 1,510 3,000	0.02 0.3 0.6	E2 M E2
EBWP	103: NT/4a Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion	800,000 (560,000 - 1,000,000) ha 350,000 - 650,000 ha (35 - 120 %) 9,100 - 16,000 ha (0.91 - 2.9 %)	>70% CP <30% MDD	<30% Central West <30% Lachlan 30-70% Western	Gundahooka NP Quanda NR Tollingo NR Woggoon NR CD9902 PA	64,282 4,767 3,247 6,113 30	10,000 2,520 50 410 15	1.25 0.32 0.01 0.05 0	E3 E1 M E2 M
EBWP	104: LC/4a Smooth-barked Coolahah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion	1,000,000 (500,000 - 1,500,000) ha 380,000 - 1,100,000 ha (25 - 220 %) 9,400 - 17,000 ha (0.63 - 3.4 %)	30-70% CP <30% MUL <30% MDD	<30% Central West <30% Lachlan 30-70% Western	Loughnan NR Mount Grenfell HS Nombinnie NR Nombinnie SCA Round Hill NR Yathong NR	390 1,365 72,128 53,261 13,642 108,768	20 60 2,000 1,000 332 10,000	0 0.01 0.2 0.1 0.03 1	E1 E2 E2 E2 E1 E2
EBWP	105: NT/5a Poplar Box grassy woodland on flats mainly in the Cobar Peneplain and Murray-Darling Depression Bioregions	900,000 (630,000 - 1,100,000) ha 350,000 - 650,000 ha (32 - 100 %) 6,300 - 11,000 ha (0.57 - 1.7 %)	>70% CP <30% MDD	30-70% Central West <30% Lachlan <30% Western	Nombinnie NR Nombinnie SCA Scrubby Mountain FR Yathong NR CD9901 PA	72,128 53,261 1,704 108,768 229	600 1,000 5 7,300 2	0.07 0.11 0 0.81 0	E2 E3 E2 E2 E2
EBWP	108: LC/4a Smooth-barked Coolabah - Mulga open woodland on gravelly ridges of the Cobar Peneplain Bioregion	450,000 (320,000 - 580,000) ha 250,000 - 450,000 ha (43 - 140 %) 11,000 - 20,000 ha (1.9 - 6.3 %)	>70% CP <30% MDD	<30% Central West <30% Lachlan 30-70% Western	Gundabooka NP Mount Grenfell HS	64,282 1,365	15,000 400	3.33 0.09	E3 E2
EBWP	109: LC/4a Poplar Box-Mulga woodland on red loam soils on plains in the Cobar Peneplain and eastern Mulga Lands Bioregions	700,000 (490,000 - 910,000) ha 390,000 - 710,000 ha (43 - 140 %) 7,600 - 22,000 ha (0.84 - 4.5 %)	30-70% CP <30% DRP <30% MUL	<30% Central West >70% Western	Gundabooka NP Ledknapper NR Paroo-Darling NP	64,282 30,759 176,427	8,000 6,540 500	1.14 0.93 0.07	E3 M E4
EBWP	110: V/5a Inland Grey Box - Black Cypress Pine shrubby woodland on stony slopes NSW South Western Slopes and Riverina Bioregions	40,000 (20,000 - 60,000) ha 5,000 - 15,000 ha (8.3 - 75 %) 210 - 370 ha (0.35 - 1.9 %)	<30% CP >70% NSS	<30% Lachlan <30% Murray <30% Murrumbidgee	Cocoparra NP Cocoparra NR Nangar NP* The Rock NR*	8,364 4,775 9,356 343	100 41 17 130	0.25 0.1 0.04 0.33	M M M E2

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EBWP	122: LC/1b Smooth-barked Coolabah woodland of Peery Hills sandslope, Mulga Lands Bioregion	3,500 (2,500 - 4,500) ha 2,300 - 4,200 ha (51 - 170 %) 3,000 - 3,500 ha (67 - 140 %)	>70% MUL	>70% Western	Paroo-Darling NP	176,427	3,264	93.26	M
EBWP	201: CE/5a Fuzzy Box - Inland Grey Box on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	100,000 (70,000 - 130,000) ha 4,200 - 7,800 ha (3.2 - 11 %) 54 - 100 ha (0.042 - 0.14 %)	<30% BBS <30% CP >70% NSS	<30% Central West 30-70% Lachlan <30% Murrumbidgee	Coolbaggie NR* Weddin Mountains NP*	1,773 8,697	50 27	0.05 0.03	E2 M
EBWP	207: LC/3a Poplar Box grassy low woodland of drainage lines and depressions of the semi-arid (hot) and arid zone climate zones	200,000 (100,000 - 300,000) ha 85,000 - 250,000 ha (28 - 250 %) 9,200 - 16,000 ha (3.1 - 16 %)	<30% BHC <30% CHC <30% CP <30% MUL <30% MDD	>70% Western	Gundabooka NP Kajuligah NR Nocoleche NR Paroo-Darling NP	64,282 13,826 71,068 176,427	5,000 1,400 2,000 4,620	2.5 0.7 1 2.31	E3 E3 E4 E1
EBWP	244: E/5a Poplar Box grassy/shrubby woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (whcatbelt).	1,500,000 (1,100,000 - 1,900,000) ha 280,000 - 520,000 ha (15 - 47 %) 170 - 480 ha (0.0089 - 0.044 %)	<30% BBS 30-70% DRP <30% NSS	30-70% Border R/Gwydir <30% Central West <30% Lachlan <30% Namoi	Boomi NR Boomi West NR Budelah NR Midkin NR NY9902 PA	157 148 4,049 374 20	16 76 22 190 20	0 0.01 0 0.01 0	M M M M M
EBWP	248: E/5a Mixed box woodland on low sandy-loam rises on alluvial plains in central western NSW	50,000 (25,000 - 75,000) ha 5,000 - 15,000 ha (6.7 - 60 %) 0 - 0 ha (0 - 0 %)	30-70% CP 30-70% NSS	<30% Central West 30-70% Lachlan	Not Protected				
EBWP	258: NT/5a Smooth-barked Coolabah on granite low hills in the eastern Cobar Peneplain Bioregion	50,000 (35,000 - 65,000) ha 28,000 - 52,000 ha (43 - 150 %) 0 - 0 ha (0 - 0 %)	>70% CP	>70% Central West	Not Protected				
EGA	150: LC/3a Bottlewasher - copperburr grassland of the arid zone.	30,000 (3,000 - 57,000) ha 13,000 - 240,000 ha (23 - 8000 %) 3,000 - 9,000 ha (5.3 - 300 %)	<30% BHC <30% MUL <30% MDD	<30% Lower MD >70% Western	Kinchega NP Sturt NP	44,441 338,232	4,000 2,000	13.33 6.67	E4 E3
EGA	167: LC/5a Kerosene Grass - Mulka grass - short grassland/forbland of the arid zone	130,000 (65,000 - 190,000) ha 65,000 - 190,000 ha (34 - 290 %) 500 - 1,500 ha (0.26 - 2.3 %)	30-70% BHC <30% CHC <30% MUL	>70% Western	Sturt NP	338,232	1,000	0.77	E3

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EIW	002: NT/3a River Red Gum-sedge dominated tall open forest in frequently flooded sites of the semi-arid warm elimate zone	35,000 (25,000 - 45,000) ha 21,000 - 39,000 ha (47 - 160 %) 3,100 - 5,600 ha (6.9 - 22 %)	<30% NSS >70% RIV	>70% Murray <30% Murrumbidgee	Billabong FR Lake Urana NR Moira Lakes FR Native Dog FR Pollaek FR Sanddune Pine FR Snake Island FR Toupna Creek FR Wiesners Swamp NR* Yanga NP	334 302 1,441 44 714 60 37 79 102 70,581	50 9 40 43 100 10 5 2 70 4,000	0.14 0.03 0.11 0.12 0.29 0.03 0.01 0.01 0.2 11.43	E3 M E3 E3 E3 E3 E3 E3 E1 E3
EIW	005: NT/4a River Red Gum herbaceous-grassy tall open forest of the inner floodplains of the lower NSW South West Slopes and Riverina Bioregions	15,000 (7,500 - 22,000) ha 4,500 - 13,000 ha (20 - 170 %) 200 - 360 ha (0.91 - 4.8 %)	30-70% NSS 30-70% RIV	>70% Murray <30% Murrumbidgee	Billabong FR Moira Lakes FR Narrandera FR Narrandera NR* Snake Island FR Toupna Creek FR Wilbertroy FR*	334 1,441 14 59 37 79 136	110 50 12 50 30 10 20	0.73 0.33 0.08 0.33 0.2 0.07 0.13	E3 E3 E1 E2 E3 E3 E3
EIW	007: NT/3a River Red Gum - herbaceous tall open forest mainly in the Riverina Bioregion	100,000 (70,000 - 130,000) ha 60,000 - 110,000 ha (46 - 160 %) 6,100 - 11,000 ha (4.7 - 16 %)	>70% RIV	<30% Lachlan >70% Murray <30% Murrumbidgee	Kalyarr NP Pollaek FR Sanddune Pine FR Toupna Creek FR Yanga NP DE9906 PA	14,936 714 60 79 70,581 43	70 530 20 30 8,000 25	0.07 0.53 0.02 0.03 8 0.03	M E3 E3 E3 E3 M
EIW	008: LC/4a River Red Gum - Warrego Grass - Couch Grass riparian tall woodland of the semi-arid (warm) climate zone	30,000 (21,000 - 39,000) ha 18,000 - 32,000 ha (46 - 150 %) 230 - 410 ha (0.59 - 2 %)	<30% DRP 30-70% RIV	30-70% Lower MD 30-70% Murray	Kemendok NR Moira Lakes FR Peaeock Creek FR HA9904 PA VCA105 VCA	1,063 1,441 99 14 38	50 200 60 2 10	0.17 0.67 0.2 0.01 0.03	E3 E3 E3 M E1
EIW	009: V/3a River Red Gum - wallaby grass tall woodland on the outer River Red Gum zone in the semi-arid (warm) elimate zone	35,000 (25,000 - 45,000) ha 11,000 - 19,000 ha (24 - 76 %) 810 - 1,400 ha (1.8 - 5.6 %)	<30% NSS >70% RIV	>70% Murray <30% Murrumbidgee	Billabong FR Moira Lakes FR Yanga NP	334 1,441 70,581	117 30 1,000	0.33 0.09 2.86	E3 E3 E3
EIW	010: NT/5a River Red Gum - Black Box woodland of the semi-arid (warm) climatie zone	70,000 (49,000 - 91,000) ha 28,000 - 52,000 ha (31 - 110 %) 93 - 170 ha (0.1 - 0.35 %)	<30% MDD >70% RIV	<30% Lachlan 30-70% Murray <30% Murrumbidgee	Kalyarr NP Kemendok NR Peacock Creek FR HA9904 PA	14,936 1,063 99 14	30 64 30 8	0.04 0.09 0.04 0.01	E1 M E3 M

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EIW	011: NT/3a River Red Gum - Lignum very tall open forest or woodland on floodplains of semi-arid (warm) climate zone	60,000 (42,000 - 78,000) ha 25,000 - 45,000 ha (32 - 110 %) 4,600 - 8,400 ha (5.9 - 20 %)	<30% CP <30% MDD >70% RIV	<30% Lachlan 30-70% Lower MD 30-70% Murray <30% Murrumbidgee	Goonawarra NR Kalyarr NP Kemendok NR Kinchega NP Yanga NP	410 14,936 1,063 44,441 70,581	300 80 300 814 5,000	0.5 0.13 0.5 1.36 8.33	E1 E1 E2 M E3
EIW	013: V/3a Blackbox - Lignum woodland of the inner floodplains in the semi-arid (warm) climate zone	350,000 (180,000 - 520,000) ha 110,000 - 190,000 ha (21 - 110 %) 22,000 - 39,000 ha (4.2 - 22 %)	<30% CP <30% DRP >70% RIV	<30% Lachlan 30-70% Lower MD 30-70% Murray <30% Murrumbidgee	Kalyarr NP Kemendok NR Kinchega NP Morrisons Lake NR Oolambeyan NP Peacock Creek FR Willandra NP Yanga NP	14,936 1,063 44,441 319 21,839 99 18,835 70,581	830 330 8,600 40 297 5 3,560 17,000	0.24 0.09 2.46 0.01 0.08 0 1.02 4.86	E1 E2 M E2 M E4 E3 E3
EIW	015: NT/4a Black Box open woodland with chenopod understorey mainly on the outer floodplains in south-western NSW	500,000 (350,000 - 650,000) ha 180,000 - 320,000 ha (28 - 91 %) 9,300 - 17,000 ha (1.4 - 4.9 %)	<30% DRP <30% MDD >70% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee	Kinchega NP Nearie Lake NR Willandra NP Yanga NP VCA105 VCA	44,441 4,354 18,835 70,581 38	7,875 282 90 5,000 20	1.58 0.06 0.02 1 0	M M E3 E3 E1
EIW	016: NT/5a Black Box grassy open woodland of rarely flooded depressions in south western NSW	200,000 (100,000 - 300,000) ha 50,000 - 150,000 ha (17 - 150 %) 240 - 430 ha (0.08 - 0.43 %)	<30% DRP 30-70% MDD 30-70% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee	Kajuligah NR Mallee Cliffs NP Nombinnie NR LE9801 PA Scotia AWC VCA	13,826 57,956 72,128 11 64,528	100 10 163 11 50	0.05 0.01 0.08 0.01 0.03	E3 E2 M M E3
EIW	036: V/4a River Red Gum open forest and woodland mainly of the Darling Riverine Plains Bioregion	300,000 (210,000 - 390,000) ha 110,000 - 190,000 ha (28 - 90 %) 6,600 - 8,000 ha (1.7 - 3.8 %)	<30% BBS >70% DRP <30% MUL	<30% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Budelah NR Culgoa NP Gundabooka NP Macquarie Marshes NR Narran Lake NR* Paroo-Darling SCA VCA022 VCA	4,049 24,965 64,282 19,465 21,830 41,457 19	230 74 500 6,000 87 420 9	0.08 0.02 0.17 2 0.03 0.14 0	M M E2 E1 M E2 E1
EIW	037: V/4a Black Box woodland on floodplains mainly in the Darling Riverine Plains Bioregion.	900,000 (630,000 - 1,100,000) ha 280,000 - 520,000 ha (25 - 83 %) 8,300 - 15,000 ha (0.75 - 2.4 %)	<30% CP >70% DRP <30% MUL	<30% Border R/Gwydir 30-70% Central West <30% Namoi <30% Western	Culgoa NP Gundabooka NP Macquarie Marshes NR Paroo-Darling NP Paroo-Darling SCA	24,965 64,282 19,465 176,427 41,457	2,500 500 609 1,440 6,800	0.28 0.06 0.07 0.16 0.76	M E3 M E2 E3

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EIW	038: LC/3a Black Box low woodland lining ephemeral watercourses or fringing lakes and clay pans of semi-arid (hot) and arid zones	50,000 (25,000 - 75,000) ha 20,000 - 60,000 ha (27 - 240 %) 4,400 - 7,900 ha (5.9 - 32 %)	<30% BHC >70% CHC >30% MUL <30% MDD <30% SSD	>70% Western	Nocoleche NR Paroo-Darling NP	71,068 176,427	5,000 1,150	10 2.3	E3 M
EIW	039: E/4a Coolabah - River Coobah - Lignum woodland of frequently flooded channels mainly of the Darling Riverine Plains Bioregion	350,000 (250,000 - 450,000) ha 98,000 - 180,000 ha (22 - 72 %) 15,000 - 17,000 ha (3.3 - 6.8 %)	>70% DRP <30% MUL	30-70% Border R/Gwydir <30% Central West <30% Namoi 30-70% Western	Budelah NR Culgoa NP Narran Lake NR* Nocoleche NR Paroo-Darling NP Paroo-Darling SCA VCA022 VCA	4,049 24,965 21,830 71,068 176,427 41,457 19	93 6,600 50 5,000 3,500 440 10	0.03 1.89 0.01 1.43 1 0.13 0	E1 E1 E3 E3 E2 E3 E1
EIW	040: E/4a Coolabah open woodland with chenopod/grassy ground cover on grey and brown clay floodplains	1,100,000 (770,000 - 1,400,000) ha 300,000 - 540,000 ha (21 - 70 %) 10,000 - 18,000 ha (0.71 - 2.3 %)	<30% BBS >70% DRP <30% MUL	30-70% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Boomi NR Boomi West NR Budelah NR Culgoa NP Gundabooka NP Macquarie Marshes NR Midkin NR Narran Lake NR* Paroo-Darling NP Paroo-Darling SCA	157 148 4,049 24,965 64,282 19,465 374 21,830 176,427 41,457	23 28 1,840 6,000 1,000 395 10 570 4,000 300	0 0 0.17 0.55 0.09 0.04 0 0.05 0.36 0.03	E1 E1 E1 E1 E3 M M E2 E2 E3
EIW	041: LC/2a River Red Gum open woodland of intermittent watercourses mainly of the arid climate zone	40,000 (28,000 - 52,000) ha 25,000 - 45,000 ha (48 - 160 %) 4,900 - 8,900 ha (9.4 - 32 %)	<30% BHC <30% CHC <30% MUL <30% SSD	>70% Western	Mutawintji NP Mutawintji NR Paroo-Darling NP Sturt NP	67,581 6,711 176,427 338,232	1,780 140 3,000 2,000	4.45 0.35 7.5 5	M E1 E1 E2
EIW	067: LC/3a Yapunyah woodland of Cuttaburra-Paroo River system, Mulga Lands Bioregion	250,000 (180,000 - 320,000) ha 160,000 - 280,000 ha (50 - 160 %) 15,000 - 27,000 ha (4.7 - 15 %)	>70% MUL	>70% Western	Nocoleche NR Paroo-Darling NP	71,068 176,427	20,000 800	8 0.32	E3 E1
EIW	074: E/5a Riverine Yellow Box - River Red Gum tall grassy woodland of NSW South West Slopes and Riverina Bioregions	30,000 (21,000 - 39,000) ha 5,600 - 10,000 ha (14 - 48 %) 19 - 35 ha (0.049 - 0.17 %)	30-70% NSS 30-70% RIV	<30% Lachlan <30% Murray <30% Murrumbidgee	Narrandera NR* Sanddune Pine FR Toupna Creek FR DE9906 PA	59 60 79 43	8 3 13 3	0.03 0.01 0.04 0.01	E2 E3 E3 M
EIW	197: NT/3a Black Box - Gidgee - chenopod low open woodland on alluvial clay soils mainly of the Darling Riverine Plain Bioregion	15,000 (7,500 - 22,000) ha 5,000 - 15,000 ha (23 - 200 %) 1,400 - 1,600 ha (6.4 - 21 %)	30-70% DRP 30-70% MUL	>70% Western	Culgoa NP	24,965	1,500	10	E1

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EIW	200: LC/4b River Red Gum woodland of lake fringes in the semi-arid (hot) and arid climate zones	4.500 (3,200 - 5.800) ha 2,900 - 5,300 ha (50 - 170 %) 350 - 650 ha (6 - 20 %)	30-70% CHC 30-70% MUL	>70% Western	Paroo-Darling NP	176,427	500	11.11	E2
EIW	206: V/5a Dirty Gum tall woodland of alluvial sandy lenses (sand monkeys) mainly of the Darling Riverine Plain Bioregion	50,000 (35.000 - 65.000) ha 16,000 - 28,000 ha (25 - 80 %) 150 - 260 ha (0.23 - 0.74 %)	<30% BBS >70% DRP	30-70% Border R/Gwydir <30% Central West <30% Namoi	Boronga NR Budelah NR Sand Monkey FR* Sandgate FR	198 4,049 80 15	5 122 60 15	0.01 0.24 0.12 0.03	E3 M E3 M
EIW	208: LC/4b River Red Gum low woodland of rocky gorges and creeks in the Cobar Peneplain	6,000 (4,200 - 7,800) ha 3,900 - 7,100 ha (50 - 170 %) 270 - 810 ha (3.5 - 19 %)	>70% CP	<30% Central West <30% Lachlan >70% Western	Gundabooka NP Mount Grenfell HS	64,282 1,365	500 40	8.33 0.67	E3 E2
EIW	230: LC/3b Coolabah woodland of intermittent watercourses in arid zone, mainly in the Channel Country Bioregion	6,000 (3,000 - 9,000) ha 2,500 - 7,500 ha (28 - 250 %) 740 - 1,300 ha (8.2 - 43 %)	>70% CHC	>70% Western	Pindera Downs AA Sturt NP	11,790 338,232	50 1,000	0.83 16.67	E3 E3
EIW	231: LC/2b Coolabah open woodland dunefield depressions of the arid zone	3,000 (1,500 - 4,500) ha 1,400 - 4,200 ha (31 - 280 %) 500 - 1,500 ha (11 - 100 %)	>70% SSD	>70% Western	Sturt NP	338,232	1,000	33.33	E3
EIW	233: LC/5a River Red Gum - Poplar Box grassy woodland on Quaternary alluvial sandy-loam soils of the Cobar Peneplain	20,000 (10,000 - 30,000) ha 9,000 - 27,000 ha (30 - 270 %) 36 - 44 ha (0.12 - 0.44 %)	>70% CP	>70% Western	Mount Grenfell HS	1,365	40	0.2	E2
EIW	234: LC/4b River Red Gum woodland of rocky creeks in the ranges of the arid climate zone	10,000 (5,000 - 15.000) ha 4,500 - 13,000 ha (30 - 260 %) 940 - 1,700 ha (6.3 - 34 %)	30-70% BHC 30-70% CHC <30% MUL	>70% Western	Mutawintji HS Mutawintji NP Mutawintji NR Sturt NP	597 67,581 6,711 338,232	43 600 197 500	0.43 6 1.97 5	M E1 M E3
EIW	237: V/5a Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone	12,000 (6,000 - 18.000) ha 2,800 - 5,200 ha (16 - 87 %) 9 - 27 ha (0.05 - 0.45 %)	30-70% NSS 30-70% RIV	<30% Lachlan 30-70% Murray <30% Murrumbidgee	Billabong FR Sanddune Pine FR Toupna Creek FR	334 60 79	2 3 13	0.02 0.03 0.11	E3 E3 E3
EIW	249: V/5b River Red Gum grass - swamp tall woodland of depressions (cowals) on floodplains and alluvial plains	5,000 (2,500 - 7,500) ha 1,000 - 3,000 ha (13 - 120 %) 0 - 0 ha (0 - 0 %)	<30% DRP 30-70% NSS <30% RIV	30-70% Central West <30% Lachlan <30% Murrumhidgee	Not Proteeted				
EIW	251: E/5a Mixed Eucalypt woodlands of floodplains in the southern-eastern Cobar Peneplain Bioregion	35,000 (18,000 - 52,000) ha 5,000 - 15,000 ha (9.6 - 83 %) 62 - 110 ha (0.12 - 0.61 %)	30-70% CP 30-70% NSS	>70% Lachlan <30% Murrumbidgee	CD9901 PA	229	88	0.25	E2

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EIWI	192: NT/5a Silver-leaved Ironbark - Poplar Box woodland mainly on gravelly ridges of the north-western plains of NSW	150,000 (110,000 - 190,000) ha 70,000 - 130,000 ha (37 - 120 %) 500 - 1,500 ha (0.26 - 1.4 %)	30-70% BBS 30-70% DRP <30% MUL	30-70% Border R/Gwydir 30-70% Western	Narran Lake NR*	21,830	1,000	0.67	E2
EIWI	217: V/3a Mugga Ironbark - Inland Grey Box - Pine tall woodland of the NSW South Western Slopes Bioregion	60,000 (30,000 - 90,000) ha 13,000 - 37,000 ha (14 - 120 %) 4,300 - 5,100 ha (4.8 - 17 %)	>70% NSS <30% RIV	<30% Central West 30-70% Lachlan <30% Murrumbidgee	Big Bush NR* Blue Mallee FR* Buddigower NR* Ingalba NR* Pucawan NR* The Chareoal Tank NR* PA9902 PA* VCA008 VCA*	643 66 329 4,179 287 84 248 400	450 10 120 3,550 225 42 248 31	0.75 0.02 0.2 5.92 0.38 0.07 0.41 0.05	M E3 E2 M M E2 E1 M
EIWI	227: E/5b Silver-leaved Ironbark - White Cypress Pine on alluvial sandy loam soils in central-north NSW	5,000 (2,500 - 7,500) ha 350 - 1,000 ha (4.7 - 40 %) 18 - 22 ha (0.24 - 0.88 %)	>70% DRP	<30% Border R/Gwydir 30-70% Central West <30% Namoi	Midkin NR	374	20	0.4	E1
EIWI	243: NT/4a Mugga Ironbark - White Cypress Pine woodland on sedimentary or metamorphic low rises in the temperate (hot summer) climate zone	40,000 (28,000 - 52,000) ha 21,000 - 39,000 ha (40 - 140 %) 280 - 340 ha (0.54 - 1.2 %)	<30% CP >70% NSS <30% RIV	30-70% Lachlan <30% Murrumbidgee	CD9907 PA CD9911 PA	343 410	182 128	0.46 0.32	M M
EMDI	115: NT/5b Eurah shrubland of inland floodplains	5,000 (2,500 - 7,500) ha 1,400 - 2,600 ha (19 - 100 %) 0 - 0 ha (0 - 0 %)	>70% DRP	>70% Border R/Gwydir <30% Namoi <30% Western	Not Protected				
EMDI	138: NT/4b Desert Paper-bark shrubland of semi-arid and arid climate zone watercourses.	3,000 (1,500 - 4,500) ha 2,000 - 3,600 ha (44 - 240 %) 180 - 220 ha (4 - 15 %)	30-70% BHC <30% CHC <30% CP	>70% Western	Gundabooka NP Sturt NP	64,282 338,232	100 100	3.33 3.33	E3 E3
EMDI	140: LC/5e Broombush shrubland in dunefields of the arid climate zone	800 (400 - 1,200) ha 400 - 1,200 ha (33 - 300 %) 50 - 150 ha (4.2 - 38 %)	>70% SSD	>70% Western	Sturt NP	338,232	100	12.5	E3
EMDI	142: V/5b Broombush shrubland in the mallee landscapes of the temperate and semi-arid (warm) climate zones	10,000 (5,000 - 15,000) ha 1,500 - 4,500 ha (10 - 90 %) 200 - 570 ha (1.3 - 11 %)	<30% CP >70% MDD	30-70% Lachlan <30% Murrumbidgee	Cocoparra NP Cocoparra NR Loughnan NR Nombinnie NR Pulletop NR Yathong NR	8,364 4,775 390 72,128 145 108,768	20 28 5 220 10 100	0.2 0.28 0.05 2.2 0.1 1	E1 E1 E3 E2 E2 E4

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EMDI	143: LC/Ia Narrow-leaved Hopbush-Scrub Turpentine-Senna shrubland of semi-arid and arid sandplains and dunes.	100,000 (10,000 - 190,000) ha 180,000 - 320,000 ha (95 - 3200 %) 36,000 - 65,000 ha (19 - 650 %)	<30% BHC <30% DRP <30% MUL 30-70% MDD	<30% Lachlan >70% Lower MD <30% Murrumbidgee <30% Western	Kinchega NP Mallee Cliffs NP Mungo NP Mutawintji NP Mutawintji NR Nocoleche NR Paroo-Darling NP Tarawi NR Willandra NP Nanya Ballarat Uni VCA Scotia AWC VCA	44,441 57,956 111,842 67,581 6,711 71,068 176,427 33,445 18,835 28,849 64,528	1,760 500 1,000 9,000 200 1,000 15,500 6,880 100 3,750 11,000	1.76 0.5 1 9 0.2 1 15.5 6.88 0.1 3.75 11	M E3 E2 E1 E1 E3 E2 E2 E4 E1 E2
EMDI	194: LC/3a Heather Bush - Umbrella Mulga open shrubland of the semi-arid zone	80,000 (56,000 - 100,000) ha 56,000 - 100,000 ha (56 - 180 %) 3,700 - 4,400 ha (3.7 - 7.9 %)	>70% MUL	>70% Western	Ledknapper NR	30,759	4,014	5.02	E1
EMDI	213: V/4b Murray's Wattle sparse shrubland/forbland on sand rises of the Darling Riverine Plain Bioregion	2,000 (1,000 - 3,000) ha 500 - 1,500 ha (17 - 150 %) 140 - 260 ha (4.7 - 26 %)	>70% DRP	>70% Western	Narran Lake NR*	21,830	200	10	E4
EMDI	229: LC/1b Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion	1,000 (700 - 1,300) ha 140,000 - 260,000 ha (10770 - 37140 %) 7,000 - 12,000 ha (540 - 1710 %)	>70% CP	>70% Western	Gundabooka NP Mount Grenfell HS Nombinnie SCA Yathong NR	64,282 1,365 53,261 108,768	9,000 35 300 600	900 3.5 30 60	E2 E1 E2 E2
EMDI	232: LC/1a Senna - Mulga - Needlewood open shrubland on loam-clay soils in swales and on the edges of claypans in the arid zone	30,000 (15,000 - 45,000) ha 15,000 - 45,000 ha (33 - 300 %) 5,000 - 15,000 ha (11 - 100 %)	>70% SSD	>70% Western	Sturt NP	338,232	10,000	33.33	E3
EMDI	252: V/5a Sugarwood open woodland of the inland plains mainly Murray-Darling Depression Bioregion	30,000 (15,000 - 45,000) ha 7,500 - 22,000 ha (17 - 150 %) 120 - 360 ha (0.27 - 2.4 %)	>70% MDD	>70% Lower MD	Tarawi NR Scotia AWC VCA	33,445 64,528	40 200	0.13 0.67	E3 E3
EMDI	261: NT/3c Swamp Paper-bark shrubland on edges of depressions in the Mulga Lands Bioregion	500 (150 - 850) ha 140 - 760 ha (16 - 510 %) 100 - 300 ha (12 - 200 %)	>70% MUL	>70% Western	Nocoleche NR	71,068	200	40	E1

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EWRHI	184: LC/4a Dwyers Red Gum - Currawang low woodland mainly of the Cobar Peneplain Bioregion	100,000 (70,000 - 130,000) ha 56,000 - 100,000 ha (43 - 140 %) 2,400 - 4,300 ha (1.8 - 6.1 %)	>70% CP <30% MDD	<30% Central West 30-70% Lachlan <30% Western	Nombinnie NR Round Hill NR Scrubby Mountain FR Yathong NR CD9907 PA VCA008 VCA* WE9905 PA	72,128 13,642 1,704 108,768 343 400 819	13 123 400 1,850 20 245 674	0.01 0.12 0.4 1.85 0.02 0.25 0.67	M M E3 E2 M M M
EWRHI	185: LC/4a Dwyers Red Gum - White Cypress Pine - Currawang shrubby woodland mainly of the NSW South Western Slopes Bioregion	100,000 (70,000 - 130,000) ha 56,000 - 100,000 ha (43 - 140 %) 1,500 - 2,700 ha (1.2 - 3.9 %)	<30% CP >70% NSS	<30% Lachlan <30% Murray <30% Murrumbidgee	Buddigower NR* Cocoparra NP Cocoparra NR WE9904 PA*	329 8,364 4,775 84	40 1,100 897 84	0.04 1.1 0.9 0.08	E1 M M E1
EWRHI	186: LC/2a Dwyer's Mallee - Black Cypress Pine - Currawang woodland on rocky hills mainly in the NSW South Western Slopes Bioregion	130,000 (65,000 - 190,000) ha 50,000 - 150,000 ha (26 - 230 %) 16,000 - 29,000 ha (8.4 - 45 %)	<30% CP >70% NSS	30-70% Lachlan <30% Murray 30-70% Murrumbidgee	Benambra NP* Blue Mallee FR* Boginderra Hills NR* Cocoparra NP Cocoparra NR Eugowra NR* Goobang NP* Ingalba NR* Livingstone NP* Livingstone SCA* Mudjarn NR* Tabletop NR* The Charcoal Tank NR* The Rock NR* Ulandra NR* Weddin Mountains NP* Woomargama NP* CO9801 PA*	1,400 66 798 8,364 4,775 115 42,352 4,179 1,918 485 590 102 84 343 3,958 8,697 24,189 525	72 10 133 6,100 3,200 100 500 400 390 17 332 64 2 193 1,728 5,196 3,807 525	0.06 0.01 0.1 4.69 2.46 0.08 0.38 0.31 0.3 0.01 0.26 0.05 0 0.15 1.33 4 2.93 0.4	E1 E3 M M M M E1 E2 E1 E1 E1 E2 E1 E2 E1 M E1 M
EWRHI	188: NT/5c Dwyer's Red Gum - Quinine Tree open woodland on igneous intrusive hills of the Macquarie River floodplain	390 (360 - 420) ha 280 - 340 ha (67 - 94 %) 0 - 0 ha (0 - 0 %)	>70% DRP	>70% Central West	Not Protected				
EWRHI	239: LC/4c Red Stringybark - Dwyers Red Gum - Black Cypress Pine woodland on siliceous ranges in the south-eastern Cobar Peneplain Bioregion	500 (250 - 750) ha 200 - 600 ha (27 - 240 %) 70 - 130 ha (9.3 - 52 %)	>70% CP	30-70% Lachlan 30-70% Murrumbidgee	Cocoparra NP Pucawan NR* The Rock NR*	8,364 287 343	60 20 20	12 4 4	M E2 E2

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EWRHI	257: NT/5a Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW	45,000 (32,000 - 58,000) ha 21,000 - 39,000 ha (36 - 120 %) 0 - 0 ha (0 - 0 %)	30-70% CP 30-70% NSS	30-70% Central West <30% Laehlan <30% Western	Not Proteeted				
EWT	071: E/4a Carbeen woodland on alluvial soils	20,000 (18,000 - 22,000) ha 4,100 - 4,900 ha (19 - 27 %) 140 - 160 ha (0.64 - 0.89 %)	<30% BBS >70% DRP	>70% Border R/Gwydir <30% Namoi	Boomi NR Boomi West NR Boronga NR	157 148 198	49 30 70	0.25 0.15 0.35	M M E1
EWT	100: LC/5a Desert Bloodwood - Mulga low woodland of the semi-arid plains	120,000 (84,000 - 150,000) ha 70,000 - 130,000 ha (47 - 150 %) 500 - 1,500 ha (0.33 - 1.8 %)	<30% CP >70% MUL	<30% Central West >70% Western	Gundabooka NP	64,282	1,000	0.83	E3
EWT	133: LC/4b Western Bloodwood - Whitewood low open woodland on Tibooburra Granite	3,000 (2,100 - 3,900) ha 1,900 - 3,300 ha (49 - 160 %) 100 - 300 ha (2.6 - 14 %)	>70% CHC	>70% Western	Sturt NP	338,232	200	6.67	E3
FWI	012: LC/4a Shallow marsh of regularly flooded depressions on floodplains mainly in the semi-arid (warm) climatie zone	25,000 (18,000 - 32,000) ha 14,000 - 26,000 ha (44 - 140 %) 520 - 1,500 ha (1.6 - 8.3 %)	>70% RIV	<30% Laehlan <30% Lower MD 30-70% Murray <30% Murrumbidgee	Billabong FR Kemendok NR Moira Lakes FR Pollaek FR Sanddune Pine FR Snake Island FR Toupna Creek FR Yanga NP	334 1,063 1,441 714 60 37 79 70,581	4 20 400 80 16 1 5 500	0.02 0.08 1.6 0.32 0.06 0 0.02 2	E1 E1 E2 E1 E1 E1 E1 E3
FWI	017: V/5a Lignum shrubland of the semi-arid (warm) plains - mainly in the Riverina Bioregion	400,000 (280,000 - 520,000) ha 110,000 - 190,000 ha (21 - 68 %) 2,300 - 4,100 ha (0.44 - 1.5 %)	<30% DRP <30% MDD >70% RIV	<30% Laehlan <30% Lower MD 30-70% Murray 30-70% Murrumbidgee	Goonawarra NR Kalyarr NP Kemendok NR Morrisons Lake NR Mungo NP Oolambeyan NP Wilbertroy FR* Willandra NP Yanga NP DE9905 PA	410 14,936 1,063 319 111,842 21,839 136 18,835 70,581 663	75 700 11 20 100 493 2 1,000 670 110	0.02 0.18 0 0.01 0.03 0.12 0 0.25 0.17 0.03	E1 E2 E1 E2 E3 M E4 E3 E3 M
FWI	025: LC/4a Lignum shrubland on floodplains and depressions of the Mulga Lands, Channel Country Bioregions in the arid and semi-arid (hot) climate zones	500,000 (350,000 - 650,000) ha 280,000 - 520,000 ha (43 - 150 %) 4,200 - 7,600 ha (0.65 - 2.2 %)	30-70% CHC <30% MUL <30% SSD	>70% Western	Ledknapper NR Nocoleche NR Paroo-Darling NP Pindera Downs AA Sturt NP	30,759 71,068 176,427 11,790 338,232	1,860 500 2,000 500 1,000	0.37 0.1 0.4 0.1 0.2	E1 E3 E2 E3 E3

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FWI	053: V/4a Shallow freshwater sedge swamp on inland floodplains and depressions	150,000 (75,000 - 220,000) ha 35,000 - 100,000 ha (16 - 130 %) 1,800 - 3,200 ha (0.82 - 4.3 %)	<30% BBS 30-70% DRP <30% MUL <30% RIV <30% NSS	30-70% Border R/Gwydir 30-70% Central West <30% Lachlan <30% Murray <30% Murrumbidgee <30% Namoi <30% Western	Boomi NR Budelah NR Kirramingly NR* Maequarie Marshes NR Noeoleehe NR	157 4,049 1,329 19,465 71,068	2 17 9 2,000 500	0 0.01 0.01 1.33 0.33	E3 M M E2 E2
FWI	066: CE/5e Artesian Mound Spring forbland/sedgeland/grassland mainly of the Mulga Lands Bioregion	50 (25 - 75) ha 8 - 22 ha (10 - 88 %) 4 - 7 ha (4.7 - 26 %)	>70% MUL	>70% Western	Paroo-Darling NP	176,427	5	10	E1
FWI	161: LC/3a Golden Goosefoot shrubland swamps of the arid and semi-arid (hot summer) zones	50,000 (25,000 - 75,000) ha 13,000 - 37,000 ha (17 - 150 %) 3,500 - 6,500 ha (4.7 - 26 %)	<30% BHC 30% CHC >70% DRP <30% MUL	<30% Border R/Gwydir <30% Namoi >70% Western	Sturt NP	338,232	5,000	10	E3
FWI	181: LC/3a Common Reed - Bushy Groundsel reedland/forbland of inland river systems	30,000 (15,000 - 45,000) ha 10,000 - 30,000 ha (22 - 200 %) 2,700 - 4,900 ha (6 - 33 %)	<30% CP <30% DRP <30% MUL <30% MDD <30% NSS 30-70% RIV	<30% Border R/Gwydir <30% Central West <30% Lachlan <30% Lower MD 30-70% Murray <30% Murrumbidgee <30% Namoi	Maequarie Marshes NR Yanga NP	19,465 70,581	3,800 5	12.67 0.02	E2 E3
FWI	182: LC/4a Cumbungi rushland of shallow semi-permanent water bodies of the inland river systems	40,000 (12,000 - 68,000) ha 15,000 - 45,000 ha (22 - 380 %) 200 - 600 ha (0.29 - 5 %)	<30% DRP <30% MUL <30% MDD <30% NSS 30-70% RIV	<30% Border R/Gwydir <30% Central West <30% Lachlan <30% Lower MD <30% Murray <30% Murrumbidgee <30% Namoi	Maequarie Marshes NR	19,465	400	1	E2
FWI	205: CE/5b Marsh Club-rush very tall sedgeland of inland watereourses	5,000 (3,500 - 6,500) ha 320 - 380 ha (4.9 - 11 %) 0 - 0 ha (0 - 0 %)	>70% DRP	>70% Border R/Gwydir	Not Proteeted				
FWI	226: NT/5c Cyperus - Typha sedgeland of the arid zone elimate zone	500 (250 - 750) ha 250 - 750 ha (33 - 300 %) 0 - 0 ha (0 - 0 %)	>70% SSD	>70% Western	Not Proteeted				

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FWI	238: NT/5a Permanent and semi-permanent freshwater lakes of the inland slopes and plains	1,000,000 (500,000 - 1,500,000) ha 200,000 - 600,000 ha (13 - 120 %) 720 - 2,100 ha (0.048 - 0.42 %)	<30% BBS >70% DRP >30% MUL <30% MDD <30% NSS 30-70% RIV <30% SSD	<30% Border R/Gwydir <30% Central West <30% Lachlan <30% Lower MD <30% Murray <30% Murrumbidgee <30% Namoi <30% Western	Billabong FR Macquarie Marshes NR Moira Lakes FR Morrisons Lake NR Peacock Creek FR Pollack FR Willandra NP Yanga NP	334 19,465 1,441 319 99 714 18,835 70,581	19 300 664 180 5 6 100 150	0 0.03 0.07 0.02 0 0 0.01 0.02	E1 E3 E1 E2 E2 E1 E4 E1
FWI	240: NT/5c River Coobah tall shrubland of the floodplains in the Riverina and Murray-Darling Depression Bioregions	800 (400 - 1,200) ha 350 - 650 ha (29 - 160 %) 27 - 33 ha (2.3 - 8.3 %)	30-70% MDD 30-70% RIV	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumbidgee	Kalyarr NP	14,936	30	3.75	E4
FWI	241: NT/5b River Coobah swamp on the floodplains of the Darling Riverine Plains and Brigalow Belt South Bioregions	10,000 (7,000 - 13,000) ha 3,500 - 6,500 ha (27 - 93 %) 7 - 13 ha (0.054 - 0.19 %)	<30% BBS 30-70% DRP	30-70% Border R/Gwydir <30% Central West <30% Namoi	Macquarie Marshes NR	19,465	10	0.1	E2
FWI	247: E/4a Lignum shrubland on regularly flooded alluvial clay depressions in the Brigalow Belt South and Darling Riverine Plains Bioregions	350,000 (250,000 - 450,000) ha 91,000 - 160,000 ha (20 - 64 %) 3,600 - 6,500 ha (0.8 - 2.6 %)	<30% BBS >70% DRP	30-70% Border R/Gwydir <30% Central West <30% Namoi	Culgoa NP Gundabooka NP Macquarie Marshes NR Narran Lake NR*	24,965 64,282 19,465 21,830	21 300 50 4,700	0.01 0.09 0.01 1.34	M E3 E1 E1
FWI	271: LC/5b Spotted Fuchsia shrubland in drainage depressions on inland plains	3,000 (1,500 - 4,500) ha 1,300 - 3,700 ha (29 - 250 %) 0 - 0 ha (0 - 0 %)	<30% BHC <30% CHC <30% CP <30% DRP <30% MUL	<30% Central West <30% Lachlan >70% Western	Not Protected				
GFAPF	024: LC/4a Canegrass swamp of drainage depressions, lakes and pans of the inland plains	500,000 (250,000 - 750,000) ha 200,000 - 600,000 ha (27 - 240 %) 7,600 - 13,000 ha (1 - 5.2 %)	<30% BHC <30% CHC <30% DRP <30% MUL <30% MDD <30% RIV <30% SSD	<30% Central West <30% Lachlan <30% Lower MD <30% Murray <30% Murrumbidgee <30% Namoi 30-70% Western	Kalyarr NP Mungo NP Nocoleche NR Paroo-Darling NP Pindera Downs AA Sturt NP Willandra NP AL9907 PA AL9908 PA CD9901 PA	14,936 111,842 71,068 176,427 11,790 338,232 18,835 19 22 229	430 100 500 1,600 7,000 1,000 123 5 5 2	0.09 0.02 0.1 0.32 1.4 0.2 0.02 0 0 0	E3 E3 E3 E3 E3 E3 E3 E1 E1 E1

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GFAPF	047: V/5a Swamp grassland of the Riverine Plain	50,000 (25,000 - 75,000) ha 13,000 - 37,000 ha (17 - 150 %) 81 - 99 ha (0.11 - 0.4 %)	>70% RIV	<30% Lachlan <30% Murray <30% Murrumbidgee	Oolambeyan NP	21,839	90	0.18	E4
GFAPF	050: LC/5a Couch Grass grassland on river banks and floodplains of inland river systems	50,000 (25,000 - 75,000) ha 15,000 - 45,000 ha (20 - 180 %) 45 - 55 ha (0.06 - 0.22 %)	<30% BBS 30-70% DRP <30% MUL <30% RIV	30-70% Border R/Gwydir <30% Central West <30% Lachlan <30% Lower MD <30% Murray <30% Murrumbidgee <30% Namoi	Moira Lakes FR	1,441	50	0.1	E4
GFAPF	204: E/4a Water Couch marsh of frequently flooded inland watercourses	90,000 (63,000 - 110,000) ha 11,000 - 19,000 ha (10 - 30 %) 850 - 1,000 ha (0.77 - 1.6 %)	<30% BBS >70% DRP	30-70% Border R/Gwydir <30% Central West <30% Namoi	Macquarie Marshes NR	19,465	940	1.04	E3
GFAPF	242: NT/5b Rat's Tail Couch sod grassland of inland floodplains	5,000 (2,500 - 7,500) ha 1,500 - 4,500 ha (20 - 180 %) 0 - 0 ha (0 - 0 %)	30-70% DRP <30% RIV	<30% Border R/Gwydir <30% Central West <30% Laehlan <30% Lower MD <30% Murray <30% Murrumbidgee <30% Namoi	Not Proteeted				
GFTI	043: V/4a Mitehell Grass grassland of the semi-arid (hot) and arid zone alluvial floodplains	350,000 (180,000 - 520,000) ha 110,000 - 190,000 ha (21 - 110 %) 7,600 - 13,000 ha (1.5 - 7.2 %)	<30% BHC >70% DRP <30% MUL	<30% Border R/Gwydir <30% Central West <30% Namoi 30-70% Western	Culgoa NP Narran Lake NR* Paroo-Darling NP Paroo-Darling SCA	24,965 21,830 176,427 41,457	4,000 1,600 120 5,000	1.14 0.46 0.03 1.43	E1 E1 M E3
GFTI	044: E/5a Forb-rieh Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	300,000 (150,000 - 450,000) ha 40,000 - 120,000 ha (8.9 - 80 %) 31 - 57 ha (0.0069 - 0.038 %)	>70% RIV	30-70% Murray 30-70% Murrumbidgee	Jerilderie NR Koonadan HS DE9905 PA	37 21 663	37 5 2	0.01 0 0	M E4 E1
GFTI	045: V/5a Plains Grass grassland on alluvial dark grey elays of ecntral New South Wales	250,000 (130,000 - 370,000) ha 50,000 - 150,000 ha (14 - 120 %) 1,400 - 2,600 ha (0.38 - 2 %)	30-70% DRP 30-70% RIV	<30% Central West <30% Laehlan 30-70% Murray 30-70% Murrumbidgee	Oolambeyan NP	21,839	2,000	0.8	E3
GFTI	046: LC/3a Curly Windmill Grass - speargrass - wallaby grass on alluvial elay and loam on the Hay Plain, Riverina Bioregion	250,000 (130,000 - 370,000) ha 100,000 - 300,000 ha (27 - 230 %) 12,000 - 34,000 ha (3.2 - 26 %)	>70% RIV	30-70% Lachlan 30-70% Murrumbidgee	Kalyarr NP Oolambeyan NP Willandra NP DE9906 PA	14,936 21,839 18,835 43	2,050 15,600 5,445 5	0.82 6.24 2.18 0	E2 E2 E3 M

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GFTI	049: V/4a Windmill Grass - Curly Windmill Grass - Button Grass alluvial plains grasslands in the dry subtropical climate zone	200,000 (100,000 - 300,000) ha 35,000 - 100,000 ha (12 - 100 %) 3,400 - 6,200 ha (1.1 - 6.2 %)	<30% BBS >70% DRP	>70% Border R/Gwydir <30% Central West <30% Namoi	Arakoola NR* Boronga NR Budelah NR Careunga NR* Macquarie Marshes NR Midkin NR Planchonella NR*	3,159 198 4,049 492 19,465 374 722	534 5 150 20 4,000 30 100	0.27 0 0.08 0.01 2 0.02 0.05	E2 E3 E3 E3 E2 E3 E4
GFTI	052: E/5a Queensland Bluegrass - Cup Grass - Mitchell Grass - Native Millet alluvial plains grassland	500,000 (250,000 - 750,000) ha 75,000 - 220,000 ha (10 - 88 %) 2,100 - 2,500 ha (0.28 - 1 %)	<30% BBS >70% DRP	>70% Border R/Gwydir <30% Namoi <30% Western	Budelah NR Kirramingly NR*	4,049 1,329	1,200 1,100	0.24 0.22	E3 M
GFTI	061: LC/2a Mitchell Grass - saltbush grassland/shrubland of the gibber downs of the arid climate zone	800,000 (560,000 - 1,000,000) ha 280,000 - 820,000 ha (28 - 150 %) 120,000 - 200,000 ha (12 - 36 %)	>70% CHC <30% MUL	>70% Western	Pindera Downs AA Sturt NP	11,790 338,232	2,000 157,500	0.25 19.69	E3 E3
GFTI	149: LC/3a Neverfail Grass - ephemeral herbaceous forbland of interdune claypans mainly in the arid climate zone	30,000 (15,000 - 45,000) ha 13,000 - 37,000 ha (29 - 250 %) 750 - 2,200 ha (1.7 - 15 %)	<30% CHC <30% MUL >70% SSD	>70% Western	Noeoleche NR Sturt NP	71,068 338,232	1,000 500	3.33 1.67	E3 E3
GFTI	165: LC/1a Derived corkserew grass grassland/forbland on sandplains and plains in the semi-arid (warm) climate zone	30,000 (15,000 - 45,000) ha 50,000 - 150,000 ha (110 - 1000 %) 15,000 - 27,000 ha (33 - 180 %)	<30% CP >70% MDD <30% RIV	<30% Lachlan >70% Lower MD <30% Murrumbidgee <30% Western	Kalyarr NP Mallee Cliffs NP Mungo NP Nombinnie NR Nombinnie SCA Oolambeyan NP Tarawi NR Yathong NR Nanya Ballarat Uni VCA Scotia AWC VCA VCA006 VCA	14,936 57,956 111,842 72,128 53,261 21,839 33,445 108,768 28,849 64,528 18	45 3,900 7,500 1,700 400 5 400 6,040 720 110 2	0.15 13 25 5.67 1.33 0.02 1.33 20.13 2.4 0.37 0.01	E1 E2 E2 E1 E2 E3 E1 E2 E1 E1 M
GFTI	183: LC/5b Windmill Grass - love grass - daisy derived grassland/forbland of arid climate zone	1,000 (100 - 1,900) ha 50,000 - 150,000 ha (2630 - 150000 %) 0 - 0 ha (0 - 0 %)	30-70% BHC <30% MUL	>70% Western	Not Protected				
GFTI	214: V/5a Native Millet - Cup Grass grassland of the Darling Rverine Plain Bioregion	30,000 (15,000 - 45,000) ha 7,000 - 13,000 ha (16 - 87 %) 180 - 210 ha (0.4 - 1.4 %)	>70% DRP	<30% Border R/Gwydir <30% Central West <30% Namoi	Boomi NR Boomi West NR Budelah NR	157 148 4,049	30 11 150	0.1 0.04 0.5	E4 E4 E4

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GFTI	215: LC/3a Woollybutt open grasslands on red earths of the inland plains	40,000 (20,000 - 60,000) ha 20,000 - 60,000 ha (33 - 300 %) 3,600 - 6,600 ha (6 - 33 %)	<30% CP <30% DRP <30% MUL <30% MDD	>70% Western	Noeoleehe NR Paroo-Darling NP	71,068 176,427	500 4,600	1.25 11.5	E3 M
GFTI	250: LC/2b Derived tussock grasslands of the central western plains and lower slopes of NSW	1,000 (100 - 1,900) ha 200,000 - 600,000 ha (10530 - 600000 %) 440 - 530 ha (23 - 530 %)	<30% CP 30-70% NSS	30-70% Central West 30-70% Lachlan <30% Murrumbidgee	CD9907 PA CD9911 PA VCA008 VCA*	343 410 400	122 260 100	12.2 26 10	M M M
HGI	117: LC/4a Buck Spinifex hummock grassland - Silver-leaved Ironbark open woodland on deep sand	60,000 (54,000 - 66,000) ha 52,000 - 62,000 ha (79 - 110 %) 2,000 - 2,300 ha (3 - 4.3 %)	<30% DRP 30-70% MUL	>70% Western	Ledknapper NR Narran Lake NR*	30,759 21,830	1,065 1,079	1.78 1.8	M M
HGI	151: NT/5c Sandhill Cane Grass hummock grassland on siliceous sands on dune crests of the arid zone	800 (400 - 1,200) ha 300 - 900 ha (25 - 230 %) 51 - 93 ha (4.3 - 23 %)	<30% DRP <30% MDD 30-70% SSD	30-70% Lower MD <30% Western	Kinchega NP	44,441	72	9	M
HGI	235: NT/5b Yetman Buloke - Inland Grey Box - spinifex woodland on alkaline, sandy outwash plains mainly in the BBS Bioregion	2,000 (1,400 - 2,600) ha 1,100 - 1,900 ha (42 - 140 %) 0 - 0 ha (0 - 0 %)	30-70% BBS 30-70% DRP	>70% Border R/Gwydir	Not Proteeted				
MWSI	170: NT/4a Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones	1,100,000 (770,000 - 1,400,000) ha 530,000 - 970,000 ha (38 - 130 %) 34,000 - 62,000 ha (2.4 - 8.1 %)	>70% CHC <30% DRP 30-70% MDD	<30% Lachlan 30-70% Lower MD <30% Murray <30% Murrumhidgee <30% Western	Kajuligah NR Mallee Cliffs NP Mungo NP Tarawi NR Yanga NP Nanya Ballarat Uni VCA Scotia AWC VCA	13,826 57,956 111,842 33,445 70,581 28,849 64,528	2,000 14,100 5,000 9,000 500 1,500 16,000	0.18 1.28 0.45 0.82 0.05 0.14 1.45	E3 E1 E2 E1 E3 E3 E3
MWSI	171: LC/3a Spinifex linear dune mallee mainly of the Murray-Darling Depression Bioregion	800,000 (560,000 - 1,000,000) ha 460,000 - 840,000 ha (46 - 150 %) 73,000 - 130,000 ha (7.3 - 23 %)	>70% MDD	<30% Lachlan >70% Lower MD <30% Western	Mallee Cliffs NP Mungo NP Nomhinnie NR Nomhinnie SCA Round Hill NR Tarawi NR Yathong NR Nanya Ballarat Uni VCA Scotia AWC VCA	57,956 111,842 72,128 53,261 13,642 33,445 108,768 28,849 64,528	17,300 6,000 250 200 143 9,000 34,000 10,530 26,150	2.16 0.75 0.03 0.03 0.02 1.13 4.25 1.32 3.27	E2 E2 E1 E1 M E1 E2 E1 E1
MWSI	172: LC/3a Deep sand mallee of irregular dunefields of the semi-arid (warm) zone	364,000 (330,000 - 400,000) ha 330,000 - 390,000 ha (83 - 120 %) 38,000 - 46,000 ha (9.5 - 14 %)	>70% MDD	>70% Lower MD	Mallee Cliffs NP Mungo NP	57,956 111,842	4,500 37,500	1.24 10.3	E1 E2

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MWSI	173: NT/2a Sandplain mallee of central NSW	700,000 (490,000 - 910,000) ha 250,000 - 450,000 ha (27 - 92 %) 120,000 - 130,000 ha (13 - 27 %)	<30% CP 30-70% MDD <30% NSS	<30% Central West 30-70% Lachlan <30% Murrumbidgee	Gubbata NR Kajuligah NR Langtree NR Loughnan NR Mount Grenfell HS Nombinnie NR Nombinnie SCA Pulletop NR Round Hill NR Scrubby Mountain FR Yathong NR WE9906 PA* WE9907 PA*	151 13,826 232 390 1,365 72,128 53,261 145 13,642 1,704 108,768 24 35	146 4,000 32 360 100 57,590 33,830 135 12,540 250 13,400 24 35	0.02 0.57 0 0.05 0.01 8.23 4.83 0.02 1.79 0.04 1.91 0 0.01	E1 E3 E1 E1 E2 E1 E2 E1 E1 E3 E2 M M
MWSI	174: V/3a Mallee - Smooth-barked Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	80,000 (56,000 - 100,000) ha 25,000 - 45,000 ha (25 - 80 %) 7,700 - 14,000 ha (7.7 - 25 %)	>70% CP	<30% Central West <30% Lachlan 30-70% Western	Quanda NR Tollingo NR Woggoon NR	4,767 3,247 6,113	2,200 3,180 5,500	2.75 3.98 6.88	E1 M E1
MWSI	190: NT/3c Mallee Box open woodland	300 (210 - 390) ha 170 - 310 ha (44 - 150 %) 73 - 130 ha (19 - 62 %)	>70% MDD	<30% Lachlan >70% Lower MD	Tarawi NR Tollingo NR Woggoon NR	33,445 3,247 6,113	100 2 1	33.33 0.67 0.33	E2 E2 E4
MWSI	191: LC/1b Snap and Rattle Mallee - Moonah open mallee shrubland	7,000 (3,500 - 10,000) ha 3,300 - 9,700 ha (33 - 280 %) 3,200 - 5,900 ha (32 - 170 %)	>70% MDD	>70% Lower MD	Tarawi NR Nanya Ballarat Uni VCA Seotia AWC VCA	33,445 28,849 64,528	2,000 560 2,000	28.57 8 28.57	E2 E3 E3
MWSI	193: E/3a Tall bull mallee woodland on clayey soils of central NSW	20,000 (10,000 - 30,000) ha 2,500 - 7,500 ha (8.3 - 75 %) 1,100 - 1,900 ha (3.7 - 19 %)	<30% CP 30-70% MDD	<30% Central West 30-70% Lachlan	Nombinnie NR Nombinnie SCA Quanda NR	72,128 53,261 4,767	500 1,000 10	2.5 5 0.05	E1 E1 E4
MWSR	169: LC/5b Curly Mallee - bluebush open woodland of the arid zone	1,400 (980 - 1,800) ha 910 - 1,600 ha (51 - 160 %) 0 - 0 ha (0 - 0 %)	>70% BHC	>70% Western	Not Protected				
MWSR	175: NT/5a Ridge mallee woodland on hills of meta-sediments and volcanics, eastern Cobar Peneplain Bioregion	60,000 (42,000 - 78,000) ha 32,000 - 58,000 ha (41 - 140 %) 0 - 0 ha (0 - 0 %)	>70% CP	30-70% Central West <30% Lachlan <30% Western	Not Protected				
MWSR	176: LC/3a Green Mallee - White Cypress Pine woodland on gravelly rises of central NSW	75,000 (53,000 - 97,000) ha 42,000 - 78,000 ha (43 - 150 %) 5,000 - 9,200 ha (5.2 - 17 %)	>70% CP <30% MDD <30% NSS	30-70% Central West <30% Lachlan 30-70% Western	Nombinnie SCA Yathong NR CD9907 PA CD9911 PA WE9902 PA*	53,261 108,768 343 410 57	260 6,800 2 21 40	0.35 9.07 0 0.03 0.05	M E2 M M E1

Formation Group Aeronym	Veg ID: Threat/Proteeted Area Code Plant Community Common Name	ESTIMATED EXTENT: pre-European (range) Current Range (% pre-European) Proteeted Range (% pre-European)	% of Community in Bioregion	% of Community in CMA	Proteeted Area Name and Size (ha) (* = also on Western Slopes)		Veg Area (ha) % of Pre-European & Accuracy Code		
MWSR	180: LC/3a Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	35,000 (25,000 - 45,000) ha 24,000 - 42,000 ha (53 - 170 %) 3,200 - 3,800 ha (7.1 - 15 %)	>70% CP	30-70% Central West <30% Lachlan <30% Western	Nombinnie NR Round Hill NR Scrubby Mountain FR Yathong NR	72,128 13,642 1,704 108,768	23 200 50 3,250	0.07 0.57 0.14 9.29	M E3 E3 E1
MWSR	218: LC/3a Grey Mallee - Mulga shrubland of the north-western Cobar Peneplain Bioregion	33,000 (30,000 - 36,000) ha 28,000 - 34,000 ha (78 - 110 %) 1,300 - 2,300 ha (3.6 - 7.7 %)	>70% CP	>70% Western	Gundabooka NP Mount Grenfell HS	64,282 1,365	1,500 310	4.55 0.94	E2 E2
MWSR	256: LC/5b Green Mallee - Blaek Cypress Pine tall mallee woodland on rises in central NSW	10,000 (5,000 - 15,000) ha 4,300 - 12,000 ha (29 - 240 %) 45 - 55 ha (0.3 - 1.1 %)	<30% BBS 30-70% CP 30-70% NSS	>70% Central West <30% Laehlan	Coolbaggie NR*	1,773	50	0.5	E2
RDGI	137: NT/3a Whitewood - Western Rosewood low woodland on sandplains and dunes of the semi-arid (hot) and arid elimatie zones	40,000 (20,000 - 60,000) ha 13,000 - 37,000 ha (22 - 190 %) 1,500 - 2,700 ha (2.5 - 14 %)	<30% CHC <30% DRP <30% MUL <30% SSD	>70% Western	Ledknapper NR Nocoleehe NR Sturt NP	30,759 71,068 338,232	500 1,500 100	1.25 3.75 0.25	E2 E3 E3
RDGI	144: NT/4a Leopardwood woodland of alluvial plains	350,000 (180,000 - 520,000) ha 100,000 - 300,000 ha (19 - 170 %) 3,400 - 10,000 ha (0.65 - 5.6 %)	<30% BBS <30% CP 30-70% DRP 30-70% MUL	<30% Border R/Gwydir <30% Central West <30% Namoi <30% Western	Gundabooka NP Narran Lake NR* Nocoleehe NR Paroo-Darling NP	64,282 21,830 71,068 176,427	1,000 171 2,000 3,500	0.29 0.05 0.57 1	E2 E2 E3 E2
RDGI	145: E/5a Wilga - Western Rosewood shrubland of the tropical sub-humid climate zone Brigalow Belt South and Darling Riverine Plains Bioregions	150,000 (75,000 - 220,000) ha 20,000 - 60,000 ha (9.1 - 80 %) 10 - 30 ha (0.0045 - 0.04 %)	30-70% BBS 30-70% DRP	<30% Border R/Gwydir <30% Central West <30% Namoi	Planehonella NR*	722	20	0.01	M
RDGI	146: E/5b Whitewood open woodland of the subtropical sub-humid plains (BBS and eastern DRP Bioregions).	10,000 (5,000 - 15,000) ha 1,000 - 3,000 ha (6.7 - 60 %) 5 - 15 ha (0.033 - 0.3 %)	30-70% DRP	<30% Border R/Gwydir <30% Central West <30% Namoi	Midkin NR	374	10	0.1	E1
RDGI	264: NT/4a Supplejaek woodland of the semi-arid plains	35,000 (18,000 - 52,000) ha 15,000 - 45,000 ha (29 - 250 %) 380 - 700 ha (0.73 - 3.9 %)	<30% DRP 30-70% MUL	>70% Western	Gundabooka NP Ledknapper NR	64,282 30,759	500 40	1.43 0.11	E2 E2
SWISL	018: NT/5a Slender Glasswort low shrubland in saline depressions in the semi-arid and arid elimate zones	200,000 (140,000 - 260,000) ha 84,000 - 150,000 ha (32 - 110 %) 1,300 - 1,400 ha (0.5 - 1 %)	<30% MUL <30% MDD 30-70% RIV	<30% Laehlan >70% Lower MD <30% Murray <30% Murrumbidgee <30% Western	Kalyarr NP	14,936	1,350	0.68	E3
SWISL	062: LC/4a Samphire - Small Hogweed saline forbland of lake margins in the arid and semi-arid (hot) zones	50,000 (35,000 - 65,000) ha 32,000 - 58,000 ha (49 - 170 %) 1,700 - 3,000 ha (2.6 - 8.6 %)	<30% DRP 30-70% MUL <30% SSD	>70% Western	Narran Lake NR* Paroo-Darling NP Sturt NP	21,830 176,427 338,232	30 300 2,000	0.06 0.6 4	E1 E3 E3

Formation Group Aeronym	Veg ID: Threat/Protected Area Code Plant Community Common Name	ESTIMATED EXTENT: pre-European (range) Current Range (% pre-European) Protected Range (% pre-European)	% of Community in Bioregion	% of Community in CMA	Protected Area Name and Size (ha) (* = also on Western Slopes)		Veg Area (ha) % of Pre-European & Accuracy Code		
SWISL	063: NT/5b Spiny Lignum - Slender Glasswort open forbland on lake edges in the semi-arid and arid climate zones	5,000 (2,500 - 7,500) ha 2,300 - 6,700 ha (31 - 270 %) 140 - 260 ha (1.9 - 10 %)	<30% DRP 30-70% MDD <30% RIV	>70% Lower MD <30% Murray	Nearie Lake NR	4,354	200	4	E2
SWISL	064: LC/4b Samphire - Water Weed - Sea-Heath shrubland of saline depressions of the arid and semi-arid (warm) zones	10,000 (5,000 - 15,000) ha 5,000 - 15,000 ha (33 - 300 %) 740 - 890 ha (4.9 - 18 %)	30-70% DRP 30-70% MDD	>70% Lower MD	Tarawi NR Nanya Ballarat Uni VCA Scotia AWC VCA	33,445 28,849 64,528	1 800 11	0.01 8 0.11	E1 E2 E1
SWISL	065: V/1e Halosarcia lylei low, open shrubland of arid and semi-arid regions	50 (35 - 65) ha 35 - 65 ha (54 - 190 %) 32 - 58 ha (49 - 170 %)	>70% MDD	>70% Lower MD	Nanya Ballarat Uni VCA	28,849	45	90	E2
SWISL	162: LC/5b Sturts Pigface sparse forbland of saline soils of the arid zone	3,000 (900 - 5,100) ha 900 - 5,100 ha (18 - 570 %) 10 - 190 ha (0.2 - 21 %)	30-70% CHC 30-70% SSD	>70% Western	Sturt NP	338,232	100	3.33	E3
SWISL	189: NT/3a Ephemeral forbland of low-saline lake-beds of the arid and semi-arid (warm) climate zones	40,000 (20,000 - 60,000) ha 10,000 - 30,000 ha (17 - 150 %) 1,600 - 2,800 ha (2.7 - 14 %)	30-70% DRP 30-70% MDD	>70% Lower MD <30% Western	Kinchega NP Nearie Lake NR	44,441 4,354	417 1,737	1.04 4.34	M E2
SWISL	198: LC/3a Sparse saltbush forbland of the irregularly inundated lakes of the arid and semi-arid (persistently hot) climate zones	45,000 (23,000 - 67,000) ha 18,000 - 52,000 ha (27 - 230 %) 4,200 - 7,800 ha (6.3 - 34 %)	<30% BHC 30-70% CHC 30-70% MUL	>70% Western	Paroo-Darling NP	176,427	6,000	13.33	M
SWISL	212: LC/5a Ephemeral forbland on playas and scalds in the Darling Riverine Plain Bioregion	50,000 (25,000 - 75,000) ha 50,000 - 150,000 ha (67 - 600 %) 1,000 - 1,800 ha (1.3 - 7.2 %)	<30% CP >70% DRP	30-70% Central West <30% Namoi 30-70% Western	Culgoa NP Narran Lake NR*	24,965 21,830	350 1,070	0.7 2.14	E2 E1
SWISL	253: V/5b Gypseous shrubland on rises in the semi-arid and arid plains	2,000 (1,000 - 3,000) ha 700 - 2,100 ha (23 - 210 %) 0 - 0 ha (0 - 0 %)	>70% MDD	>70% Lower MD	Not Protected				
SWISL	262: LC/5b Submerged flora of saline temporary wetlands of arid zone	9,000 (4,500 - 13,000) ha 4,500 - 13,000 ha (35 - 290 %) 0 - 0 ha (0 - 0 %)	30-70% SSD	>70% Western	Not Protected				
SWISL	263: LC/5b Submerged flora of saline permanent wetlands of the arid zone	10,000 (5,000 - 15,000) ha 5,000 - 15,000 ha (33 - 300 %) 0 - 0 ha (0 - 0 %)	30-70% MUL 30-70% SSD	>70% Western	Not Protected				

Plant communities

A total of 213 plant communities are classified and assessed for the NSW Western Plains. Query reports in the NSWVCA database (described in Benson 2006) list plant communities for bioregions, bioregion sub-regions, CMA areas, Local Government Areas, conservation reserves, secure property agreements, Formation Groups, NSW Vegetation Classes (Keith 2004), the major Australian vegetation sub-groups in the National Vegetation Information System (NLWRA 2001, ESCAVI 2003) and communities selected using the 'search' mode of the database (eg all communities with *Eucalyptus camaldulensis* (River Red Gum) in the 'scientific name' field). These reports are available in full format (90 fields of information) or short format (28 fields) and can be generated from the copy of the NSWVCA database on the CD in the back pocket of this journal. The search routine in the database can be used to select communities by ID number, common name, scientific name, Formation Group, Bioregion, sub-region, CMA area, Botanical Division and Local Government Area.

An All Records Full Report from the NSWVCA database of the 213 Western Plains plant communities is presented in Appendix A in Folder 3 on the CD accompanying this paper. This includes all information recorded in the database for each community and up to three low resolution photographs.

Table 4. Cross reference of 213 plant communities classified in the NSW Western Plains with 19 Formation Groups classified in the NSWVCA for that section of NSW.

Formation Group	Acronym	NWVCA Veg. ID Numbers	No.
Acacia Woodlands and Shrublands of the Inland Slopes and Plains	ASAZ	23, 26, 27, 29, 31, 35, 77, 118, 119, 120, 121, 123, 124, 125, 127, 128, 129, 130, 131, 132, 134, 136, 139, 199, 220	25
Casuarina Communities of the Inland Slopes and Plains	CCI	20, 22, 54, 55, 57, 58, 59, 60, 221, 228, 254	11
Chenopod (Halophytic) Shrublands of the Inland	CHS	152, 153, 154, 155, 156, 157, 158, 159, 160, 163, 164, 166, 168, 195, 196, 210, 211, 216, 222, 224, 225, 236	22
Cypress Pine (*Callitris*) woodlands mainly of the Inland	CPW	19, 21, 28, 48, 68, 69, 70, 72, 106, 245, 246	11
Ephemeral Grasslands in Semi-arid and Arid Regions	EGA	150, 167	2
Eremophila, *Melaleuca* and *Dodonaea* Shrublands of the Inland	EMDI	115, 138, 140, 142, 143, 194, 213, 229, 232, 252, 261, 271	12
Eucalyptus Box Woodlands of the Inland Plains	EBWP	56, 75, 76, 80, 82, 83, 86, 87, 88, 98, 103, 104, 105, 108, 109, 110, 122, 201, 207, 244, 248, 258	22
Eucalyptus Communities of Inland Watercourses and Inner Floodplains	EIW	2, 5, 7, 8, 9, 10, 11, 13, 15, 16, 36, 37, 38, 39, 40, 41, 67, 74, 197, 200, 206, 208, 230, 231, 233, 234, 237, 249, 251	29
Eucalyptus Corymbia Communities of the Tropics	EWT	71, 100, 133	3
Eucalyptus Ironbark Woodlands and Forests of the Inland Plains and Peneplains	EIWI	192, 217, 227, 243	4
Eucalyptus Woodlands on Rocky Hills of the Inland	EWRHI	184, 185, 186, 188, 239, 257	6
Freshwater Wetlands: Inland Freshwater Aquatic, Swamp and Shrubland Communities	FWI	12, 17, 25, 53, 66, 161, 181, 182, 205, 226, 238, 240, 241, 247	14
Grasslands of Freshwater Aquatic Habitats or Periodically Flooded Soils	GFAPF	24, 47, 50, 204, 242	5
Grasslands on Fine Texture Soils on the Inland Slopes and Plains	GTP	43, 44, 45, 46, 49, 52, 61, 149, 165, 183, 214, 215, 250	13
Hummock Grasslands and Woodlands of the Inland Plains and Peneplains	HGI	117, 151, 235	3
Mallee Woodlands and Shrublands of Inland Sandplains and Sand Dunes	MWSI	170, 171, 172, 173, 174, 190, 191, 193	8
Mallee Woodlands and Shrublands of Inland Stony Ridges	MWSR	169, 175, 176, 180, 218, 256	6
Rainforest-derived Genera Woodlands and Shrublands of the Inland Slopes and Plains	RDGI	137, 144, 145, 146, 264	5
Saline Wetlands: Saline and Clay Lakes (Playas) of the Inland	SWISL	18, 62, 63, 64, 65, 162, 189, 198, 212, 253, 262, 263	12

The communities are also listed under the 19 higher hierarchy Formation Groups that occur in western NSW.

An All Records Short Report from the database is presented in Appendix B in Folder 3 on the CD. This lists all the plant communities in one file in order of the Formation Group names. The 28 fields in the short report include characteristic species and the vegetation description but exclude most of the physiographic and location data fields.

The common name, estimated extents and distribution of each plant community is summarised in Table 3 that forms the main meta-analysis of the vegetation classification and assessment. Table 3 lists all communities in order of 19 Formation Groups recording their ID number, threat/ protected area code and common name; estimated pre-European, current, and protected area extents with confidence ranges; proportion in bioregions and CMAs; and extent in each protected area with an accuracy code.

Table 5. Cross reference of the 213 plant communities classified in the NSW Western Plains in the NSWVCA database with the 32 Vegetation Classes mapped in Keith (2004) that occur wholly of partly in the NSW Western Plains.
* indicates Vegetation Classes in Keith (2004) that predominantly occur outside the NSW Western Plains and therefore are incompletely classified at this point in NSWVCA.

Vegetation Class (Keith 2004)	NSWVCA Veg. ID Numbers	Total
Aeolian Chenopod Shrublands	152, 153, 154, 222	4
Brigalow Clay Plain Woodlands	29, 31, 35, 55, 145	5
Desert Woodlands	100, 133	2
Dune Mallee Woodlands	171, 172, 191	3
Floodplains Transition Woodlands	56, 74, 76, 80, 82, 237, 248, 251	8
Gibber Chenopod Shrublands	61, 136, 150, 155, 156, 167, 183, 210, 224	9
Gibber Transition Shrublands	118, 131, 197	3
Inland Floodplain Shrublands	17, 24, 25, 115, 160, 161, 240, 241, 247, 261, 271	11
Inland Floodplain Swamps	12, 47, 53, 66, 181, 182, 204, 205, 225, 226, 238	11
Inland Floodplain Woodlands	13, 15, 16, 83, 207,	5
Inland Riverine Forests	2, 5, 7, 8, 9, 10, 11, 36, 208, 233, 234, 249	12
Inland Rocky Hill Woodlands	104, 106, 122, 175, 176, 180, 184, 185, 188, 218, 239, 256, 257, 258	14
Inland Saline Lakes	18, 62, 63, 64, 65, 149, 162, 166, 189, 198, 253, 262, 263	13
North-west Alluvial Sand Woodlands	71, 137, 192, 206, 227	5
North-west Floodplain Woodlands	37, 38, 39, 40, 41, 67, 87, 200, 230, 231	10
North-west Plain Shrublands	77, 125, 144, 213, 229, 264	6
North-west Slopes Dry Sclerophyll Woodlands*	70, 228	2
Pilliga Outwash Dry Sclerophyll Forests*	88, 235	2
Riverine Chenopod Shrublands	157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254,	13
Riverine Plain Grasslands	44, 45, 46, 165	4
Riverine Plain Woodlands	26, 27	2
Riverine Sandhill Woodlands	19, 20, 21, 22, 23, 28, 48, 75, 86	9
Sand Plain Mallee Woodlands	142, 170, 173, 174, 190, 193	6
Sand Plain Mulga Shrublands	69, 119, 124, 128, 129, 139, 140, 143, 151, 199, 215, 220, 232	13
Semi-arid Floodplain Grasslands	43, 49, 50, 52, 214, 242	6
Semi-arid Sand Plain Woodlands	57, 58, 59, 221, 252	5
Stony Desert Mulga Shrublands	60, 68, 120, 121, 123, 127, 130, 132, 138, 169, 194	11
Subtropical Semi-arid Woodlands	117, 146	2
Western Peneplain Woodlands	72, 98, 103, 105, 134, 108, 109, 244, 245, 246	10
Western Slopes Grasslands*	250	1
Western Slopes Grassy Woodlands*	201	1
Western Slopes Dry Sclerophyll Forests*	54, 110, 186, 217, 243,	5

Table 6. Cross reference of 213 NSWVCA communities with the 32 major sub-groups (version 3, 2005) of the National Vegetation Information System (ESCAVI 2003) that occur in the Western Plains of NSW.
Note: as NSWVCA progresses to eastern areas of NSW additional plant communities will be assigned to some of these NVIS sub-groups and to other sub-groups not listed here.

NVIS Major Sub-group V3, 2005	NSWVCA Veg. IDs	Total
Allocasuarina woodland and open woodland with hummock grass	235	1
Arid and semi-arid Acacia low open woodlands and shrublands with chenopods	127, 139, 220	3
Arid and semi-arid Acacia low open woodlands and shrublands with tussock grass	124, 128, 129, 130, 131, 134, 136	7
Arid and semi-arid hummock grasslands	117, 151	2
Blue grass (Dicanthium) and tall bunch grass (Chrysopogon) tussock grasslands	52	1
Brigalow (Acacia harpophylla) forests and woodlands	29, 31, 35	3
Callitris forests and woodlands	19, 21, 28, 48, 68, 69, 70, 72, 106, 245, 246	11
Casuarina and Allocasuarina forests and woodlands	20, 22, 54, 55, 57, 58, 59, 60, 221, 228, 254	11
Chenopod shrublands	152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 163, 164, 168, 195, 196, 201, 211, 216, 222, 224, 225, 236	22
Eucalyptus forests with a grassy understorey	2, 5, 7, 36	4
Eucalyptus forests with a shrubby understorey	11	1
Eucalyptus low open woodlands with a chenopod or samphire understorey	169, 197	2
Eucalyptus low open woodlands with a grassy understorey	16, 37, 40, 207	4
Eucalyptus low open woodlands with a shrubby understorey	38, 100, 133	3
Eucalyptus open woodlands with a shrubby understorey;	109, 122	2
Eucalyptus woodlands with a grassy understorey	8, 9, 56, 74, 75, 76, 83, 86, 87, 88, 105, 108, 188, 192, 227, 230, 233, 237, 244, 248, 249, 251, 257	23
Eucalyptus woodlands with a shrubby understorey	10, 13, 15, 39, 41, 67, 71, 80, 82, 98, 103, 104, 110, 184, 185, 186, 200, 206, 208, 217, 231, 234, 239, 243, 258	25
Freshwater dams, lakes, lagoons and aquatic plants	238	1
Mallee Eucalyptus low open woodlands	170, 173, 174, 175, 176, 180, 190, 193, 218, 256	10
Mallee heath and shrublands	171, 172, 191	3
Melaleuca open forests and woodlands	138, 140, 142, 261	4
Mitchell grass (Astrebla) tussock grasslands	43, 61	2
Mixed chenopod, samphire and forblands	18, 62, 63, 64, 65, 162, 198	7
Mulga (Acacia aneura) woodlands and tall shrublands with tussock grass	119, 120, 123, 125, 132	5
Naturally bare sand, rock, claypan	24, 166, 189, 212, 253	5
Other Acacia forests and woodlands	26, 27, 118	3
Other Acacia open shrublands and shrublands	23, 77, 240, 241	4
Other low open woodlands and shrublands with tussock grass	121, 137, 144, 146, 152, 264	6
Other shrublands	17, 25, 115, 143, 145, 194, 199, 210, 213, 229, 232, 247, 271	13
Other tussock grasslands	44, 45, 46, 47, 49, 149, 150, 165, 167, 183, 214, 215, 250	13
Salt lakes and lagoons	262, 263	2
Wet tussock grassland, herbland, sedgeland and rushland	12, 50, 53, 66, 181, 182, 204, 205, 226, 242	10

An example of a Full Report database record of plant communities is in Appendix D. An example of a Short Report database record is in Appendix E. Some of the plant communities are shown in Figures 9–36.

Range of plant communities

The plant communities vary greatly in their species heterogeneity, species richness, extent, range and condition. In summary, they comprise of tussock grasslands occurring on fine grained soils; hummock grasslands on sandier soils; chenopod shrublands on loams and clays; samphire shrublands in saline depressions; dry lake forblands; *Acacia* woodlands on clayey soils including: *Acacia pendula* (Weeping Myall), *Acacia harpophylla* (Brigalow) and *Acacia cambagei* (Gidgee) woodlands; *Acacia* shrublands and low woodlands on sandplains or washouts including those dominated by: Mulga (*Acacia aneura* sens lat.), *Acacia excelsa* (Ironwood), *Acacia cana* (Cabbage-tree Wattle) and Gidgee; *Acacia* shrublands on rocky outcrops dominated by *Acacia aneura* sens lat. (Mulga), *Acacia tetragonophylla* (Dead Finish) and *Acacia brachystachya* (Umbrella Mulga); riparian forests and floodplain depression woodlands dominated by *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus largiflorens* (Black Box) and *Eucalyptus coolabah* (Coolabah); *Eucalyptus* box woodlands on alluvial plains including those dominated by *Eucalyptus populnea* (Poplar Box), *Eucalyptus microcarpa* (Inland Grey Box) and *Eucalyptus melliodora* (Yellow Box); low open woodlands dominated by *Alectryon oleifolius* (Western Rosewood) and Belah/Black Oak (*Casuarina cristata* and *C. pauper*); shrublands dominated by species of *Hakea*, *Dodonaea*, *Melaleuca* or *Eremophila*; mallee (*Eucalyptus* spp.) shrublands and woodlands on sand dunes and sand plains; hill mallee woodlands on outcropping substrates; *Callitris* (cypress pine) dominated woodlands on rocky hills, alluvial plains and sand dunes; a range of wetland types are dominated by structurally distinct species including trees, shrubs, sedges, rushes, grasses and forbs. Some plant communities are restricted to small areas due to physiographic factors such as unusual geological formations or soil types (e.g. ID132 Mulga — Rock Fuchsia on Silcrete scarps). Others span vast areas on widespread landforms and soils (e.g. ID119 Sandplain Mulga).

Table 7. Plant communities in the eight IBRA Bioregions (Version 6) that comprise the Western Plains Section of New South Wales. Note: Many communities occur in more than one bioregion.

IBRA Region & No. Communities	ID Numbers of Plant Communities
Broken Hill Complex 37	24; 38; 41; 43; 59; 60; 68; 69; 119; 120; 123; 124; 127; 128; 129; 130; 136; 138; 143; 150; 153; 154; 155; 156; 160; 161; 167; 169; 183; 198; 207; 220; 221; 222; 224; 234, 271
Channel Country 32	24; 25; 38; 41; 61; 69; 119; 123; 124; 127; 131; 132; 133; 137; 138; 149; 153; 156; 158; 160; 161; 162; 167; 170; 198; 199; 200; 207; 210; 230; 234, 271
Cobar Peneplain 66	11; 13; 23; 26; 29; 37; 55; 56; 57; 58; 59; 69; 70; 72; 77; 82; 100; 103; 104; 105; 106; 108; 109; 110; 119; 123; 125; 130; 134; 138; 139; 142; 144; 153; 154; 158; 165; 173; 174; 175; 176; 180; 181; 184; 185; 186; 193; 201; 207; 208; 212; 215; 218; 229; 233; 239; 243; 245; 246; 248; 250; 251; 256; 257; 258, 271
Darling Riverine Plains 88	8; 13; 15; 16; 17; 24; 27; 35; 36; 37; 39; 40; 43; 45; 49; 50; 52; 53; 54; 55; 56; 59; 62; 63; 64; 69; 70; 71; 77; 83; 87; 88; 98; 109; 115; 117; 118; 119; 124; 128; 130; 134; 137; 139; 143; 144; 145; 146; 151; 152; 153; 154; 157; 158; 159; 160; 161; 166; 168; 170; 181; 182; 188; 189; 192; 195; 197; 199; 204; 205; 206; 211; 212; 213; 214; 215; 220; 227; 228; 235; 238; 241; 242; 244; 247; 249, 264, 271
Mulga Lands 69	18; 24; 25; 29; 31; 36; 37; 38; 39; 40; 41; 43; 50; 53; 59; 60; 61; 62; 66; 67; 68; 69; 98; 100; 104; 109; 117; 118; 119; 120; 121; 122; 123; 127; 129; 134; 137; 139; 143; 144; 149; 150; 153; 154; 155; 156; 157; 158; 161; 166; 167; 181; 182; 183; 192; 194; 195; 197; 198; 199; 200; 207; 215; 234; 238; 261; 263, 264, 271
Murray-Darling Depression 71	10; 11; 15; 16; 17; 18; 21; 22; 23; 24; 28; 38; 57; 58; 63; 64; 65; 70; 82; 103; 104; 105; 106; 108; 119; 125; 128; 130; 134; 139; 142; 143; 150; 151; 152; 153; 154; 156; 157; 159; 160; 163; 164; 165; 166; 170; 171; 172; 173; 176; 181; 182; 184; 189; 190; 191; 193; 196; 199; 207; 215; 216; 220; 221; 238; 240; 245; 246; 252; 253; 254
Riverina 56	2; 5; 7; 8; 9; 10; 11; 12; 13; 15; 16; 17; 18; 19; 20; 21; 23; 24; 26; 28; 44; 45; 46; 47; 48; 50; 53; 58; 63; 74; 75; 76; 80; 86; 152; 153; 154; 157; 159; 160; 163; 164; 165; 166; 181; 182; 216; 217; 236; 237; 238; 240; 242; 243; 249
Simpson-Strzelecki Dunefields 25	24; 25; 38; 41; 62; 69; 119; 120; 124; 131; 137; 140; 149; 151; 155; 156; 162; 163; 225; 226; 231; 232; 238; 262; 263

While floristie variation is the main eonsideration in the elassifieation, landform or geomorphology is used as a determinant in some eases. For example, the plant community ID66 eovers all the mound springs of the inland plains, even though there is considerable variation in their floristie eomposition (Piekard 1992).

Most plant communities (160) are eonsidered to have been 'originally eommon' before European settlement with an extent greater than 10 000 ha, 39 are estimated to have been restrieted to 1000–10 000 ha and 17 are estimated to have been rare with less than 1000 ha prior to European settlement (Table 2).

Based on floristie, struetural and geographieal information, the Western Plains plant eommunities have been eross-refereneed to three broad seale elassifieations of vegetation:

- Table 4 shows the plant eommunities distributed between the 19 Formation Groups used as a higher order hierarehy in the NSWVCA. A mean of about 12 (S.D. 8) eommunities are listed under eaeh Formation Group;
- Table 5 lists the plant eommunities grouped under 32 Vegetation Classes from the NSW State Compilation Vegetation Map of Keith (2004). (Ineluding Vegetation Classes that predominantly oeeur in the NSW Western Slopes) A mean of about 7 (S.D. 4) eommunities are listed under eaeh vegetation elass;

Table 8. Plant eommunities in NSW Catehment Management Authority areas in the NSW Western Plains.
Notes: the Western Plains Seetion of NSW eovers all of the Western and Lower Murray/Darling CMAs and the western parts of BorderRivers/ Gwydir, Namoi, Central West, Laehlan, Murrumbidgee and Murray CMAs. Many eommunities oeeur in more than one CMA.

CMA & No. Communities	ID Number of Plant Communities
Border Rivers/Gwydir 42	27; 35; 36; 37; 39; 40; 43; 49; 50; 52; 53; 55; 56; 70; 71; 87; 88; 98; 115; 144; 145; 146; 158; 161; 168; 181; 182; 192; 195: 204; 205; 206; 211; 214; 227; 228; 235; 238; 241; 242; 244;
Central West 74	24; 26; 27; 35; 36; 37; 39; 40; 43; 45; 49; 50; 53; 54; 55; 56; 57; 70; 77: 82; 83; 87: 88; 98; 100: 103; 104; 105; 106; 108; 109; 118; 125; 134; 141; 144; 145; 146; 153; 157; 158; 168; 173; 174; 175; 176; 180; 181; 182; 184; 188; 193; 195; 201; 204; 206; 208; 211; 212; 214; 217; 227; 228; 238; 241; 242; 244; 247; 248; 249; 250; 256; 257; 258, 271
Laehlan 81	7; 10; 11; 12; 13; 15; 16; 17; 18; 23; 24; 26; 28; 29; 45; 46; 47; 50; 53; 54; 56; 57; 58; 70; 72; 74; 76; 77; 80; 82; 103; 104; 105; 106; 108; 110; 134; 142; 143; 153; 154; 157; 159; 160; 163; 164; 165; 166; 170; 171; 173; 174; 175; 176; 180; 181; 182; 184; 185; 186; 190; 193; 201; 208; 216; 217; 236; 237; 238; 239; 240; 242; 243; 244; 248; 249; 250; 251; 256: 257; 271
Lower Murray/Darling 58	8; 11; 12; 13; 15; 16; 17; 18; 20; 21; 22; 23; 24: 28; 50; 58; 63; 64; 65; 119; 123; 124; 128; 139; 143: 150; 151; 152; 153; 154; 155; 156; 157; 159; 160; 163; 164; 165; 166; 170; 171; 172: 181; 182; 189; 190; 191; 196; 199; 216; 220; 221; 238; 240; 242; 252; 253; 254
Murray 52	2; 5; 7; 8; 9; 10; 11; 12; 13; 15; 16; 17; 18; 19; 20; 22; 23; 24; 26; 28; 44; 45; 47; 48; 50; 53; 58; 63; 74; 75; 76; 77; 80; 86; 110; 157; 159; 160; 163; 164; 166; 170; 181; 182; 185; 186; 216; 237; 238; 240; 242
Murrumbidgee 64	2; 5; 7; 9; 10; 11; 12; 13; 15; 16; 17; 18; 22; 23; 24; 26; 28; 44; 45; 46; 47; 48; 50; 53; 57; 58; 74; 75; 76; 77; 80; 110; 142; 143; 153; 154; 157; 159; 160; 163; 164; 165; 166; 170; 173; 181; 182; 185; 186; 201; 216; 217; 236; 237; 238; 239; 240; 242; 243; 249; 250; 251
Namoi 40	24; 27; 35; 36; 37; 39; 40; 43; 49; 50; 52; 53; 55; 56; 70; 71; 83; 87; 88; 98; 115; 144; 145; 146; 161; 168; 181; 182; 195; 204; 206; 211; 212; 214; 227; 238; 241; 242; 244; 247
Western 123	18; 23; 24; 25; 27; 29; 31; 35; 36; 37; 38; 39; 40; 41; 43; 52; 53; 55; 58; 59; 60; 61; 62; 66; 67; 68; 69; 72; 82; 87; 100; 103; 104; 105; 106; 108; 109; 115; 117; 118; 119; 120; 121; 122; 123; 124; 125; 127; 128; 129; 130: 131; 132; 133; 134: 136; 137; 138; 139; 140; 143; 144; 149; 150; 151; 152; 153; 154; 155; 156; 158; 160; 161; 162; 163; 165; 166; 167; 168; 169; 170; 171; 174; 175; 176; 180; 183; 184; 189; 192; 194; 195; 197; 198; 199; 200; 207; 208; 210; 212; 213; 215; 218; 220; 222; 224; 225; 226; 229; 230; 231; 232; 233; 234; 238; 245; 246; 257; 261; 262; 263, 264, 271

Table 9. Number and area of different types of protected areas in New South Wales and in the NSW Western Plains, December 2005.

Protected Area Type	No. in NSW	Area in NSW	% of NSW (ha)	No. in NSW Western Plains	Area (ha) NSW in Western Plains	% of NSW Western Plains
Aboriginal Areas	14	12,075	0.015	1	11,790	0.026
Historic Sites	16	3,236	0.004	3	1,983	0.004
Karst Conservation Reserves	4	4,555	0.006	0	0	0.000
National Parks	173	5,064,165	6.335	13	1,020,280	2.243
Nature Reserves	388	899,112	1.125	30	424,883	0.934
Regional Parks	13	5,463	0.007	0	0	0.000
State Conservation Areas	84	347,580	0.435	3	119,918	0.264
Other Secure DEC Areas	1	9	0.000	0	0	0.000
Total all DEC reserves	693	6,336,195	7.926	50	1,578,853	3.470
Flora Reserves	86	33,317	0.042	12	4,611	0.010
Total all public reserves	779	6,369,512	7.968	62	1,583,464	3.481
Secure PAs (NVC Act)	55	5,542	0.007	16	2,841	0.006
VCAs (NPW Act)*	183	107,164	0.134	5	93,452	0.205
Bush Heritage Reserves	3	988	0.001	0	0	0.000
Total non-public protected areas	241	113,695	0.142	21	96,293	0.212
Total for all protected areas	1,020	6,483,207	8.11	83	1,679,757	3.69

Notes: The areas in the DEC conservation reserves include all areas that were held as acquired lands in December 2005. The figures exclude 163,200 ha of marine parks in coastal waters of NSW and 10,877 ha of land in 10 Crown Reserves managed by DEC in eastern NSW. DEC Acquired lands are allocated to reserve types based on advice from DEC Parks and Wildlife Division expertise. It is assumed that the newly acquired Yanga National Park in south-west NSW will be about 70,600 ha once cleared areas are excised from it and the present Yanga NR is amalgamated with it. Parts of Narran Lake Nature Reserve, Strahorn Flora Reserve, property agreements AL9921 and CD9910 fall outside the Western Plains and are excluded. For example, only 3,534 ha of the 15,239 ha Narran Lake Nature Reserve is within NSW Western Plains. Data sources are: NSW Department of Environment and Conservation Estates GIS layer, December 2005; DEC Acquired Lands GIS layer, December 2005; DEC database on Voluntary Conservation Agreements, December 2005; NSW State Forests Flora Reserves GIS layer, December 2003; Property Agreement data from the NSW Department of Infrastructure, Planning and Natural Resources PANet database and GIS layers, December 2003 - PAs in perpetuity were selected using shape files coded as being remnant vegetation (i.e. excluding cleared land being re-vegetated). *Assumes that VCAs are being made over the 28,906 ha 'Nanya Station' owned by Ballarat University and the 64,653 ha 'Scotia Sanctuary' owned by the Australian Wildlife Conservancy. Calculations were undertaken in Areview Version 3.3 (ESRI Inc. 1992-2002) in Lamberts projection and AGD66.

- Table 6 shows the plant communities allocated to the 32 major sub-groups in the National Vegetation Information System (NVIS) classification (ESCAVI 2003) that occur in the NSW Western Plains. A mean of about 7 (S.D. 6) communities are listed under each NVIS major sub-group.

Frequency in bioregions

Of the 213 communities 92 are restricted to one bioregion, 56 to two bioregions, 35 to three bioregions, 17 to four bioregions, six to five bioregions, two to six bioregions and three to seven bioregions (Table 7). 148 (70%) of the communities occur in one or two bioregions and in most cases the second bioregion occurrence is mostly less than 30% of the community's distribution. The number of communities per bioregion ranges from 86 in the Darling Riverine Plains Bioregion to 25 in the Simpson-Strzelecki Dunefields Bioregion. Differences in numbers of communities in each Bioregion may be due to differences in the relative heterogeneity of physical environments in the bioregions, arid versus wetter climes between the bioregions, differences in sizes of the bioregions and differences in the detail of information on the vegetation.

Table 8 lists the communities by Catchment Management Authority areas (CMAs). While the classification totally covers the Western and Lower Murray/Darling CMAs it only covers the western part of the six CMAs that run westwards off the NSW Tablelands (Figure 1). The Western CMA area contains 123 communities but it is also the largest CMA in NSW covering 29% of the State.

15 of the 213 communities are considered to be derived from a previous vegetation structure and floristic composition. These are the veg. IDs 143, 150, 160, 163, 164, 165, 166, 168, 183, 212, 216, 224, 229, 236 and 250. Some other native grassland communities could be derived from previous shrublands or woodlands but there was not enough evidence to designate them as such. These derived plant communities are still 'native vegetation' but are considered to be substantially

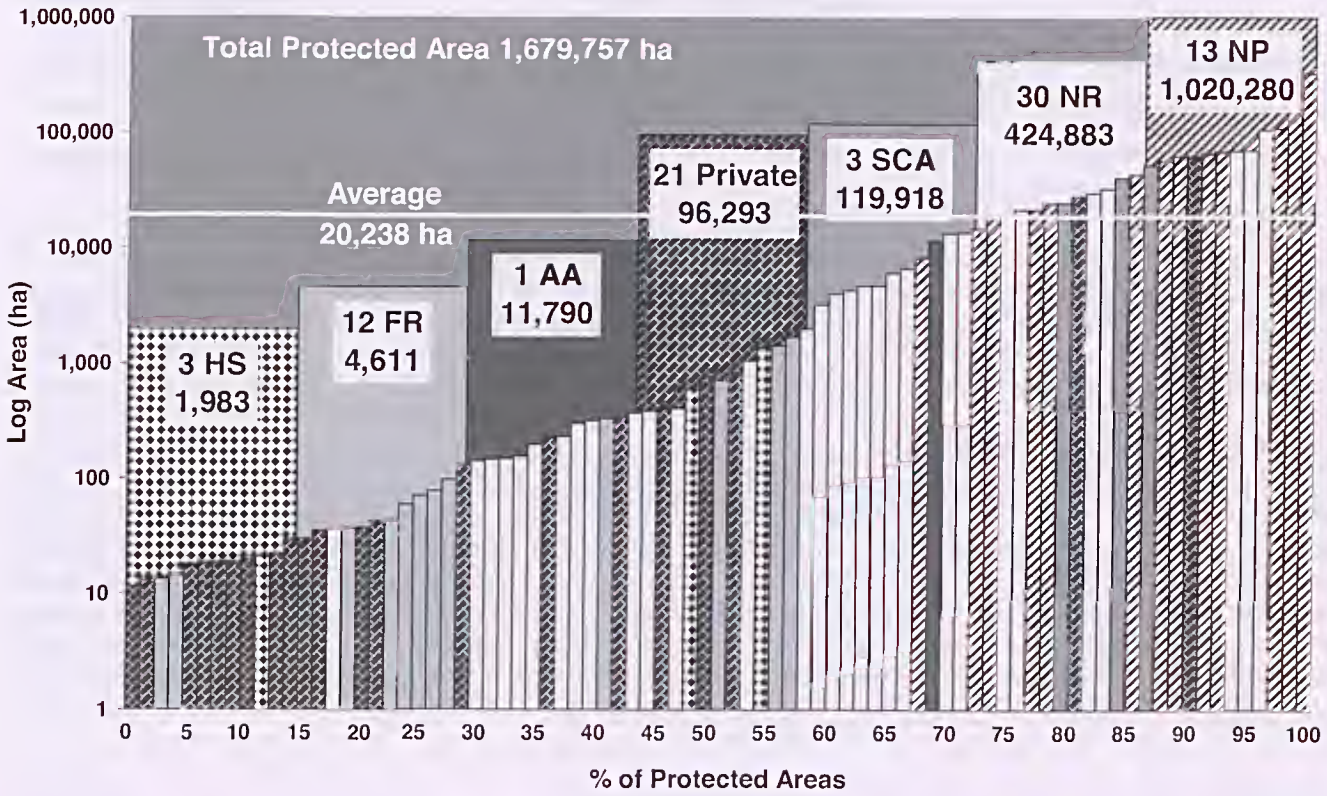

Fig. 6. Area of all protected areas in the Western Plains Section of NSW as of December 2005 assuming all DEC acquired lands at that time are added to reserves.

Thin columns in foreground are areas of individual protected areas. Wide columns in background are cumulative areas for each protected area type. The number, type and area of each protected area type is shown in the white boxes. Columns are: checked = Historic Sites, dark grey = Flora Reserves, light grey = Aboriginal Areas, brick pattern = State Conservation Areas, white = secure property agreements under National Parks and Wildlife Act 1974 and Native Vegetation Act 2003, black = Nature Reserves, and diagonal stripe = National Parks. The two National Reserve System purchased private properties 'Scotia Sanctuary' and 'Nanya Station' are included as VCAs but they are much larger than average property agreements. Only 6,194 ha of the total 15,239 ha area of Narran Lake Nature Reserve is included because most of this reserve is in the Brigalow Belt South Bioregion in the NSW Western Slopes Section.

different in species composition and/or vegetation structure compared to what they would have been prior to European settlement.

55 of the 213 plant communities that occur on the Western Plains also occur on the NSW Western Slopes. The *Eucalyptus* box woodlands, ironbark forests and communities that are found on the NSW Western Slopes will be described in the Part 2 of the NSWVCA project.

A photographic collection of about 4000 images of the plant communities of the Western Plains has been collated, labelled and stored at the Botanic Gardens Trust, Sydney. About 500 of these images have been scanned for use in reports or publications.

Protected areas in the NSW Western Plains

As of December 2005, 8.1% of NSW was held in 1020 protected areas, comprising all types of public conservation reserves and all secure property agreements, as defined and discussed in Benson (2006) (Table 9). In the NSW Western Plains there were 83 protected areas covering 3.7% of that section of NSW – a significantly lower proportion than for the State as a whole.

Of the 779 public reserves in NSW, 62 covering over 1.5 million hectares are in the Western Plains (Table 9, Figure 5). A small number (13 of 173) of NSW national parks are in the Western Plains, covering 1 020 280 ha or about 2.2% of the region. Similarly, only 30 of the 388 nature reserves in NSW are in the Western Plains, covering 424 883 ha or 0.9% of the region though some of the nature reserves such as Yathong, Nombinnie and Nocoleche are large compared to those in eastern NSW. 12 of the 86 Flora Reserves in NSW, protected under the *NSW Forestry Act 1916*, are in the Western Plains. About half of these are located in the River Red Gum forests along the Murray River.

Table 10. Proportion of protected areas in the eight bioregions that comprise the NSW Western Plains

IBRA Bioregion	Protected Area (ha)	% of Bioregion Protected
Broken Hill Complex	75,440	2.0
Channel Country	231,098	9.9
Cobar Peneplain	187,538	2.5
Darling Riverine Plains	157,972	1.7
Mulga Lands	222,815	3.4
Murray Darling Depression	535,891	6.8
Riverina	130,349	1.9
Simpson Strzelecki Dunefields	118,923	10.8
Total for Western Plains	**1,660,025**	**3.7**

Secure property agreements include Conservation Agreements (VCAs) under the *NSW National Parks and Wildlife Act 1974* and some property agreements under the *Native Vegetation Conservation Act 1997* and *Native Vegetation Act 2003* (Benson 2006). By December 2005, there were 183 VCAs in NSW with only five in the NSW Western Plains. These five include two large, recent VCAs covering former Western Lands Leases in far south-western NSW (Nanya 28 906 ha and Scotia 64 653 ha). The other three VCAs are small in area totaling less than 3000 ha. Complementing the VCAs are 16 secure property agreements under the *Native Vegetation Conservation Act 1997*. These cover 2841 ha or 0.006% of the Western Plains. Summing both types of secure property agreements reveals that a minuscule 0.2% of the Western Plains was held under secure property agreements in December 2005 (Table 9).

There are a large range of sizes in the 83 protected areas (graphed on a log scale in Figure 6). The average size of protected areas is 20 238 ha but this is bounded by a very large standard deviation of 46 943 ha (Figure 6). The largest conservation reserve is Sturt National Park at 338 231 ha. Other large reserves include Paroo-Darling National Park (175 683 ha), Nombinnie Nature Reserve (125 871 ha), Yathong Nature Reserve (108 768 ha), Gundabooka National Park (92 121 ha), Mungo National Park (89 502 ha) and Nocoleche Nature Reserve (71 040 ha) and the newly acquired Yanga National Park, that will be about 70 600 ha once cleared areas are excised from it and Yanga Nature Reserve is amalgamated with it. The smallest protected area is the secure property agreement LE9801 covering 11 ha. About one quarter or 21 of the 83 protected areas are above the average size with 62 being less than the average size. Public reserves such as national parks and nature reserve are, on average, larger than secure property agreements that mainly apply over private land (Figure 6).

A number of public conservation reserves are located in the NSW Western Slopes near the boundary of the Western Plains in the Brigalow Belt South and NSW South Western Slopes Bioregions. These contain plant communities that occur in the Western Plains (Table 2). In the Brigalow Belt South Bioregion, reserves close to the boundary of the Western Plains are Brigalow Park (455 ha), Careunga Nature Reserve (469 ha), Kirramingly Nature Reserve (1306 ha) and 11 705 ha of the 15 239 ha of Narran Lake Nature Reserve. In the NSW South Western Slopes Bioregion reserves close to the boundary of the Western Plains are Wiesners Swamp Nature Reserve (103 ha), The Rock Nature Reserve (347 ha), Buckingbong Flora Reserve (155 ha), Wilbertroy Flora Reserve (134 ha) and Narrandera Nature Reserve (58 ha). Narrandera Nature Reserve contains similar vegetation to the nearby Narrandera Flora Reserve indicating the need for minor adjustments to bioregion boundaries.

Table 11. Plant communities identified by their NSWVCA database ID number listed under a range of proportions of estimated pre-European extent in protected areas
Note: This includes occurrences of plant communities that extend to the NSW Western Slopes and occur in protected areas there. Several derived communities are in 50-100% category because it is considered they may either have not existed in 1788 or have expanded.

Protected pre-European Extent	Community ID Number	Number of plant communities
0	22, 48, 83, 86, 115, 136, 169, 175, 183, 188, 195, 205, 211, 221, 222, 224, 225, 226, 228, 235, 242, 246, 248, 249, 253, 254, 257, 258, 262, 263, 271	31
>0 - <0.2%	10, 16, 20, 26, 27, 29, 44, 47, 50, 55, 56, 70, 74, 76, 80, 88, 145, 146, 159, 201, 237, 238, 241, 244	24
0.2 - <0.5%	35, 52, 69, 75, 82, 87, 168, 206, 227, 233, 251	11
0.5 - <1%	17, 18, 31, 45, 71, 98, 100, 105, 110, 118, 125, 156, 157, 158, 167, 192, 214, 243, 252, 256	20
1 - <2%	5, 8, 21, 25, 28, 37, 40, 53, 77, 103, 104, 119, 129, 144, 154, 182, 196, 204, 247, 264	20
2 - <5%	9, 12, 15, 19, 23, 24, 36, 39, 43, 49, 54, 58, 62, 63, 106, 108, 109, 117, 120, 123, 128, 130, 142, 153, 162, 170, 184, 185, 212, 240	30
5 - <10%	7, 13, 46, 57, 59, 60, 64, 67, 68, 72, 133, 134, 137, 138, 149, 151, 160, 176, 189, 193, 194, 207, 208, 217, 218	25
10 - <15%	2, 11, 38, 66, 139, 140, 155, 161, 171, 172, 174, 180, 181, 197, 198, 199, 200, 213, 215, 220, 234, 245	22
15 - <20%	41, 61, 124, 152, 173, 186, 230	7
20 - <50%	131, 150, 164, 190, 216, 231, 232, 239, 250, 261	10
>=50%	65, 121, 122, 127, 132, 143, 163, 165, 166, 191, 210, 229, 236	13

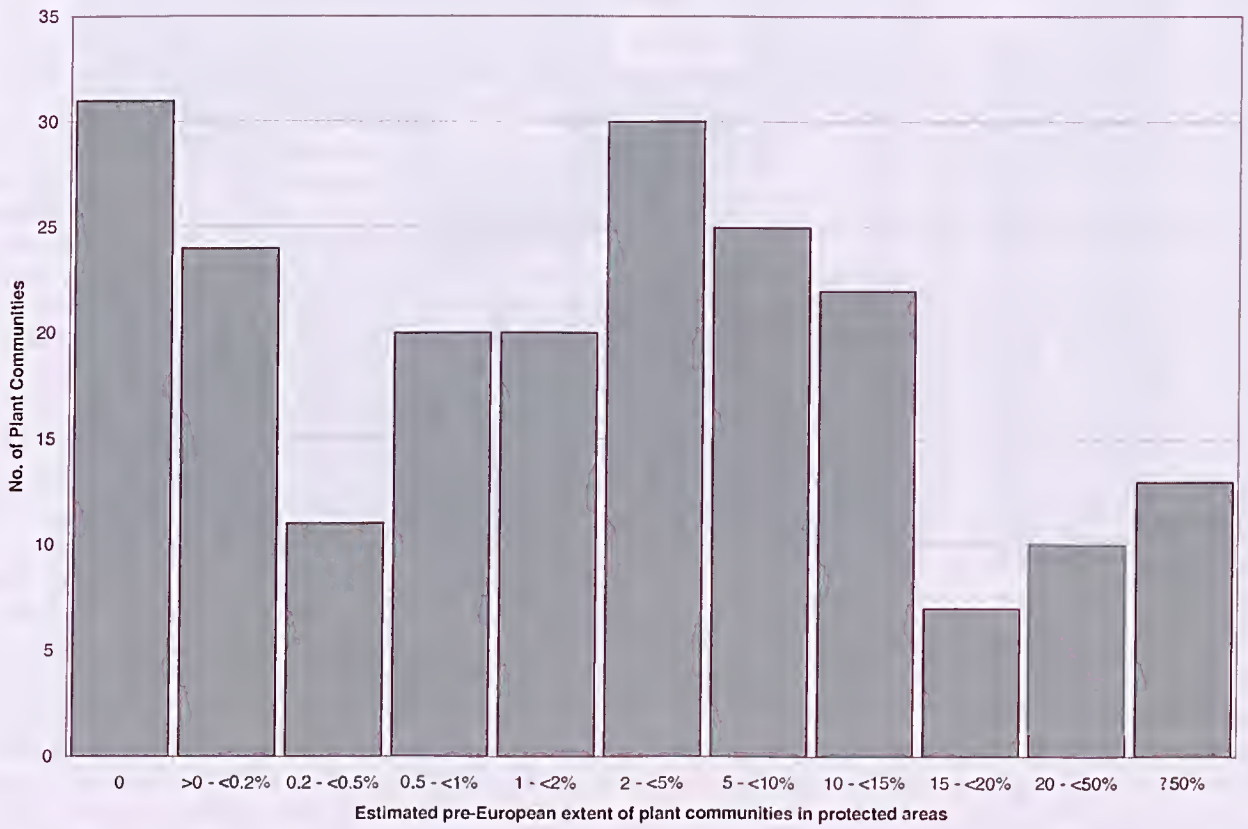

Fig. 7. Proportions of the 213 plant communities classified for NSW Western Plains in protected areas. The percentage divisions are derived by comparing the estimated existing area in protected areas to an estimate of pre-European extent. 75% of the plant communities have less than 10% of their pre-European extent in protected areas

Table 12. NSW Western Plains plant communities that are part of eritieally endangered, endangered or vulnerable eeologieal eommunities listed or nominated under the NSW Threatened Species Conservation Aet 1995 and/or the Australian Environmental Proteetion and Biodiversity Conservation Act 1999 as of Deeember 2005.
Note: The plant communities defined in the NSWVCA do not neeessarily match the definitions of listed or nominated eeologieal communities under these laws. This list ignores three broadly defined inland aquatie endangered eeological communities listed under the NSW Fisheries Act that cover vertebrates and invertebrates.

ID No.	Common Name	TSC Aet	EPBC Aet
20	Buloke - Moonbah - Black Box open woodland on sandy rises of semi arid (warm) elimate zone	Nominated	Listed
22	Semi-arid shrubby Buloke - Slender Cypress Pine woodland	Nominated	Listed
23	Yarran shrubland of the sandplains and plains of the semi-arid (warm) and arid elimate zones	Nominated	-
26	Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	Listed	Nominated
27	Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions	Listed	Nominated
29	Brigalow open woodland on red earth and clay plains mainly in the Mulga Lands Bioregion	Nominated	Listed
31	Brigalow-Gidgee open woodland on clay plains west of the Culgoa River, Mulga Lands Bioregion	Nominated	Listed
35	Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion.	Listed	Listed
37	Black Box woodland on floodplains mainly in the Darling Riverine Plains Bioregion.	Listed	Nominated
39	Coolabah - River Coobah - Lignum woodland of frequently flooded channels mainly of the Darling Riverine Plains Bioregion	Listed	Nominated
40	Coolabah open woodland with chenopod/grassy ground cover on grey clays on higher floodplains	Listed	Nominated
44	Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	-	Nominated
45	Plains Grass grassland on alluvial dark grey clays of central New South Wales	-	Nominated
46	Curly Windmill Grass - speargrass - wallaby grass on alluvial clay and loam on the Hay Plain, Riverina Bioregion	-	Nominated
47	Swamp grassland of the Riverine Plain	-	Nominated
52	Queensland Bluegrass - Cup Grass - Mitchell Grass - Native Millet alluvial plains grassland	-	Listed
54	Buloke - White Cypress Pine woodland mainly in the NSW SW Slopes Bioregion	Nominated	Listed
65	Halosarcia lylei low, open shrubland of arid and semi-arid regions	Listed	-
66	Artesian Mound Spring forbland/sedgeland/grassland mainly of the Mulga Lands Bioregion	Listed	Listed
71	Carbeen woodland on alluvial soils	Listed	-
76	Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Nominated	Nominated
77	Yarran shrubland on peneplains and alluvial plains of central-northern NSW	Nominated	-
80	Inland Grey Box - White Cypress Pine tall woodland on sandy loam soil on alluvial plains of NSW South-western Slopes and Riverina Bioregions	Nominated	Nominated
81	Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions	Nominated	Nominated
82	Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Nominated	Nominated
86	Yellow Gum tall woodland of the Murray River floodplain, Riverina Bioregion	Nominated	-
110	Inland Grey Box - Black Cypress Pine shrubby woodland on stony slopes NSW South Western Slopes and Riverina Bioregions	Nominated	Nominated
128	Nelia tall open shrubland of semi-arid sandplains	Listed	-
158	Old Man Saltbush shrubland of the semi-arid hot (persistently dry) and arid climate zones (north-western NSW)	Nominated	Nominated
159	Old Man Saltbush shrubland mainly of the semi-arid (warm) climate zone (south western NSW)	Nominated	Nominated
201	Fuzzy Box - Inland Grey Box on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	Listed	-
220	Purple Wood wattle shrubland of the arid zone sandplains	Nominated	-
237	Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone	Nominated	Nominated

Table 13. Number of plant communities in threat categories in relation to proteeted area eodes
Notes. Explanations of the proteeted area and threat codes are provided in Benson (2006). See Appendix B in Benson (2006) for explanation of the threat eategories.

	No. of Extant NSW Western Plains Plant Communities Proteeted Area Code															
Threat Category	1a	1b	1e	2a	2b	2e	3a	3b	3e	4a	4b	4e	5a	5b	5e	Total
Critically Endangered (CE)	-	-	-	-	-	-	-	-	-	-	-	-	5	4	2	11
Endangered (E)	-	-	-	-	-	-	1	-	-	8	-	-	16	4	2	31
Vulnerable (V)	-	-	1	-	-	-	5	-	-	6	1	-	11	4	-	28
Near Threatened (NT)	-	-	-	1	-	-	14	-	2	15	1	-	19	6	4	62
Least Concern (LC)	7	8	-	4	3	-	19	1	-	13	5	1	7	11	2	81
Total	7	8	1	5	3	-	39	1	2	42	7	1	58	29	10	213

Table 14. Number of plant communities with different threat eategories distributed aeross the eight bioregions that eomprise the NSW Western Plains.
Figures in braekets ( ) indieate the number of plant eommunities (of the total) that are restrieted to a single IBRA Bioregion. Bioregions: BHC = Broken Hill Complex, CHC = Channel Country, CP = Cobar Peneplain, DRP = Darling Riverine Plain, MDD = Murray Darling Depression, ML = Mulga Lands, RIV = Riverina, SSD = Simpson-Strzeleeki Dunefields. See Appendix B in Benson (2006) for explanations of the threat eategories.

	No. of Extant NSW Western Plains Plant Communities IBRA Bioregion v6								
Threat Category Code	Broken Hill Complex	Channel Country	Cobar Peneplain	Darling Riverine Plain	Mulga Lands	Murray-Darling Depression	Riverina	Simpson-Strzelecki Dunefields	Total Western Plains
Critically Endangered	1	-	2	4 (1)	1 (1)	3	6 (1)	-	11 (3)
Endangered	1	1	8	19 (2)	4	5 (1)	7 (3)	-	31 (6)
Vulnerable	1	-	8 (1)	18 (4)	6	9 (3)	10	-	28 (8)
Near Threatened	15	9	22 (3)	29 (2)	25 (2)	26 (1)	18 (2)	9 (1)	62 (11)
Least Conecrn	19 (4)	22 (4)	26 (6)	18	33 (4)	28 (5)	14 (3)	16 (5)	81 (31)
Total	37 (4)	32 (4)	66 (10)	88 (9)	69 (7)	71 (10)	55 (9)	25 (6)	213 (59)

Table 15. Number of plant communities with different threat eategories distributed aeross eight Catehment Management Authority areas that are fully or partly in the NSW Western Plains.
Figures in braekets ( ) indieate the number of plant eommunities (of the total) that are restrieted to a single CMA area. *This assessment does not represent an entire list of plant communities for the Border Rivers/Gwydir, Namoi, Central West, Lachlan, Murrumbidgee or Murray CMAs because only the western part of these CMAs are in the NSW Western Plains. See Appendix B in Benson (2006) for an explanation of the threat eategories.

	No. of Extant NSW Western Plains Plant Communities Catehment Management Authority Areas								
Threat Category Code	Lower Murray/ Darling	Western	Murray*	Murrumbidgee*	Lachlan*	Namoi*	Border Rivers/ Gwydir*	Central West*	Total Western Plains
Critically Endangered	4	3 (1)	6	6	4	1	2 (2)	3	11 (3)
Endangered	3	10	9 (2)	8	10 (1)	15	15 (1)	19	31 (4)
Vulnerable	8 (3)	8 (1)	8	12	13 (1)	11	11	16	28 (5)
Near Threatened	22 (1)	40 (14)	15	19	24	7	10 (1)	18 (2)	62 (18)
Least Concern	21 (5)	62 (40)	13	18	29	6	4	18	81 (45)
Total	58 (9)	123 (56)	51 (2)	63	80 (2)	40	42 (4)	74 (2)	213 (75)

Only three bioregions have greater than 5% of their extent sampled in protected areas (Table 10). These are the Simpson-Strzelecki Dunefields Bioregion with 10.8%, the Channel Country Bioregion with 9.9% and the Murray-Darling Depression Bioregion with 6.7%. Sturt National Park accounts for most of the protected area status in the Simpson-Strzelecki Dunefields and Channel Country Bioregions. Conversely, bioregions with very poor representation in protected areas include the Riverina Bioregion with 1.9%, Darling Riverine Plains with 1.7%, Broken Hill Complex with 2.0% and Cobar Peneplain with 2.5%. Therefore, if a target of sampling 10% of a bioregion in protected areas is adopted, reflecting IUCN (1994) guidelines, then only one bioregion (the Simpson-Strzelecki Dunefields) meets the target with the Channel Country Bioregion just below it.

The vast majority of the 213 plant communities in the NSW Western Plains are very poorly represented in protected areas (Table 11, Figure 7). 31 or 15% have no known representation in protected areas. 86 or 40% have between 0–1% of their estimated pre-European extent in protected areas, 50 or 23% have between 1 and 5% and 47 or 22% have between 5 and 15% (Table 11). 52 or 24% of the 213 plant communities classified for the NSW Western Plains meet the international target of sampling 10% of extent in protected areas (IUCN 1994). The Australian forest protection criteria in JANIS (1997) prescribe adequate protection as being at least 15% of the original extent of a community in protected areas (ignoring the higher threshold protection requirements of restricted or rare communities used in JANIS); only 30 or 14% of the 213 plant communities currently meet this standard.

Taking the above statistics into account, it can be stated that less than one quarter of the plant communities in the NSW Western Plains are adequately represented in protected areas when applying international targets for representation. The corollary of this is that three quarters are under-represented in the protected area system.

Assessment of threats to the vegetation

It is important to emphasise that a caveat should apply to any species or ecological community threat assessment and categorization. The main purpose of threat status assessment is to assist with setting priorities for management and conservation action. If an ecological community is judged not to be threatened, at a particular juncture, it does not imply that areas of it do not contain important wildlife or landscape values worthy of protection. In the fragmented and degraded landscapes of NSW, every patch of bush may be important for certain animal or plant species or for protecting landscape features or ecological processes including lowering saline water tables, mitigating soil erosion and providing services such as pollinators for crops or shade for stock (Smith et al. 2000, Gillespie 2000). Native vegetation, whatever its threat status, may also important in Aboriginal and European cultural life (Lambert & Elix 2000).

This threat assessment of the plant communities of the NSW Western Plains complements previous assessments of restricted or rare plant species in the region (Pressey et al. 1990, Bowen & Pressey 1993).

As of December 2005, 8 NSW VCA defined plant communities were listed and 17 were nominated for listing under the

Fig. 8. Land clearing of *Eucalyptus intertexta* (Smooth-barked Coolabah) woodland (ID104) north-west of Nyngan in central western NSW. Clearing remains the major threat to some plant communities in western NSW including on the eastern edge of the NSW Western Division. Photograph, Jaime Plaza, 27/8/2003.

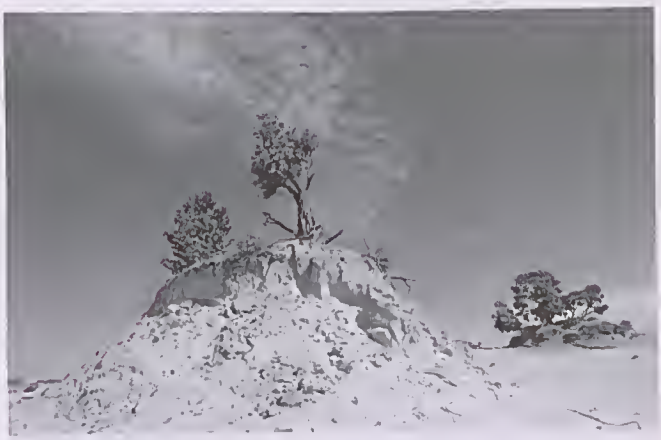

Fig. 9. Isolated *Callitris glaucophylla* (White Cypress Pine) on eroded lake lunette (ID152) near Lake Nitchie in the Darling Ana Branch in far south western NSW. Accelerated erosion due to high stocking rates degraded large areas of western NSW in the late 1800s and early 1900s. Some areas have not recovered. Natural erosion may also have been occurring on these ancient lunettes. Photograph, Jaime Plaza, 14/4/2002.

Australian *Environmental Protection and Biodiversity Conservation Act 1999*. 11 NSWVCA communities were listed and 17 were nominated for listing as threatened ecological communities under the NSW *Threatened Species Conservation Act 1995* (Table 12). The NSWVCA plant communities do not necessarily equate precisely in definition to these legal listings. Some are equivalent to them and others form part of the listings or nominations. Given the suggested threat status of other communities classified in the NSWVCA, it is anticipated that more communities will be listed under these laws in the future.

Fig. 10. *Eucalyptus camaldulensis* (River Red Gum) woodland lining the Bogan River in the Darling Riverine Plains Bioregion (ID36). Although large areas of River Red Gum remain along the Murray River in southern NSW, vegetation lining inland river systems in the NSW central-northern wheatbelt have been affected by clearing, weed invasion, trampling by stock and reduced flooding regimes. Photograph, Jaime Plaza, 27/10/01.

Fig. 11. *Eucalyptus coolabah* (Coolabah) open woodland ID40) with a grassy ground cover south of Goodooga north-west plains of NSW. Coolabah is largely cleared in the NSW Central Division with some larger patches remaining in the Western Division. The long term survival and regeneration of Coolabah woodland is threatened by clearing and reduction in floodplain flooding due to the draw-off of river flow for irrigation. Photograph, J.Plaza, 21/10/01.

Applying the threat criteria and threat categories outlined in Appendix B of Benson (2006), to the 213 plant communities in the NSW Western Plains, 71 or one third of them (33%) are judged to be threatened, that is, 'critically endangered' (CE), 'endangered' (E) or 'vulnerable' (V) (Table 13). Of these 11 are considered to be 'critically endangered' and 31 'endangered'. Another 62 communities are considered to be 'near threatened' and 81 as being of 'least concern'. However, many of the 'least concern' and 'near threatened' categorized communities may become threatened over the coming decades if particular threatening processes are not mitigated. The four main threats are high, continuous grazing pressure throughout the Western Plains, vegetation clearing in the eastern third of the region, rises in saline water tables (NSW Department of Land and Water Conservation 1999) and reductions in natural flooding regimes on floodplains. Reducing total grazing pressure includes controlling feral animal numbers, particularly rabbits and goats, not just dealing with grazing regimes of domestic stock.

Most threatened (CE, E, V) plant communities are poorly represented in protected areas (i.e. with a protected area code of 4 or 5), however a few are moderately well protected (i.e. with a protected area code of 3) (Table 13). All but one of the communities that are well represented in protected areas (protected area codes 1 and 2) are recorded as either 'near threatened' or 'least concern' — probably because most occur in the arid, far western parts of NSW beyond the main clearing belt.

Since many threatening processes affect whole landscapes irrespective of land tenure, it is important not to consider a community as 'safe' just because it is well represented in protected areas. Some threatening processes in the Western Plains extend into national parks and nature reserves – for example weed invasion, feral herbivores, soil erosion, flooding regime change and climate change.

The threatened (CE, E, V) communities are distributed unevenly across the eight bioregions in the Western Plains (Table 14). 6 of the 11 'critically endangered' communities occur in the Riverina Bioregion while none occur in the arid climate zone Channel Country or Simpson-Strzelecki Dunefields Bioregions (Table 14). 23 of the 42 'critically endangered' and 'endangered' communities occur in the Darling Riverine Plains Bioregion with only a few occurring in the arid zone bioregions to the west (Table 14). There are similar patterns for 'vulnerable' communities. These findings reflect the impact of land clearing in the wetter climate regimes and in the alluvial soil-dominated Riverina and Darling Riverine Plain Bioregions compared to the sand plains and rocky ranges of the drier, far inland bioregions. Similar trends are repeated with the CMA areas (Table 15). Compared to the fully assessed Western and Lower Murray/ Darling CMA areas, there are more threatened communities recorded in the Murrumbidgee, Murray, Lachlan and Central

West CMAs even though the vegetation of the eastern half these CMAs is not included in this classification or assessment.

The most common threatening processes, recorded in the NSWVCA database, to the plant communities in the NSW Western Plains are:

- Land clearing that affects plant communities in the wetter, eastern third of the Western Plains including the *Eucalyptus* box woodlands (Figure 8), *Casuarina* and *Acacia* woodlands and a variety of native tussock grasslands and wetlands;
- Wind and sheet soil erosion, due to 150 years of grazing by stock and feral animals such as rabbits and goats (Figure. 9);
- Altered hydrological regimes, due to irrigation draw off of water from rivers and artesian aquifers that threatens riparian and floodplain forests and woodlands including *Eucalyptus camaldulensis* (River Red Gum) (Figure 10), *Eucalyptus coolabah* (Coolabah) (Figure 11) and *Eucalyptus largiflorens* (Black Box) (Figure 12) woodlands and mound springs (Figure 13). Wetlands in the eastern half of the Western Plains are highly threatened, including some registered on international RAMSAR wetland list such as the Macquarie Marshes that has been reduced from about 200 000 ha to about 50 000 (W. Johnson pers. comm.) and the Gwydir River wetlands that are now surrounded by irrigated crops and have been reduced from an estimated 50 000 ha to about 1000 ha (Southeron 2002). Other threatened wetlands include the Lowbidgee wetlands on the floodplain of the lower Murrumbidgee River that have been cleared and drained, and the Culgoa River floodplain in the Darling Riverine Plains Bioregion where regular flooding is now rare due to upstream irrigation development in Queensland;
- Exotic weed invasion, most prevalent in highly fragmented plant communities on richer soils including riparian zones;
- Dieback due to disease. For example, saltbush dieback in the Riverina Bioregion (Cliff et al. 1987, Semple 1989);
- Increased extent of salinity (Bradd & Gates 1996, NSW Department of Land and Water Conservation 1999) (Figure 14).

The main consequences of these impacts on the vegetation are a loss of extent, simplification of vegetation structure and loss of biomass, changes in plant species composition

Fig. 13. Artesian mound spring sedgeland-grassland (ID66) at in the arid zone at Peery Lake in Paroo-Darling National Park, Mulga Lands Bioregion. This is one of the only remaining active mound springs in NSW. Most mound springs have become 'extinct' due to draw down in artesian hydrostatic pressure from the use of bores over the last 100 years. Three threatened plant species occur on this spring. Photograph, Jaime Plaza, 23/10/01.

Fig. 12. *Eucalyptus largiflorens* (Black Box) woodland (ID37) with *Atriplex nummularia* (Old Man Saltbush) in the understorey at Marra Creek, west of Byrock, Darling Riverine Plains Bioregion. This community has largely been cleared for grazing and cropping. Photograph, Jaime Plaza, 27/8/03.

Fig. 14. Dead *Eucalyptus largiflorens* (Black Box) woodland (formally ID13) between Echuca and Barham on the Murray River floodplain in south western NSW. This low lying woodland has been killed by a rising saline watertable due to over-clearing of native vegetation in the catchment since European settlement in the 1840s. Photograph, Jaime Plaza, 10/4/2002.

and loss of fauna species. There has generally been a loss of ground cover and recruitment is limited for most palatable, perennial plant species – many of which are major components of plant communities. In the long term this could lead to further structural and compositional changes as woody native trees and shrubs become senescent and are replaced by less palatable shrubs, grasses and forbs.

Most of the NSW Western Plains is in the NSW Western Division, an administrative part of NSW (see Figure 1 in Benson 2006) where the main land tenure is leasehold. This arid and semi-arid region reverted from freehold tenure to leasehold as a consequence of the recommendations in the 1901 Royal Commission into the Western Division based on the impacts on soil erosion and vegetation cover changes due to over-grazing and drought in the late 19th Century. In the latter half of the 20th Century cropping began to expand into areas of the Western Division that had previously been used for extensive grazing. A 1984 NSW Parliamentary Inquiry into the Western Division raised concerns about this expansion of cropping because of its impacts on degradation.

The NSW wheatbelt in the Central Division of NSW (see Figure 1 in Benson 2006) comprises the eastern third of the NSW Western Plains. It is mainly cleared (Benson 1999, Bedward et al. 2001). In some parts of the wheatbelt less than

Fig. 15. *Callitris glaucophylla* (White Cypress Pine) woodland (ID19) on a souree-bordering dune in Millewa State Forest on the Murray River floodplain. Regeneration of the pine on this dune was severely impaired by rabbit grazing. Feneing the dune has assisted with regeneration. Photograph, Jaime Plaza, 10/4/02.

Fig. 17. *Atriplex nummularia* (Old Man Saltbush) ehenopod shrubland (ID159), near Balranald, far south western New South Wales. Old Man Saltbush has been eliminated by domestie stoek and the shrubland is now restrieted in extent and endangered. Photograph, Jaime Plaza, 12/4/02.

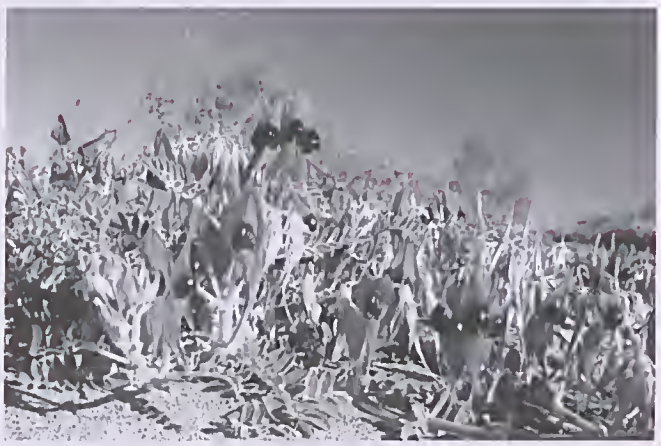

Fig. 16. *Swainsona formosa* (Sturts Desert Pea) in plant community ID133 Western Bloodwood *Corymbia terescens* (Western Bloodwood) - *Atalaya hemiglauca* (Whitewood) low open woodland on Tibooburra Granite. This spectaeular plant is endangered in NSW due to 150 years of grazing by domestic stock and is restrieted to a few sites where grazing has been limited. Photograph, Jaime Plaza, 24/8/2003.

Fig. 18. *Atriplex vesicaria* (Bladder Saltbush) and *Disphyma crassifolium* subsp. *clavellatum* (Round-leaf Pigfaee) ehenopod shrubland (ID157), on alluvial clay plains north of Maude in the Riverina Bioregion. Limited areas of this eommunity is presently sampled in proteeted areas as of 2005 and Bladder Saltbush shrubland has retraeted in extent over the last 100 years due to grazing pressure and diebaek caused by insect attaek. Photograph, Jaime Plaza, 12/4/02.

20% of native woody vegetation remains (Benson 1999). Clearing continues in the northern part of the wheatbelt mainly for crops such as wheat and cotton. Cropping continues to expand westwards affecting large tracts of country that could be termed 'marginal' due to low rainfall and average soil. This particularly affects the Nyngan-Walgett region of central-north NSW. Clearing on the eastern edge of the Cobar Peneplain, often justified as clearing 'woody weeds', is also clearing mature *Eucalyptus* trees such as *Eucalyptus intertexta* (Smooth-barked Coolabah) (Figure 8) that appears to have low recruitment compared to other species of *Eucalyptus* (J. Benson pers. obs.)

Stock and feral animal grazing continue to degrade native vegetation throughout the NSW Western Plains (Auld 1995, Lang & Graham 1983, Pickard 1991a, 1991b, 1993). While grazing management by domestic stock has generally improved since the mid 20th Century, goats and rabbits continue to impair the recruitment of native plant species. Grazing is notably inhibiting the regeneration of key plant species in *Acacia* shrublands on sandplains and rocky ranges, *Casuarina cristata/pauper – Alectryon oleifolius* (Belah-Western Rosewood) low woodlands and dune *Callitris* (cypress pine) communities (Figure 15). Inflated numbers of kangaroos, due to the provision of bore water, are also impacting on vegetation regeneration, for example

Fig. 19. *Atriplex vesicaria* (Bladder Saltbush) chenopod shrubland on the Barrier Range (ID156) composed of metamorphic and sedimentary substrates, near Corona north of Broken Hill in the arid climate zone. This community is widespread but very poorly represented in protected areas as of 2005. Photograph,Jaime Plaza, 24/10/01.

Fig. 21. Samphire chenopod shrubland (ID64) dominated by *Halosarcia pergranulata* subsp. *pergranulata* and *Halosarcia indica* subsp. *leiostachya* on a dry lake on Nanya Station. Although most of the samphire communities in western NSW are not threatened, they are poorly represented in protected areas. Photograph, Jaime Plaza, 15/4/02.

Fig. 20. *Maireana astrotricha* (Low Bluebush) low open chenopod shrubland (ID222) on gibber downs, 'The Veldt' station, Coko Range, west of the Silver City Highway, far north western NSW. This community is not represented in protected areas in NSW and is more common in South Australia. Photograph, Jaime Plaza, 22/8/03.

Fig. 22. *Acacia aneura* (Mulga) shrubland (ID119) on a sand plain west of Bourke, north western NSW. Mulga is very widespread on sand plains (ID119) and stony rises (ID120). It has been partially cleared and is often cut for fodder. Goat grazing is threatening Mulga on rocky ranges. Photograph, Jaime Plaza, 22/10/01.

in Sturt National Park. The Desert Pea (*Swainsona formosa*) (Figure 16) is an example of a palatable plant species that was widespread and is now restricted to a few locations due to grazing. Even after the release of the Rabbit Calicivirus Disease in 1995, that significantly lowered rabbit populations in arid and semi-arid climatic regions, the regeneration of palatable shrubs has been demonstrated to be slow or non-existent — even in reserves where domestic stock are excluded (Denham & Auld 2004). This may be explained by the slow growth rate of perennial plant species in regions with low rainfall.

While protected areas can be de-stocked and feral animals controlled, some threats to vegetation cannot be mitigated through site management. These include maintaining flooding regimes in river systems where irrigation has substantially reduced natural flooding, and the ramifications of climate change on species survival and ecosystem functioning.

Fig. 23. *Acacia harpophylla* (Brigalow) regrowth woodland (ID35) in Brigalow Park Nature Reserve near Moree in the northern wheatbelt of NSW. This Brigalow community is endangered with less than 5% remaining and much of it is regrowth from previous cutting and clearing. Photograph, J.Plaza, 19/10/01.

Fig. 24. *Acacia cambagei* (Gidgee) woodland (ID118), 40km ESE of Wanaaring, far north western plains of NSW. Photograph, Jaime Plaza, 26/8/03.

If carbon dioxide and other greenhouse gas emissions continue unabated, temperatures in western NSW may rise between 0.5 degrees and 3 degrees by 2030 and between 1 and 7 degrees by 2070 (Hennessy et al. 2004). North-western NSW is predicted to suffer the highest temperature rises. Rainfall is expected to decrease on average by up to 15% in 30 years, and by up to 60% in some seasons by 2070 (Hennessy et al. 2004). Due to an increase in the frequency of El Nino climatic events droughts are likely to occur every 2–4 years over the next 70 years rather than every 7 years as is the current case (Hennessy et al. 2004). These statistics are guarded by large confidence levels but the indisputable trend is for hotter conditions in the inland regions of NSW. While little is known about the adaptability of native plant and animal species to such rapid climatic changes, some species may become extinct, at least locally. Due to increased vegetation clearing and habitat fragmentation there are also increasing barriers to species movement over time to locations with suitable climatic regimes.

Management and conservation priorities

The reservation status of land units in the Western Division part of the NSW Western Plains was investigated by Pressey & Nicholls (1989) applying a minimum-set approach to mapped land systems. Subsequently Pressey & Logan (1995) investigated the protected area status of the Western Division in relation to coarseness of land classifications. Since those analyses, there has been an increase in the number and area of conservation reserves in the Western Plains including major extensions to Paroo-Darling, Sturt, Mungo and Gundabooka National Parks, and in the Riverina Bioregion the dedication of Yanga National Park and several other reserves. However, protected areas still only cover 3.7% of the NSW Western Plains and 75% of the plant communities in the Western Plains

Fig. 25. *Acacia pendula* (Weeping Myall) woodland (ID27), north of Warren in the Darling Riverine Plains Bioregion. Weeping Myall woodland is endangered throughout its range due to clearing being focused on the alluvial clay soils on which it grows. Photograph, Jaime Plaza, 17/8/03.

have less than 10% of their pre-European estimated extent sampled in protected areas. Therefore, more protected areas are required to reach the minimal international standards set in IUCN (1994) or the national standards set out in the Natural Resource Management Ministerial Council directions for an Australian National Reserve System (NRMMC 2004).

The 'key sites for protection' field in the NSWVCA database provides some guidance to sites or regions to investigate for new protected areas. The 'planning and management' database field comments on management priorities.

Plant communities that are poorly represented in protected areas, for example, with less than 5% of their original extent protected, coupled with those that are 'critically endangered', 'endangered' or 'vulnerable', should be given priority for protection in future reserves and secure property agreements. These communities can either be gleaned from Table 2 or derived by manipulating the spreadsheet in Appendix F on the CD that contains a list of the communities by ID Number and common name, their threat category, protected area code and percentage in protected areas. It is also possible to select plant communities by protected area status of threat category though the query mode in the full version of the NSWVCA database. This is not possible to do on the read-only database version.

Fig. 26. *Eucalyptus microcarpa* (Inland Grey Box) woodland (ID76) near Berrigan in the Riverina Bioregion. About 95% of this community has been cleared and it is endangered. Inland Grey Box also occurs in several other communities in central NSW. Photograph, Jaime Plaza, 9/4/02.

Fig. 27. *Eucalyptus populnea* subsp. *bimbil* (Poplar Box) grassy woodland occurring on loamy soils on the alluvial plains of the Darling Riverine Plains and Brigalow Belt South Bioregions (ID244) is threatened because most of it has been cleared for grazing or cropping. Photograph, Jaime Plaza, 27/10/01.

Planning for other factors such as climate change may alter priorities. For example, it may be deemed to be as important to provide habitat linkages in well protected or non-threatened communities as concentrating conservation planning on protecting threatened or poorly reserved communities.

Strategies for protecting the plant communities should vary from region to region. New reserves could be established at a relatively low cost to improve the sampling of plant communities that occur in the semi-arid and arid rangelands. This system could be complemented by secure property agreements over Western Lands Leases where landholders would be encouraged and if possible, paid to manage their land holdings for conservation values. The main ongoing management cost for protected areas in such regions is the control of feral animals, particularly goats. When considering the higher rainfall, eastern parts of the NSW Western Plains (the wheatbelt) where clearing has left few large patches of native vegetation, it would be rarely possible to purchase and reserve large parcels of land. Achieving a target of protecting 10% of the original extent of some of these over-cleared communities would require revegetation. A two pronged approach is recommended for the wheatbelt. Some sites containing threatened or poorly protected communities in good condition, in terms of their species composition and vegetation structure, could be acquired and dedicated as public conservation reserves. However, the majority of protected areas should be long term property agreements with landholders. These should be pursued as part of the Property Vegetation Planning Process (PVP) instigated in New South Wales under the *Native Vegetation Act 2003* that is administered by 13 Catchment Management Authorities and the NSW Department of Natural Resources. The NSWVCA database and its linked spreadsheet tables could be used to set priorities for PVPs and monitor changes in the protected area status of plant communities over time.

While it would be unwieldy to describe all the plant communities requiring special management or conservation action, some notably poorly protected and/or highly threatened plant communities include:

- Chenopod shrublands including the endangered *Atriplex nummularia* (Old Man Saltbush) communities (IDs 158, 159) (Figure. 17); the *Atriplex vesicaria* (Bladder Saltbush) (IDs 156, 157 & 197) dominated communities on the

alluvial plains of the Riverina and Darling Riverine Plains Bioregions (Figure 18) and on the stony downs in the Barrier Range in the Broken Hill Complex Bioregion (Figure 19); *Mairaena* (bluebush) shrublands on alluvium (IDs 153, 154) and Bluebush shrublands on stony ranges (IDs 155, 222) (Figure 20); and *Halosarcia, Frankenia, Sclerostegia* spp. (samphire shrublands) (IDs 18, 62, 63, 64, 65) (Figure 21) of saline areas mainly in the arid climate zone;

- Acacia woodlands or shrublands including *Acacia aneura* sens lat. (Mulga) (IDs 119, 120) (Figure 22); *Acacia harpophylla* (Brigalow) (IDs 29, 31, 35) (Pulsford 1984)(Figure 23); *Acacia cambagei* (Gidgee) (ID118) (Figure 24); *Acacia pendula*(Weeping Myall) (IDs 26, 27) (Figure 25) and *Acacia melvillei/homalophylla* complex (Yarran) (IDs 27, 77) are poorly represented in proteeted areas and some communities are highly threatened even inside reserves (Porteners 2001). Stands of Brigalow and Gidgee oeeur in the Mulga Lands Bioregion between Culgoa National Park and Ledknapper Nature Reserve. Small remnants of Weeping Myall (*Acacia pendula*) oeeur on the alluvial soils in eentral NSW;

Fig. 28. *Eucalyptus conica* (Fuzzy Box) woodland (ID201) predominantly oeeurs on the NSW Western Slopes such as this site near Forbes. It is rare on the Western Plains. Fuzzy Box communities in NSW are endangered beeause they oeeur on alluvial and colluvial loamy soils that have largely been eleared for agrieulture. Remnants are often infested with exotie weeds. Photograph, Jaime Plaza, 10/10/02.

Fig. 29. *Eucalyptus leucoxylon* subsp. *pruinosa* (Yellow Gum) woodland (ID86), Yarrein Creek, west of Moulamein in the Riverina Bioregion. This community is rare in NSW and is threatened by lack of regeneration, elearing and salinity. Stands on private land urgently need to be feneed off from stock grazing. Photograph, Jaime Plaza, 11/4/02.

- Grassy *Eucalyptus* box woodlands in the eastern part of the Western Plains including in the NSW wheatbelt are generally poorly represented in proteeted areas. They have been substantially eleared and most are exposed to a number of threatening proeesses. These inelude woodlands dominated by *Eucalyptus microcarpa* (Inland Grey Box) (IDs 76, 80, 82, 110, 237) (Figure 26), *Eucalyptus populnea* subsp. *bimbil* (Poplar Box) (IDs 56, 87, 88, 244) (Figure 27), *Eucalyptus melliodora* (Yellow Box) (IDs 74, 75, 83), *Eucalyptus conica* (Fuzzy Box) (ID201) (Figure 28) and the restricted oeeurrences of *Eucalyptus leucoxylon* subsp. *pruinose* (Yellow Gum) (ID86) in the Riverina (Fig.29);
- Riverine and floodplain forests and woodlands dominated by *Eucalyptus camaldulensis* (River Red Gum) (IDs 2, 5, 7, 8, 9, 10, 11, 36) (Figures 10 and 30), *Eucalyptus coolabah* (Coolabah) (IDs 39, 40) (Figure 11) and *Eucalyptus largiflorens* (Black Box) (IDs 13, 15, 16, 37) (Figure 12) that are widespread aeross western NSW, are poorly represented in the proteeted area system and are threatened by altered flooding regimes, weed invasion and elearing. Only the arid zone River Red Gum eommunity (ID41) could be considered reasonably well proteeted in reserves such as Mutawintji and Sturt National Parks. Small areas of River Red Gum and Blaek Box are represented in flora reserves and nature reserves along the Murray and Murrumbidgee Rivers;
- *Callitris glaucophylla* (White Cypress Pine) woodlands on sandy rises and sandplains in central and far western NSW (IDs 28, 48, 69, 70) (Figure 15);
- The restrieted *Corymbia tessellaris* (Carbeen) (ID71) (Figure 31) woodland in the Darling Riverine Plains Bioregion;
- Central NSW mallee communities (IDs 173, 174, 193) that have largely been eleared and heavily grazed (Mabbutt 1982);
- *Allocasuarina luehmannii* (Buloke) (Figure 32) and *Callitris gracilis* subsp. *murrayensis* (Slender Cypress Pine) (IDs 19, 20, 21, 22) on souree-bordering dunes and other sandy rises in south-western NSW (Sluiter et al. 1997);
- Tussoek grasslands ineluding (IDs 43, 44, 45, 47, 49, 50, 52, 214, 215 and 242) (Figs. 33 and 34) are poorly represented in proteeted areas. Most of these grasslands oeeur in the wetter, eastern parts of the Western Plains and

Fig. 30. *Encalyptus camaldulensis* (River Red Gum) tall open forest with *Poa labillardierei* (snow grass) ground cover (ID5) in the Millewa State Forest, Riverina Bioregion. Although much of the original extent of this forest remains, most has been logged resulting in younger age classes. Exotic weeds dominate the ground cover in some locations. Maintaining flooding regimes is critical to the regeneration of River Red Gum forests. Photograph, Jaime Plaza, 10/4/02.

Fig. 31. *Corymbia tessellaris* (Carbeen) woodland (ID71) in the northern NSW wheatbelt. Carbeen occurs on sandy rises or clays on alluvial plains but has largely been cleared and is now restricted to a few locations. Photographer R. Dick, 30/4/86

Fig. 32. *Allocasuarina luehmannii* (Buloke) woodland (ID20) on sandy rises on the Murray River floodplain on the Echuca-Barham Rd in the Riverina Bioregion. This is a highly threatened and restricted community that has mainly been cleared and is lacking regeneration due to grazing pressure from rabbits and domestic stock. Photograph, Jaime Plaza, 11/4/02.

Fig. 33. Forb-rich native grassland dominated by *Danthonia* spp., *Austrostipa* spp., *Chrysocephalum apiculatum*, *Swainsona behriana* and *Wahlenbergia gracilis* (ID44) near Jerilderie in the Riverina Bioregion. Most of the native grasslands in the Riverina have been affected by grazing or cropping. Areas in good condition are mainly restricted to roadsides and stock routes. Photograph M.F. Porteners, 1995.

Fig. 34. Native grassland dominated by *Dichanthium sericeum* (Queensland Bluegrass) and *Astrebla lappacea* (Curly Mitchell Grass) (ID52) on black cracking, clay, alluvial soils in Kirramingly Nature Reserve south-west of Moree. Most of this grassland has been ploughed for crops. The spiny native shrub *Vachellia farnesiana* is abundant in some areas. Photograph, Jaime Plaza, 20/10/01.

have been substantially destroyed by agriculture. In contrast, the Mitchell Grass Grassland of the arid zone (ID61) (Figure 35) is well represented in Sturt National Park.

- Sedge-dominated wetlands or grasslands (IDs 53, 205, 206) in wetland swamps on floodplains (Figure 36). Most inland swamps are threatened by a lack of flooding due to increases in irrigated cropping over the last 40 years.

Future progress of the NSWVCA

Fig. 35. *Astrebla pectinata* (Barley Mitchell grass) grassland with low chenopod shrubs on gibber downs in the arid zone approximately 20km NNW of Tibooburra in the Channel Country Bioregion (ID61). While heavily grazed this community is widespread and well protected in Sturt National Park. Photograph, Jaime Plaza, 25/8/03.

Figure 36. Sedge marsh dominated by *Marsilea drummondii* and *Cyperus eragrostis* near Moomin Creek, Darling Riverine Plains Bioregion (ID53). This community has been affected by clearing and altered flooding regimes but it is also ephemeral and its composition changes depending on the time since last rainfall or flooding. Photograph, Jaime Plaza, 20/10/01.

The classification and data in the NSW Western Plains section of the NSWVCA will evolve over time as knowledge increases and experts deliberate and comment on it. The maintenance of the NSWVCA, including the database, is discussed in Benson (2006).

The next stage (Part 2) of the NSWVCA project will deal with the vegetation of the NSW Western Slopes that abut the NSW Western Plains to the east and include three bioregions: NSW South Western Slopes, Brigalow Belt South and Nandewar. Over 50 plant communities that occur on the Western Plains extend into the western margins of the Western Slopes.

It would be beneficial to complete the classification and assessment of the native vegetation of all eight CMA areas west of the Great Dividing Range because they contain many of the most degraded environments in NSW and Australia. This would require completing the classification and assessment of the vegetation in the NSW Western Slopes and the western part of the NSW Tablelands. The completion of the classification and assessment of the vegetation of all of New South Wales, including the highly diverse vegetation on the coast, will take a commitment of resources and expertise over the next decade.

Acknowledgements

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References

Note: A bibliography of all references used in the classification and assessment of the vegetation of the NSW Western Plains is in the spreadsheet file *NSW Western Plains Bibliography.xls* in Appendix C of this paper (Part 1 of the NSWVCA) in Folder 3 on the CD in the back pocket of this journal. The references below are those cited in this paper.

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Appendix A.

All Records Full Report of NSW Western Plains plant communities divided into plant communities in 19 Formation Groups, December 2005.

Appendix A is located as a digital file in the Part 1 Western Plains folder in Folder 3 on the CD in the back pocket of the journal. It contains the full descriptions from 90 fields in the NSWVCA database of 213 plant communities classified for the NSW Western Plains. It is about 800 A4 pages in length. Due to its size, the plant communities also are divided into the 19 Formation Groups for the Western Plains. These are arranged as sub-folders in Folder 3 Part 1 NSW Western Plains on the CD.

Appendix B.

All Records Short Report of NSW Western Plains plant communities, December 2005.

Appendix B is located as a digital file in Folder 3, Part 1 Western Plains folder on the CD in the back pocket of the journal. The short report includes 28 of the 90 fields of information in the NSWVDA database. The communities are grouped by alphabetical order of the Formation Groups, then in ID number order within each Group. The full text reference for the reference numbers in the Reference List field can be looked up in Appendix C.

Appendix C.

Bibliography.

A bibliography of the references used to classify the native vegetation of the NSW Western Plains is in the Part 1 Western Plains folder (Folder 3) on the CD in the back pocket of the journal in the MS Excel spreadsheet titled *NSW Western Plains Bibliography.xls* on the CD.

Appendix D

An example of a NSWVCA database full report containing 90 fields of information including full references of a broadly classified plant community with a wide distribution, is critically endangered and is poorly represented in protected areas.

Common Name: **Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions**

Scientific Name: *Acacia pendula/ Rhagodia spinescens –Maireana decalvans / Austrodanthonia caespitosa – Atriplex semibaccata –Alternanthera denticulata –Austrostipa aristiglumis*

Veg. Comm. ID.: **26**

Original Entry: John Benson 31/12/2005

Photo 1: noimage.bmp Acacia pendula woodland, Lake Urana Nature Reserve, (AGD66) 35°16'09. 8'146°08'32.9'; 9/4/02; J.Plaza.

Photo 2: noimage.bmp Acacia pendula woodland
Grenfell-West Wyalong Road, (AGD66)
33°48'02.1' 147°37'15.9'; 19/4/02; J.Plaza.

Characteristic Vegetation: (Combination of Quantitative Data and Qualitiative Estimate)

Trees: *Acacia pendula; Casuarina cristata; Eucalyptus largiflorens; Eucalyptus camaldulensis subsp. camaldulensis; Eucalyptus melliodora.*

Shrubs/Vines/Epiphytes: *Rhagodia spinescens; Maireana decalvans; Atriplex nummularia; Chenopodium nitrariaceum; Maireana aphylla; Maireana pentagona; Muehlenbeckia florulenta; Acacia stenophylla; Acacia oswaldii; Acacia salicina; Hakea tephrosperma; Santalum lanceolatum; Amyema quandang var. quandang.*

Ground Cover: *Austrodanthonia caespitosa; Atriplex semibaccata; Alternanthera denticulata; Austrostipa aristiglumis; Atriplex spinibractea; Atriplex leptocarpa; Enchylaena tomentosa; Austrostipa nodosa; Austrodanthonia setacea; Sporobolus caroli; Einadia nutans subsp. nutans; Myriocephalus rhizocephalus; Centipeda cunninghamii; Rhodanthe corymbiflora; Vittadinia cuneata var. cuneata f. cuneata; Lepidium pseudohyssopifolium.*

Weed Species: *Xanthium occidentale; Echium plantagineum; Medicago polymorpha; Medicago truncatula; Bromus madritensis; Hordeum leporinum; Lolium perenne; Vulpia myuros; Bromus diandrus; Sonchus oleraceus; Trifolium angustifolium; Cotula bipinnata; Hordeum leporinum.*

Weediness: Medium (5–15%) with 10–30% cover.

Threatened Plants: Swainsona plagiotropis (E); Swainsonia murrayana (V); Brachyscome chrysoglossa (E); Lepidium monoploeoides (E).

Threatened Fauna: Painted Honeyeater, Superb Parrot.

Mean Species Richness: 39 ± 2 (Lewer et al. 2003 in 20x20 m plots).

Rainforest Structure (Webb): Not applicable.

Structure (WH): Isolated Trees; Open Woodland; Woodland.

Height Class (WH): Low; Mid-High.

Vegetation Description: Mid-high open woodland up to 8 m high dominated by Weeping Myall (Acacia pendula). Other tree species include Belah (Casuarina cristata), while Black Box (Eucalyptus largiflorens) and River Red Gum (Eucalyptus camaldulensis) may occur in depressions. Chenopod shrubs may be common or absent. They include Rhagodia spinescens, Maireana decalvans, Atriplex nummularia, Chenopodium nitrariaceum and Maireana aphylla. The ground cover may be dense or sparse depending on rainfall. It is dominated by grass species such as Austrodanthonia caespitosa, Austrodanthonia setacea, Austrostipa aristiglumis, Austrostipa scabra, Austrostipa nodosa and Sporobolus

caroli. Saltbush species include Atriplex spinibractea, Atriplex leptocarpa and Atriplex semibaccata. Forb species include Alternanthera denticulata, Myriocephalus rhizocephalus, Centipeda cunninghamii, Rhodanthe corymbiflora and Vittadinia cuneata var. cuneata. Occurs on brown clays or loam soils on alluvial plains mainly in the Riverina and NSW South Western Slopes Bioregions of south-western NSW. Apparently extinct in Victoria. Prior to European settlement this community probably contained a dense understorey of saltbush. Much of its original extent has now altered to be a derived native grassland dominated by native grasses and forbs. Weeping Myall is a threatened community due its past extent of clearing and overall is in poor condition.

Level of Classification: Sub-formation.

Classification Confidence Level: High.

Formation Group: Acacia Woodlands and Shrublands of the Inland Slopes and Plains.

State Veg Map (Keith 2004): Riverine Plain Woodlands.

State Landscape (Mitchell 2002): Not Assessed.

NVIS Major Veg Sub-Groups: Other Acacia forests and woodlands.

Forest Type (RN 17): 214 –Wattle (P); 224 –Scrub (P).

Authority(s): (Combination of Expert Opinion and Quantitative Data). Beadle (1948 and 1981) breaks Weeping Myall alliance into north and south communities based on different understorey species composition. This southern community has been mapped on Hay Plain ascommunity 25 by Porteners (1993) and Scott (1992). Map unit 12 in Horner et al. (2002) covering part of the Hay Plain. Moore (1953,1953a) maps it on the south western slopes. Coarsely mapped in Leigh & Mulnam (1977). Eardley (1999) maps Weeping Myall forRiverina Bioregion using RBG mapping and Landsat Satellite Imagery extension mapping. Miles (2001) maps pre-European distribution inMurray catchment. Western Riverina Vegetation Management Committee (2001) map and describe this community. Modelled andmapped in central Lachlan River region by Austin et al. (2001). Map unit R5 in Sivertsen & Metcalfe (1995) in the Forbes and Cargelligoregions. Floristic group 7 and part of map unit ALP3 in Lewer et al. (2003) for the Lachlan River region.

Interstate Equivalent(s): None known. May have occurred in Victoria prior to clearing and may be extinct there.

Mapped/Modelled: Current extent partly mapped.

Plot Sampling: Inadequate.

Mapping Info: Mapable with good quality aerial photographs but Satellite imagery often fails to detect Weeping Myall. Mapped in part around Forbes and Cargelligo (Siversten & Metcalfe 1995), by Porteners (1993) and Horner et al. (2002) for western Riverine Plain. The Jerilderie and Lockhart regions are not yet mapped as of 2003. Some pre-European mapping by Miles (2001) and WRVMC (2001).

Climate Zone: Temperate: no dry season (hot summer); Semi-arid: warm (winter rain).

IBRA Bioregion (v6): Cobar Peneplain (1–30%); NSW South-western Slopes (30–70%); Riverina (30–70%).

IBRA Sub-Region: Lachlan (1–30%); Lower Slopes (30–70%); Murray Fans (1–30%); Murrumbidgee (30–70%); Nymagee (1–30%).

Botanical Division: Central Western Slopes (CWS) (1–30%); South Western Plains (SWP) (>70%); South Western Slopes (SWS) (1–30%).

Local Govt. Areas: Berrigan (1–30%); Bland (1–30%); Carrathool (1–30%); Conargo (1–30%); Coolamon (1–30%); Culcairn (1–30%);Deniliquin (1–30%); Forbes (1–30%); Jerilderie (1–30%); Lachlan (1–30%); Maclean (1–30%); Wagga Wagga (1–30%).

CMAs: Central West (1–30%); Lachlan (1–30%); Murray (1–30%); Murrumbidgee (30–70%).

MD Basin: Yes.

Substrate Mass: Alluvium.

Lithology: Clay.

Great Soil Group: Brown clay; Grey clay; Red-brown earth.

Soil Textnre: Heavy clay; Medium heavy clay; Sandy clay loam.

Landform Patterns: Plain; Rises; Stagnant alluvial plain.

Landform Elements: Plain.

Land Use: Cropping and Horticulture; Grazing.

Impaets of Enropean Settlement: Major reduction (>70%) of extent and/or range; Major alteration of understorey.

Pre-European Extent: 1 600 000 ha ± 30%. Estimated from pre-European map.

Pre-European Extent Comments: Based on estimates of 1 100 000 ha from pre-European mapping in Western Riverina draft RVM Plan (WRC 2001). This was partly based on mapping of western Riverina by Porteners (1993). Areas occur to the east of this. Miles (2001)cstimates that about 500 000 ha of Weeping Myall occurred in the Murray catchment.

Current Extent: 160 000 ha ± 30% or 10% ± 50% of pre-European extent remaining.

Current Extent Conments:(Estimated from a more broadly classified vegetation map). WRVC (2001) estimate that 107 000 ha remains inthe western Rivcrina. Additional areas are addcd to this as this community extends to the east of the WRVC area. Howcver, little remainsin the southern/central wheatbelt — only 215 ha is mapped in the Forbes area. Horner et al. (2002) map over 11 000 ha on part of the HayPlain.

Conservation Reserves: Lake Urana NR 10 (E3); Oolambcyan NP 715 (M).

Reserves Total Area: 725 ha.

No. Representatives in Reserves: 2

Protected Area Explanation: No large areas are known to be reserved as of 2001. Areas in Oolamebeyan National Park mapped by Roberts & Roberts (2001). A small patch occurs in Lake Urana NR (NPWS 2001a and Benson 1999–2004). Porteners (1993) mappedareas that warrant investigation. PA DE9905 from overlaying Porteners (1993).

Secnre Property Agreements: DE9905 PA 88 (M).

Secnre PAs Total Area: 88 ha.

No. Representatives in Secure Property Agreements: 1

Protected Current Extent: 0.5% 813 ha ± 10%.

No. Representatives in Protected Areas: 3

Protected Pre-Enropean Extent: 0.05% which is inadequately protected across distribution.

Common in 1750: Code 5a: <1% of pre-Europcan extent in protected areas (>10 000 ha).

Key Sites for Protection: The report by Eardley (1999) for the Rivcrina Bioregion highlights areas of potential conservation importance for arange of vegetation communities. Regions north of Jcrilderie may be important.

Degree of Fragmentation: Human inducod highly fragmented small stands with <30% extent remaining and high edge to area ratio.

Recoverability: Poor health as structure and/or composition significantly altered. But sufficient biota remain for natural regeneration ifcausal factors and their secondary impacts removed and dynamic processes reinstatcd.

Variation & Disturbance: Much of the present Austrodanthonia grasslands of the Riverina may have been derived from a pre-European Acacia pendula — Atriplex nummularia woodland/shrubland. The chenopods, and presumably Weeping Myall, were eliminated from vast regions through a combination of clearing and over-grazing.

Fire Regime: Unknown — occasional wildfire sweeps across the plains — an extensive fire burnt part of the Riverina in 1991. This resultedin thc mass germination of Swainsona and other legume species. Presumably, the seed of Acacia pendula is long-lived and maygerminate after fire.

Adjoining Communites: Grades into grassland, Bladder Saltbush, White Cypress Pine or Buloke eommunities and Blaek Box along ereeks or in depressions.

Threatening Proeesses: A eritieally endangered and very poorly reserved eommunity. Mostly eleared for grazing and erops in the southern wheatbelt and in the Riverina. Existing remnants threatened by further elearing. Continuous grazing by stoek and rabbits have altered the understorey.

Threatening Proeess List: Clearing for agrieulture; Dryland eropping; Irrigated eropping; Major impaets on strueture due to logging; Salinity; Unsustainable grazing and trampling by stoek; Unsustainable grazing by feral animals; Weed (exotie) invasion.

Threat Category: Critieally Endangered.

Threat/Protected Area Code: CE/5a

Threat Criteria: 1; 4; 5.

Planning Controls: Listed TSC Aet

Planning and Management: The Laehlan, Murrumbidgee and Murray Catehment Management Plans should proteet what remains of this community. No more elearing of this eommunity should be allowed under these plans and some areas should be eneouraged to regrow through feneing sehemes.

Listed Under Legislation: Listed TSCA (NSW Threatened Speeies Conservation Aet); Nominated EPBCA (Com. Environmental Proteetion

Reeovery Plan: Doesn't exist, but required.

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Appendix E

An Example of a NSWVCA database Short Report with 28 fields of information for a plant community that is widespread, has a threat status of Least Concern and is well represented in protected areas.

Common Name: **Spinifex linear dune mallee mainly of the Murray-Darling Depression Bioregion**

Scientific Name: *Eucalyptus socialis –Eucalyptus dumosa —Eucalyptus gracilis —Eucalyptus costata / Acacia colletioides —Dodonaea viscosa subsp. angustissima —Eremophila glabra / Triodia scariosa subsp. scariosa —Vittadinia cuneata —Austrostipa nitida*

Veg. Comm. ID.: **171**

Photo 1: ID171 Eucalyptus socialis—Eucalyptus dumosa linear dune mallee shrubland, Tarawi Nature Reserve, (AGD66) 33°24'06.6' 141°18' 09.6'; 14/4/02; J.Plaza.

Original Entry: 31/12/2005 John Benson

Characteristic Trees: *Eucalyptus socialis; Eucalyptus dumosa; Eucalyptus gracilis; Eucalyptus costata; Callitris verrucosa; Eucalyptus leptophylla; Eucalyptus oleosa.*

Shrubs/Vines/Epiphytes: *Acacia colletioides; Dodonaea viscosa subsp. angustissima; Eremophila glabra; Eremophila sturtii; Olearia pimeleoides; Maireana pentatropis; Acacia willelmiana; Senna form taxon 'filifolia'; Bossiaea walkeri; Chenopodium curvispicatum; Grevillea huegelii; Eutaxia microphylla; Dodonaea bursariifolia; Beyeria opaca; Exocarpos sparteus; Alectryon oleifolius subsp. canescens; Westringia rigida; Acacia brachybotrya; Acacia sclerophylla var. sclerophylla; Capparis lasiantha; Maireana triptera.*

Groundcover: *Triodia scariosa subsp. scariosa; Vittidinia cuneata; Austrostipa nitida; Sclerolaena diacantha; Enchylaena tomentosa; Sclerolaena parviflora; Chenopodium desertorum subsp. desertorum; Halgania cyanea; Vittadinia cuneata; Lomandra effusa; Atriplex stipitata; Ptilotus exaltatus var. exaltatus; Sclerolaena obliquicuspis; Podolepis capillaris; Lomandra leucocephala subsp. leucocephala; Chenopodium desertorum subsp. anidiophyllum.*

Structure (WH): Mallee Shrubland; Open Mallee Shrubland.

Vegetation Description: Mallee shrubland or open shrubland most about 5 m tall but up to 8 m, most often in a whipstick habit, dominated by a number of mallee species including White Mallee (Eucalyptus dumosa), Red Mallee (Eucalyptus socialis) and Snap and Rattle (Eucalyptus gracilis) and Ridge-fruited Mallee (Eucalyptus costata). Narrow-leaved Red Mallee (Eucalyptus leptophylla) is also often present along with Sand Dune Pine (Callitris verrucosa). This community

contains a species-rich understorey that is dominated by Porcupine Grass (Triodia scariosa). A mid-dense to sparse shrub cover includes Acacia colletioides, Dodonaea viscosa subsp. angustissima, Eremophila glabra, Olearia pimelioides, Maireana pentratropis, and Grevillea huegelii. Mulga (Aeacia aneura) and Wilga (Geijera parviflora) may occur in northern and eastern areas. Besides Porcupine Grass, the ground cover includes fuzz-weed (Vittadinia cuneata), Austrostipa nitida, Podolepis capillaris and copperburrs such as Sclerolaena diacantha and Sclerolaena obliquicuspis. After rainfall many ephemeral species germinate including daisies and other forbs. Weeds are low in number and cover but Onion Weed (Asphodelus fistulosus) can be a localised problem. The swales between the dunes are most often more loamy-clay and often contain different vegetation such as belah or box woodlands. This community occurs on calcareous brown-red sand or loamy sand sometimes overlying grey clay on east-west linear sand dunes mainly in the Murray-Darling Sands Bioregion in south far western plain of NSW extending into South Australia and Victoria. Mainly restricted to the arid zone and semi-arid (warm) climatic zones in NSW. In relatively good condition compared to most other inland plant communities due to a low proportion having been cleared and low stocking rates. Rabbits are a problem in some areas. Burnt by wildfires every two or three decades or more regularly by landholders. Frequent fire may threaten the survival of mallee species.

IBRA (v6): Murray-Darling Depression (>70%).

CMAs: Lachlan (1–30%); Lower Murray/Darling (>70%); Western (1–30%).

Pre-European Extent: 800 000 ha ± 30%.

Current Extent: 650 000 ha ± 30%.

Percent Remaining: 81% ± 50%.

Conservation Reserves: TOTAL AREA 66893 ha: Mallee Cliffs NP 17300 (E2); Mungo NP 6000 (E2); Nombinnie NR 250 (E1);Nombinnie SCA 200 (E1); Round Hill NR 143 (M); Tarawi NR 9000 (E1); Yathong NR 34000 (E2).

Secure Pty. Agreements: TOTAL AREA 36680 ha: Nanya Ballarat Uni VCA 10530 (E1); Scotia AWC VCA 26150 (E1).

Protected Current: TOTAL AREA 103573 ha (15.93%) ± 30%, or 12.94% of pre-European extent.

Threat Category: Least Concern.

Threat/Protected Area Code: LC/3a.

Threat Criteria: 4; 1.

Reference List: 39; 282; 12; 216; 17; 43; 25; 13; 244; 33; 41; 232; 78.

Appendix F

This is located in Folder 3 on the CD accompanying this journal. It is a spreadsheet listing of the 213 plant communities in the NSW Western Plains by ID number and common name with their threat code, protected area code, current extent, pre-European extent proportion of extent in protected areas compared to estimated pre-European extent, occurances in CMA areas, occurence in bioregions. The spreadsheet format facilitates ordering the plant communities by threat code, protected area status or percentage in protected areas.

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Volume 9(3): 329–450 • 2006

Foreword 329

New South Wales Vegetation Classification and Assessment: Introduction — the classification, database, assessment of protected areas and threat status of plant communities. 331
J.S. Benson

New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains 383
J.S. Benson, C.B. Allen, C. Togher and J. Lemmon