

MAY 2010 | ASSESSMENT REPORT

REGIONAL FOREST ASSESSMENT
SOUTH-WESTERN CYPRESS
STATE FORESTS

natural
resources
commission



Enquiries

Enquiries about this report should be directed to:

Pia Zadnik

Ph: **(02) 8227 4300**

E-mail: pia.zadnik@nrc.nsw.gov.au

Daniel Hoenig (media enquiries)

Ph: **(02) 8227 4300**

E-mail: daniel.hoenig@nrc.nsw.gov.au

Revised: August 2010 (updated threatened species listed under the TSC and EPBC Acts in Appendix 16).

This work is copyright. The *Copyright Act 1968* permits fair dealing for study, research, news reporting, criticism and review. Selected passages, tables or diagrams may be reproduced for such purposes provided acknowledgement of the source is included.

All photographs are by the Natural Resources Commission unless otherwise acknowledged.

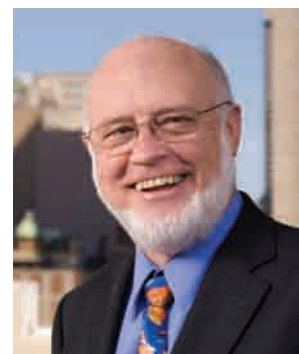
Printed on environmentally friendly paper, which is made from elemental chlorine-free pulp derived from sustainably-managed forests and non-controversial sources. Certified carbon neutral from an ISO 14001 accredited mill which utilises renewable energy sources.

Document No. D10/0596

ISBN 978 1 921050 58 9

Print management by Princept*
GIS services by Ecological Australia

Commissioner's foreword



When the NRC sought views on the value of the cypress forests, a mixed picture of positive and negative opinions came forward.

Some land managers described cypress as a 'weed' which can get growth-locked, yet they recognise the value of cypress forests for their stock as shelter, drought refuge and grazing. Environmentalists acknowledged that while their value as food and habitat for fauna species can be limited without the structural diversity provided by co-location with eucalypts, the forests contain some of the last remaining native vegetation in the central division of NSW. The forestry industry explained the viable and profitable future for cypress timber, yet has made only limited use of the 95 per cent of cypress forests which are on private land. From a regulatory perspective, cypress can legally be cleared as an invasive native scrub in some regions, yet there are explicit targets to increase the extent of cypress reserved for biodiversity conservation.

As the NRC's assessment has progressed, a much clearer picture of the positive role and value of cypress forests has emerged. The cypress forests of south-western NSW are a success story of sustainable resource use, and one which is uniquely well placed to adapt to the challenges and uncertainties facing our rural and regional communities and the ecology on which they depend. The regulatory arrangements in place to manage cypress in state forests provide a useful framework which, with further improvements, can sustain and enhance the values of the forests.

The state forests of south-western NSW that contain cypress are diverse in size and ecology. The forests are a disparate patchwork, scattered across a huge part of the state. Cypress can exist together as a co-dominant species with many diverse vegetation types and this structural and floristic diversity is critical for its ecological function as a habitat for many types of fauna.

The value of cypress depends on how actively it is managed and with what purposes in mind, as well as the structure of the cypress forests, and the presence or absence of other tree, shrub and grass species.

The forests have great value in providing for future connectivity and have the ability to contribute to the development of biodiversity corridors, refugia and other beneficial environmental outcomes. The delivery of these ecosystem functions and services is, however, contingent on appropriate active management. Conservation priorities should concentrate on improving connectivity between the cypress state forests and cypress forests on private land.

This assessment has also found that the regulation, forest management and silviculture practices in the south-western cypress state forests are generally appropriate and sustainable, subject to some refinement. Further and continued monitoring and evaluation is required to ensure the impacts of timber harvesting and grazing are assessed and managed.

As a native timber, cypress has many positive attributes. It is termite-resistant and durable, lending itself to a wide range of uses. It is a valuable timber resource with scope for expanded market development and with investment it can continue to grow as an important commodity.

Cypress forests can contribute to a positive social and economic future for communities across regional NSW as they face uncertainty in the availability of water as a result of climate variability and climate change. Cypress is adaptable to changes in rainfall and temperature, and will regenerate under a variety of climatic conditions. This inherent adaptability can provide a level of certainty that can sustain critical ecosystems and an innovative timber industry.

The findings and recommendations in this assessment report were developed after wide-ranging scientific research, evaluation of the available data and consultations with key stakeholders. While there are some data gaps, this report contains the best available information and data on the history of forest use and management of these forests, the current forest extent, condition, and environmental values.

The report also identifies cultural, heritage, social and economic values and assesses these in the context of their relationship to the forests. The recommendations are intended to ensure these values are maintained and improved so that the forests can continue to play a pivotal role in building landscape resilience for both communities and the ecosystems upon which they ultimately depend.

I would like to thank all those who worked on this assessment, including NRC staff, technical review panel members, consultants, the contributors from key government agencies including the Department of Environment, Climate Change and Water and Forests NSW, other key stakeholders and those who participated through making submissions and in stakeholder meetings.

John Williams
Commissioner

Acknowledgements

The NRC acknowledges the contribution of many agencies, individuals and organisations that provided information, data and views for this report.

Forests NSW (Department of Industry and Investment) and the Department of Environment, Climate Change and Water have made valuable contributions throughout the assessment process and during our visits to the south-western cypress state forests. The NRC appreciates the assistance of officers in these agencies in providing data, local knowledge and insights about the forests and their associated communities and industries.

The NRC is grateful to the people and organisations who took the time to prepare submissions. The submissions helped the NRC to understand the broader networks and connections that exist within local communities as a result of their interactions with these cypress state forests. Grants Holdings and the NSW Forest Products Association helped the NRC develop a detailed understanding of cypress timber industry operations and their importance to local communities.

The contributions and assistance of environmental stakeholders have been important. A number of groups and individuals provided comprehensive submissions focusing on the environmental values and issues in the cypress state forests. Specifically, the National Parks Association provided helpful submissions and was involved in additional consultation.

The NRC also appreciates the input from numerous Aboriginal Land Councils, Indigenous communities and Elders who shared with us their knowledge, concerns and aspirations. This has allowed the NRC to explore the connection with 'Country' that is being maintained within these forests.

A number of other NSW and Australian Government departments and local governments provided assistance and information, including the Commonwealth Department of Environment, Water, Heritage and the Arts; the Commonwealth Department of Agriculture, Fisheries and Forestry; NSW Department of Lands; and several Catchment Management Authorities.

The NRC also appreciates the input from the members of the Technical Review Panel who shared their scientific expertise, guided the design of our analysis and peer reviewed our assessment (see **Appendix 7** for further details). Their input enabled us to undertake this assessment within the timeframe.

The NRC would like to take this opportunity to thank all the individuals, agencies, non-government organisations, companies and industry representatives for their willingness to participate in our assessment.

Contents

1	Introduction	5
1.1	Key findings	7
1.2	Summary and recommendations	8
1.3	How the NRC determined its findings	14
1.4	Consultation and submissions	16
1.5	Structure of this report	20
2	Context for this assessment	21
2.1	Overview	22
2.2	Scope of this assessment	22
2.3	Cypress forests in the landscape	25
2.4	Institutional context	27
2.5	Historical context	28
2.6	The Brigalow decision	32
2.7	Landscape change	35
3	Environmental values	37
3.1	Overview	38
3.2	Ecology of white cypress forests and associated woodlands	38
3.3	Endangered species and ecological communities	42
3.4	Condition of white cypress forests and associated woodlands	43
3.5	Threatening processes and impacts	48
3.6	Assessing environmental values and key threats	52
4	Cultural, social and economic values	55
4.1	Overview	56
4.2	Identifying values and uses	56
4.3	Indigenous cultural values and heritage	57
4.4	Non-Indigenous cultural values and heritage	60
4.5	Social and economic values and uses	62
4.6	Communities linked to the south-western cypress state forests	70
4.7	Community capacity to adapt to change	72
5	Cypress timber resources	75
5.1	Overview	76
5.2	Cypress timber resources of the south-western cypress state forests	76
5.3	Cypress timber resources on other Crown land and private land	81
5.4	Characteristics of the cypress timber industry	82
5.5	Markets for the cypress timber industry	86
6	Managing cypress forests and associated woodlands	87
6.1	Overview	88
6.2	Managing cypress in the south-western cypress state forests	88
6.3	Managing cypress on private and leasehold land	92
6.4	Managing cypress in the reserve system	95
6.5	Goals, objectives and principles for management	95
6.6	Conservation and tenure arrangements	104
6.7	Performance review and improving information	109

Contents

Appendices	111
1 Terms of Reference	112
2 Relevant legislation	113
3 References and bibliography	115
4 Tables and figures	129
5 Acronyms and glossary	131
6 List of submissions	139
7 Technical Review Panel members	141
8 Institutional arrangements governing the south-western white cypress state forests	142
9 All vegetation types found in assessment area	149
10 Vegetation types found in assessment area that contain white cypress	165
11 Mapping methodology	169
12 Listed endangered ecological communities and species	174
13 Threat status of white cypress vegetation types	180
14 Listed endangered ecological communities and threatened species in south-western cypress state forests	183
15 Supporting information for the social and economic assessment	187
16 Profiles for south western cypress state forests	196
17 Comparison of silvicultural operations for cypress forests on private and public land	204
18 Maps of proposed management and tenure arrangements for south-western cypress state forests	206
19 The Brigalow decision	214
20 EPBC Act and FNPE Act requirements	219
21 Cypress state forests' contribution to public land in Local Aboriginal Land Councils	221
22 Methodology for landscape function values and threats	228
23 List of the south-western cypress state forests under this assessment	241

Introduction

1.1	Key findings	7
1.2	Summary and recommendations	8
1.3	How the NRC determined its findings	14
1.4	Consultation and submissions	16
1.5	Structure of this report	20





1 Introduction

The NSW Government has asked the Natural Resources Commission (NRC) to assess the cypress state forests in south-western NSW and make recommendations on their sustainable management.

The NSW Government will use this information to decide how the cypress state forests should be managed into the future to provide conservation outcomes and a sustainable future for the forests, the forestry industry and local communities. Government will implement its decision in a NSW forest agreement under the *Forestry and National Parks Estates Act 1998*.

The terms of reference for the assessment (see **Appendix 1**) require the NRC to assess the south-western cypress state forests for their:

1. environment and heritage values (including Indigenous heritage)
2. economic and social values
3. ecologically sustainable forest management
4. timber resources.

The 197 south-western cypress state forests covered by this forest assessment are listed in **Appendix 23**. A supporting map book also accompanies this assessment report, profiling each of the 197 south-western cypress state forests assessed.

The south-western cypress state forests are comprised of a range of vegetation types, and this diversity contributes to their ecological value. Within these forests, white cypress (*Callitris glaucophylla*) is the main species of commercial interest to Forests NSW.

For context, the NRC has described how white cypress forests and associated woodlands are valued, used and managed both in the south-western state forests and across the wider landscape of inland NSW.

The terms of reference also require the NRC to assess the river red gum and woodland forests in the Riverina bioregion. The river red gum assessment has been completed and was reported publicly in December 2009.

1.1 Key findings

Cypress (*Callitris spp.*) is a long-lived, coniferous tree species present in a diversity of Australian vegetation assemblages. Woodlands with significant cypress components cover some 2,704,000 hectares of the central and western divisions of NSW.

Most of the state forests included in this assessment are small and isolated, covering a total area of approximately 195,750 hectares. Approximately 134,750 hectares of these state forests are covered with white cypress forests (*C. glaucophylla*) and associated woodlands. The remaining areas of these state forests are other vegetation types, such as eucalypt-dominated woodlands, or some small areas which have not yet been adequately mapped. The extent of white cypress and associated woodlands within the south-western cypress state

forests represents less than 5 per cent of the total extent in the central and western divisions of the NSW.¹

The key findings from the NRC's assessment of the south-western cypress state forests are:

1. Cypress forests across all tenures should be actively managed to support many different community values

The south-western cypress state forests support a variety of environmental, social, cultural and economic values. It is practical to continue to manage the south-western cypress state forests for both timber and environmental values, as well as other social and cultural uses.

In the south-western cypress state forests, timber harvesting and biodiversity need not be competing values because the ecological values of the forests depend primarily on the protection of co-dominant eucalypts, understorey species, and native grasses and herbs. Cypress can generally be harvested without degrading the components of the forest and woodlands that are most important for biodiversity.

The NRC has developed management objectives and best-practice principles for management of white cypress forests and associated woodlands that should inform continual improvement of cypress forest management across all forest tenures.

2. Most of the cypress state forests should continue to be managed by Forests NSW but a small subset should be considered for conversion to other tenures

Based on available scientific information on the 197 cypress state forests, the NRC recommends that 168 cypress state forests that are valued particularly for their timber resources, environmental values and contribution to landscape function should remain as state forests and be specifically managed to maintain these suites of values.

The remaining 29 cypress state forests are valued more highly for environmental and other values than for their timber resources, and it will be more practical to manage these forests primarily for conservation. Alternative management and tenure arrangements are identified for these forests.

3. Some specific risks to ecological values require immediate management attention

In general, the risks associated with management of the south-western cypress state forests are relatively low. However, management regimes should be refined, especially in some cypress state forests which the NRC has identified as more vulnerable.

In 25 cypress state forests with high value for landscape function, the impacts of grazing on ecological values should be monitored closely and management regimes should be refined where required. In a further 11 cypress state forests that are small and isolated, timber harvesting should be carefully managed to ensure that spatial variability and habitat refuges are maintained.

¹ See **Chapter 2 (Section 2.3.1)** for a definition of the mapping categories used in this assessment.

4. Cypress forests on other tenures should be used to create habitat networks and to potentially expand the timber industry

Management of cypress forests on other land tenures, in combination with the management of the remaining state forests, will be important for biodiversity, helping species adapt to climate change and supporting a sustainable future for the forestry industry in the region.

Cypress forests on private, leasehold and other tenures such as travelling stock reserves should be managed to create ecological linkages and habitat networks across public and private land. In the longer term, there may also be scope to expand the cypress timber industry to private and leasehold land if policy settings can be refined to create appropriate incentives for landholders and managers to invest in agro – and farm-forestry.

5. Invest in information and adaptive management

Information about the condition and functions of the south-western cypress state forests is limited. It is essential that information about the cypress resource and its management is improved and made available to inform forest management planning and future wood supply agreements.

The NRC has drawn on the best available information to complete this forest assessment, including contributions from stakeholders. It is a benchmark report providing a platform for future research to better understand the function of these forests, both at individual forest and landscape scales. However, at the time of this assessment there were significant data gaps. For example, there was no high resolution vegetation mapping for the south-western cypress state forests, and there is uncertainty around the full impacts of grazing on cypress forests and the complete extent and timing of non-commercial thinning undertaken. Acknowledging these limitations, the NRC considers the information developed for this assessment provides a useful and practical basis for recommending management options and guiding future research.

1.2 Summary and recommendations

The following sections summarise the NRC's assessment and explain the NRC's recommendations.

1.2.1 Values supported by the cypress state forests

The extent of white cypress forest and associated woodland in the south-western cypress state forests is relatively small, compared to the extent of these vegetation types on private and other Crown land in the surrounding landscape (**Chapter 2**).

In pre-European forests and woodlands, cypress provided floristic and structural diversity in ecosystems that were generally dominated by eucalypts. Following European settlement and land-use practices, many of these systems have now transitioned into cypress-dominated vegetation communities. The current extent and condition of white cypress forests and associated woodlands across the landscape has been influenced by domestic and feral animal grazing, changed fire regimes, land clearing, and forest management.

Ninety per cent of the total area of cypress state forests assessed by the NRC are in the central division of NSW, where the forests are among the most significant native vegetation patches remaining within a largely cleared agricultural landscape.

In the western division, most of the cypress state forests are found within large, contiguous tracts of vegetation. Only eight of the south-western cypress state forests are found in the western division, accounting for around 10 per cent of the total area of the cypress state forests. In the landscape surrounding these forests, cypress can occur and be managed as invasive native scrub.

Under current management and tenure arrangements (**Chapters 2 and 6**), the south-western cypress state forests are contributing positively to resilient and functioning landscapes that support a range of environmental, cultural, social and economic values.

Environmental values

A range of flora and fauna, including threatened species and endangered ecological communities, are found within and around all south-western cypress state forests. Biodiversity values are greatest where there is obvious floristic and structural diversity. In the central division particularly, the cypress state forests are extremely important for flora and fauna.

Chapter 3 provides a summary of the threatened species and endangered ecological communities associated with white cypress forests and associated woodlands across NSW and also addresses the relevant matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)* (EPBC Act).

Appendix 16 presents the available survey information on the individual cypress state forests covered by this assessment, including lists of threatened species and relevant endangered ecological communities within each forest.

Cypress can establish large dense stands as it can recruit in large numbers, is highly tolerant of competition and lacks systems for rapid self-thinning. This behaviour is particularly evident in the western division. Extensive areas of dense, growth-locked cypress have more limited environmental values than structurally diverse stands and can significantly constrain agricultural production.

Catchment Management Authorities (CMAs) are working with landholders in the western division to manage the transition of dense cypress regrowth on private land into vegetation mosaics. This aims to maintain or improve environmental outcomes and also support agricultural production values. In the central division, CMAs are working with landholders and other agencies to improve landscape connectivity by managing cypress on other Crown lands, such as travelling stock reserves.

Cypress is expected to persist at all scales under predicted climate change scenarios because of its large geographical range, robust regeneration cycle and inherent hardiness; provided livestock grazing and other disturbances are appropriately managed.

Cultural values

Local Indigenous communities have connections with south-western cypress state forests and use the forests for cultural activities, such as education and the collection of bush medicines. Ongoing access to the forests is important to Indigenous communities. Many Indigenous organisations would like to see more surveying of cultural heritage in the state forests to ensure the protection of their significant sites.

There are also non-Indigenous heritage values associated with these forests and the cypress timber resource. Cypress state forests contain structures and relics that provide insight into past activities in and around the forests, including livestock grazing, sawmilling, surveying and mining (**Chapter 4**).

Social and economic values

The south-western cypress state forests support a number of commercial uses, the most significant of which is the cypress timber industry.

The cypress timber industry was consolidated and modernised following the NSW Government's 2005 Brigalow decision. On the strength of 20-year wood supply agreements, significant public and private investment was made in the remaining mills that harvest cypress sawlogs from the south-western cypress state forests. This investment in milling technologies and market development has been successful in creating a viable and forward-looking industry.

The industry supports local economies, particularly around the towns of Condobolin and Narrandera, and it can provide an economic buffer to these communities during periods of drought. The south-western mills directly employ 50 people, and also indirectly contribute to the employment of an estimated 19 additional people.

Wood from the south-western cypress state forests is also supplied to a mill at Baradine; however, this mill receives the bulk of its wood supply from cypress state forests in northern NSW (within the Brigalow Belt South and Nandewar bioregions). Under the current wood supply agreements, a further two mills located in northern NSW may also harvest timber from the south-western cypress state forests from time to time, as Forests NSW manages the south-western and northern cypress state forests as a single supply area.

From the available information and based on current sustainable yield estimates, it appears there is an adequate standing volume of cypress timber in the combined northern and south-western cypress state forests to meet the remainder of the current 20-year wood supply agreements.

Beyond the cypress timber industry, other commercial uses of the south-western cypress state forests include apiary, livestock grazing, gravel extraction, mineral exploration and broom bush harvesting. There appears to be little tourism associated with these forests; however, some cypress state forests have localised recreational value, for example through hunting or nature-based activities.

Managing forests for multiple values

The management of cypress state forests for timber harvesting generally has only temporary and localised impacts on ecological values, as long as structural variability and habitat diversity are maintained.

In the south-western cypress state forests, timber harvesting and biodiversity need not be competing values, if the forest is managed appropriately. This is because ecological values in white cypress forests and associated woodlands depend primarily on the protection of co-dominant eucalypts, understorey species and native grasses and herbs.

Cypress can generally be harvested without degrading the components of the forest and woodlands that are most important for biodiversity.

Chapters 2, 3 and 6 document the key structural role cypress has in diverse vegetation communities, and how cypress silviculture, including harvesting, can contribute to the structural diversity of cypress stands.

The cypress state forests have been actively managed for nearly a century to improve timber resource values. The current industry depends heavily on trees where the growth and commercial value of cypress stands have been improved as a result of past government investment in thinning programs.

1.2.2 Risks to the ecological and social systems of which the cypress state forests are a component

In general, the risks associated with management of the south-western cypress state forests are relatively low. However, management regimes should be refined, especially in some cypress state forests which the NRC has identified as more vulnerable.² Also, uncertainty over long-term sustainable yields present some risks to the social systems associated with the south-western cypress state forests. Forests NSW has in place the systems to periodically review and improve its forest management protocols. It is important that these systems and reviews are implemented in a timely and transparent fashion and are sufficiently resourced to enable meaningful stakeholder participation.

While many cypress forests can be managed for both timber production and ecological values, there are some risks that must be carefully managed. The main threats to the ecological values of the state forests are: lack of spatial variability in stand structures, especially in small isolated forests; and ecologically inappropriate grazing and fire regimes. Livestock grazing is also a potentially serious risk and requires careful management if it is not to pose a significant threat to ecological values by degrading important understorey species, native grasses and herbs (**Chapters 3 and 6**).

The NRC's assessment indicates that immediate management attention is needed for a small number of the south-western cypress state forests to ensure that specific threats are managed. One group of forests have been identified as having high value for landscape function but may be vulnerable to the impacts of livestock grazing. A further group of forests may be vulnerable to logging disturbance due to their small size and their isolation from similar habitat which might serve as wildlife refugia (refer to **Chapter 6**).

Forests NSW has identified the risk posed by livestock grazing and have developed a specific Grazing Management Plan (Forests NSW, 2006) for the western region to minimise threats to ecological values. However, limited monitoring of grazing impacts under this and previous grazing plans (Wilson et al., 1997) mean that the actual ecological impacts of grazing carried out under these plans are not adequately known. Forests NSW's plan recognises the need for monitoring. However, monitoring has not commenced yet, largely due to drought. Robust monitoring of grazing impacts on ecological values must be prioritised to ensure that grazing regimes can be adaptively managed and improved.

² Refer to **Chapter 6** for details of more vulnerable cypress state forests.

Risks to the social systems reliant on the cypress timber industry stem from uncertainties about long-term sustainable yields. Forests NSW's ongoing ability to sustain current annual timber supply volumes is less certain in the medium to long term, particularly after 2040. This stems from uncertainty about the current extent of growth locked cypress requiring thinning, and the adequacy of past non-commercial thinning of the 1950 and post-1950s cohorts (**Chapter 5**).

Forest NSW's implementation of remote sensing technology will help to fill these knowledge gaps. Transparent information must be available well prior to 2025 to inform new wood supply agreements and provide certainty for industry.

There is little scope to expand the industry based on current state forest timber resources. While there are significant areas of timber resource on private and leasehold land, Private Native Forestry Property Vegetation Plans (PVPs) do not offer sufficient incentive or long-term investment security to encourage investment in silviculture on private land. Similarly, the Invasive Native Scrub and Thinning PVPs that apply on both private and leasehold land (such as Western Lands Leases) do not promote the silvicultural practices needed to encourage management for commercial timber stands. As there are significant areas of white cypress forest and associated woodland on private and leasehold land, it is worth exploring mechanisms to create better incentives for landholders and managers to improve the quality of white cypress timber resources on privately managed land.

1.2.3 Recommendations

The NRC's conclusions on the requirements for ongoing management of the south-western cypress state forests as part of the broader landscape are described in the following 10 recommendations.

Actively and adaptively manage white cypress forests and associated woodlands

The NRC considers the south-western cypress state forests can be appropriately managed to maintain environmental, cultural, social and economic values, and mitigate threatening processes.

The NRC has reviewed current forestry practices and developed objectives and principles for management of white cypress forests and associated woodlands that should form a framework for ongoing improvements in forest management (**Chapter 6**). Forests NSW's existing management protocols should be refined to incorporate these objectives and principles and they should be applied to all of the south-western cypress state forests. The objectives and principles should also apply to other cypress forests on public land, including those in national parks and nature reserves. The extent to which various forms of active management are necessary in any individual forest will vary depending on the condition of the forest and the extent and nature of any process threatening its values.

These objectives and principles should be implemented as part of an Integrated Forestry Operations Approval (IFOA)³ covering the south-western cypress state forests that will preserve the ecological integrity of the forests, as well as the wood-

flow requirements. An IFOA describes the permitted forestry operations in the area covered and the conditions imposed.

The NRC notes that it has taken five years to negotiate an IFOA covering the cypress state forests in the Brigalow Belt South and Nandewar bioregions. An IFOA covering the south-western cypress state forests should be completed significantly more promptly. Based on the experience of the earliest NSW IFOAs, the NRC believes 6–12 months should be an appropriate timeframe in which to negotiate either a discrete IFOA for only the south-western cypress state forests, or expand the draft IFOA for the Brigalow Belt South and Nandewar bioregions to also cover the south-western cypress state forests. A timely IFOA is essential to provide certainty to industry and the broader community.

In addition, it is important that Forests NSW completes its next periodic reviews of the Western and Riverina Ecologically Sustainable Forest Management Plans (ESFM Plans) in tandem with the finalisation of the IFOA. This would require the ESFM Plan reviews to be brought forward from 2013 to 2011. The ESFM Plans should be updated with best available information and stakeholder input, including from the Department of Environment Climate Change and Water (DECCW), prior to finalisation of the IFOA. This would ensure the existing regulatory arrangements can deliver the desired ecological, timber and other values.

It will also be important to continue investment in silvicultural non-commercial thinning. The south-western cypress forests require active management to support a viable cypress timber industry beyond the current 20-year wood supply agreements.

Recommendation 1:

Actively and adaptively manage all cypress forests

White cypress forests and associated woodlands require active and adaptive management across all tenures. All cypress forest managers on public land, including those managing cypress forests as reserves, should implement the forest management objectives and principles outlined in **Chapter 6**. In particular, those principles cover the appropriate implementation of:

- silviculture
- livestock grazing
- ecological thinning
- fire management.

Implementing the objectives and principles outlined in **Chapter 6** will rely on effective adaptive management and reporting frameworks. These objectives and principles should be included and implemented within management plans and agreements, subject to ongoing monitoring, review and improvement.

³ An IFOA is made under the *Forestry and National Parks Estate Act 1998* (NSW) and may contain the terms of a licence under the *Protection of the Environment Operations Act 1997*, the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*. Enforcement of the licences rests with DECCW or Department of Industry and Investment (DII) – Fisheries. There are currently four IFOAs in NSW. The Upper North East, Lower North East, and Eden IFOAs commenced on 1 January 2000 and another for the Southern Region commenced on 13 May 2002. An IFOA for the Brigalow and Nandewar Community Conservation Area is currently being finalised.

Recommendation 2:

Implement an Integrated Forestry Operations Approval for south-western cypress state forests

The NSW Government should codify cypress forest management operations by developing an IFOA covering the south-western cypress state forests. The IFOA should apply the management objectives and principles outlined in **Chapter 6** to ensure these forests maintain their environmental and economic values. The IFOA should be negotiated in conjunction with the next periodic review of Forests NSW's Western and Riverina ESFM Plans, both of which should be concluded by the end of 2011.

Recommendation 3:

Review forest management zoning and operational management protocols

Forests NSW should expedite its planned reviews of the Western and Riverina ESFM Plans. The reviews should be completed by the end of 2011 and done in conjunction with the negotiation of the IFOA. The revised ESFM Plans should implement the forest management principles outlined in **Chapter 6**.

Forest management zones, harvesting plans and associated strategic and operational plans relevant to the south-western cypress state forests should all be reviewed to adopt the recommended principles and incorporate best available information. Forests NSW and DECCW need to collaborate to establish practical ways for pre-harvest assessments, forest management zones and associated operational plans to reflect the best available information on threatened species and endangered ecological communities, while ensuring continuity of wood supply values under the current wood supply agreements.

Forests NSW should give priority within their review to improving the forest management zoning and operational management protocols in place for the 11 state forests identified in **Chapter 6 (Table 6.10)** as potentially being vulnerable due to their small size and isolation (also refer to **Recommendation 6**).

Recommendation 4:

Invest in silvicultural thinning

Forests NSW should continue its program of active management and non-commercial thinning of south-western cypress state forests to ensure these forests continue to provide environmental, social and economic benefits. The NSW Government should ensure that an appropriate share of the costs of silviculture is recovered from the cypress timber industry through royalties. Government should determine the appropriate publicly funded share of active management costs based on a transparent method of estimating the ecological benefits of increased structural and floristic diversity, and the localised social and regional development benefits of continued operations of a cypress timber industry.

Review management and tenure to support values

The NRC has identified management approaches and associated possible tenure arrangements for the south-western cypress state forests that are most likely to continue to support multiple community values and promote resilient landscapes.

Recommendation 5:

Review management and tenure of state forests to maintain multiple values

On the basis of the available scientific information on the 197 south-western state forests, the NRC recommends that:

- **168 state forests**, covering 169,486 hectares, that are valued for their cypress timber resource, their environmental values and their contribution to maintaining landscape function, should remain as state forests and be specifically managed to maintain these suites of values (see **Chapter 6, Table 6.8** for a list of the forests). Forests NSW should modify and improve its forest management protocols to ensure they are consistent with the forest management principles developed in **Chapter 6**.
- **29 state forests**, covering 26,256 hectares, are significantly more valuable for their environmental and other values than for their timber resources (see **Chapter 6, Table 6.11** for a list of the forests). It would be more practical and efficient for these forests to be managed primarily for conservation, while still in accordance with the management objectives and principles outlined in **Chapter 6**. The specific environmental, cultural, social and economic values of these forests will determine the tenure arrangement that will best support their management:
 - a number could be added to the National Reserve System by establishing reserves under the *National Parks and Wildlife Act 1974*, subject to further consideration by DECCW
 - others might be considered for conversion to other land tenures which will best support long-term management for environmental and social values. For example, in some cases, it may be most practical for these lands to be sold or gifted to private landholders or conservation organisations, subject to in-perpetuity conservation covenants.

All of these forests should be subject to further consideration of local recreational or Indigenous cultural values or other economic uses (for example, apiary) that may be affected by any changes in tenure or conditions of access to the forests.

The NRC acknowledges some data limitations, particularly around the exact locations and extent of threatened species and endangered ecological communities. Until an IFOA is in place, Forests NSW should work closely with DECCW in conducting pre-harvest inspections and reviewing the ESFM Plans to gain their assistance in identifying and protecting ecological values.

⁴ As identified by Forests NSW.

Specific risks to ecological values should be addressed

The NRC has also identified a number of forests that available evidence suggests may have particularly high value for landscape function and/or are vulnerable to threatening processes (**Chapter 3** and **6**). The NRC believes they warrant immediate management attention.

Recommendation 6:

Manage specific threats to more vulnerable forests

Within the 168 state forests that should maintain their current tenure (see **Recommendation 5**):

- **25 state forests** (covering 61,457 hectares) have been identified as both particularly important for landscape function and as being subject to one or more grazing licences (see **Chapter 6, Table 6.9** for a list of the forests). The planned monitoring program as part of Forest NSW's Grazing Management Plan should be improved and prioritised to these 25 forests. This monitoring program must be robust and assess the actual impacts of grazing on fine fuel levels and ecological values, so that the effects of livestock grazing can be better understood and management regimes can be refined over time where required.
- **11 state forests** (covering 1,717 hectares) are small and isolated, and any harvesting that reduces structural variability and faunal dispersal would have adverse impacts on biodiversity (see **Chapter 6, Table 6.10** for a list of the forests). Timber harvesting should not commence in these forests until the reviews of the Western and Riverina ESFM Plans and subsidiary operational plans are completed to ensure that any harvesting and silvicultural activities follow the principles outlined in **Chapter 6** and do not reduce spatial variability below acceptable thresholds.

Manage the whole landscape for greater resilience

Most of the south-western cypress state forests exist in a fragmented landscape. Therefore, management of cypress forests on private and leasehold lands, in combination with the management of the remaining state forests, will likely be very important for biodiversity, helping species adapt to climate change and to support a sustainable future for the forestry industry in the region.

In the central division, cypress within the wider landscape should be managed to create or maintain ecological linkages and networks of habitat across public and private land, with the cypress state forests, and other public lands such as travelling stock reserves, acting as connective nodes within these habitat networks. In the western division, the focus should be improving the structural diversity of existing areas of vegetation surrounding the cypress state forests. These management principles will lead to greater landscape resilience, especially under the impacts of climate change.

In the longer term, there may also be scope to expand the cypress timber industry to private and leasehold land. Policy settings could be refined to encourage more active management of cypress forests and woodlands on private and leasehold land, including investment in agro- and farm-forestry. This is a long-term proposition, given there has been

little history of active silviculture and forest management in these privately managed forests and woodlands, and current policy and legislation do not provide long-term incentives to undertake the silvicultural activities required to develop commercially viable timber stands or to enhance ecological values. It will require collaboration between government agencies, industry, catchment management authorities and landholders to improve both the ecological and commercial value of cypress forests and woodlands in privately managed forests.

Recommendation 7:

Improve ecological connectivity

To improve ecological connectivity across the historically heavily cleared landscapes of the central division of NSW, the NSW Government should encourage the creation of corridors and linkages between the cypress state forests and across adjacent public and private land. To achieve this, the NSW Government should:

- request that the Central West, Lachlan, Murrumbidgee and Murray CMAs ensure their regional Catchment Action Plans appropriately reflect the values supported by the south-western cypress state forests, and that these CMAs collaborate in identifying opportunities for creating and maintaining landscape corridors and ecological connectivity. The significance of travelling stock reserves should be carefully considered in this process.
- request that DECCW ensures the *NSW Biodiversity Strategy* and *National Parks Establishment Plan* appropriately identify priorities for future reservation or conservation management of other public and private land to improve connectivity
- work with the Australian Government to implement the *National Reserve System Strategy* and give effect to enhanced ecological connectivity as proposed in the Australian Government's *Australia's Biodiversity Conservation Strategy 2010–2020 Consultation Draft*.

Recommendation 8:

Refine policy settings to enhance management of cypress forests on private and leasehold tenures

Policy settings should be refined to create longer-term and stronger incentives for private landholders and managers to invest in agro- and farm-forestry. CMAs, landholders, industry, DECCW, Forests NSW and non-government organisations should collaborate to encourage active management of cypress forests on private and leasehold land for productive timber values and landscape function.

To achieve this, the NSW Government should review policy arrangements with a view to:

- creating economic incentives that will encourage long-term investment in silviculture on private and other Crown timber land
- delivering benefits to landholders or lessees comparable to those from similar investments in state forests



Yarranjerry State Forest

- providing the landholder or land manager with long-term security to ensure that returns on investments in silviculture can be realised.

This should be implemented in a way that supports ecological values, such as improved ecological connectivity, as well as providing economic benefits for landholders, land managers and the cypress timber industry.

Improve information and knowledge to support adaptive management and decision making

The NRC has based its assessment on best available information, but this information is limited. It is essential that information about the cypress resource and its management is improved and made available to inform forest management planning and future wood supply agreements.

In particular, some of the mapping of threatened species and endangered ecological communities is highly uncertain. It is important that Forests NSW involves DECCW in pre-harvest inspections and ESFM Plan reviews (see **Recommendation 5**) to rapidly improve the information base and mapping so that there can be confidence that the forest management zones accurately reflect the ecological values of the cypress state forests.

As more information is gathered, it should be made transparently available, as should the operation of the FRAMES modelling. Therefore, it is important that Forests NSW continues to implement its planned improvements in forest inventory sampling using remote sensing technology. This information is fundamental to improving the accuracy and utility of cypress resource estimates and thinning regimes, by providing Forests NSW with detailed information about the standing cypress volume across the state forest estate.

Before the next wood supply agreements are negotiated government will also need a better understanding of how much timber may be able to be sourced from private land.

Within Forests NSW's current business model, there are uncertainties about the costs, efficacy and return on investment for active management and silviculture. Management costs for the cypress state forests must be better documented to inform future decision making.

Recommendation 9:

Conduct research to support ecologically sustainable forest management

Forests NSW and, where appropriate DECCW, should conduct and publish the results of research on management regimes and options for cypress forests, including research on the impacts of silvicultural thinning, livestock grazing and fire regimes. This research should inform ecologically sustainable forest management, supporting environmental, social, cultural and economic values within the south-western cypress state forests. The research should be based on spatially explicit and temporally accurate information (see **Chapter 6, Section 6.7.1** for some priority information gaps to be addressed).

There are opportunities for collaboration in this research with relevant national and state agencies (particularly in Queensland), with universities, and with relevant non-government organisations.

Recommendation 10:

Improve information about the cypress resource

Forests NSW should invest significantly to continue its initiatives to improve knowledge about the extent and quality of the available cypress resource, and the extent and effectiveness of silvicultural thinning undertaken to date. This information should be used to inform any future wood supply agreements. Specifically, Forests NSW should:

- assemble and analyse a complete set of remote sensing data for the cypress state forests, to improve information about the cypress resource and improve resource planning
- incorporate this information into Forests NSW's modelling methods to update sustainable yield estimates as new information becomes available
- implement transparent reporting to help the cypress timber industry and the wider community understand the extent and quality of the cypress resource base, the extent and effectiveness of silvicultural thinning undertaken, the implications for future wood flows, and plans for future harvesting and thinning.

1.3 How the NRC determined its findings

In conducting a forest assessment, the NRC is required to assess particular aspects of the forests' values, timber resources and sustainable management. This information is required before the NSW Government negotiates a NSW Forest Agreement and codifies regulatory arrangements for the forests.

The terms of reference indicate that the NRC should also recommend how the information within this forest assessment should underpin the future management of the cypress state forests. Future management initiatives could then be implemented through NSW Forest Agreements and other regulatory instruments.

1.3.1 Why conduct a forest assessment?

NSW Ministers may only negotiate a NSW Forest Agreement following a forest assessment by the NRC.

NSW Forest Agreements are formal agreements between the NSW Ministers for Environment and for Mineral and Forest Resources. NSW forest agreements set out how forests in particular regions will be managed by Forests NSW as state forests, or by DECCW as part of the NSW reserve system. They must contain certain minimum provisions, and can be used to frame an IFOA under which Forests NSW carries out its harvesting operations. NSW Forest Agreements must also meet the requirements of the Commonwealth EPBC Act.

As outlined in the terms of reference (**Appendix 1**), an NRC forest assessment should assess the environmental, heritage, social and economic values of the forests, as well as assessing their timber resources and principles for ecologically sustainable forest management. The NRC's forest assessments also give consideration to the requirements of the Commonwealth EPBC Act.

1.3.2 Analytical framework for the assessment

The NRC has developed an analytical framework to guide its assessment of the south-western cypress state forests. The analytical framework has five steps, as shown in **Figure 1.1**.

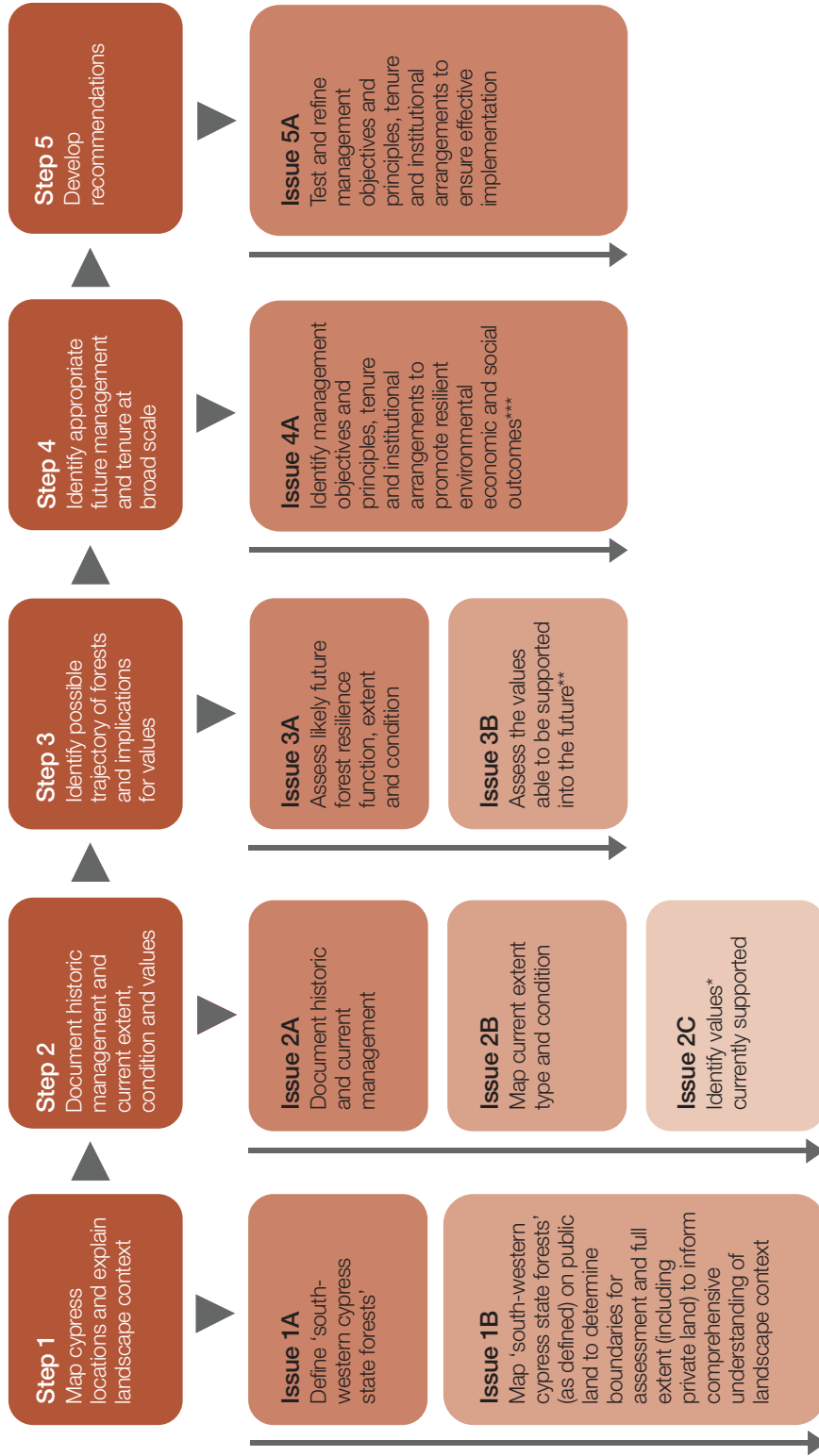
A central task of the NRC's forest assessment is to identify and recommend land tenure and management arrangements to promote an appropriate balance between the environmental, cultural, social and economic values that these cypress state forests can provide. The NRC has:

- characterised the landscape context, historic management (including silviculture) and current extent and condition of the south-western cypress state forests and their surrounding landscapes, and described the values they currently support
- identified how the cypress state forests, surrounding landscapes and values may change in the future, including under the projected impacts of climate change (to the extent possible), and described those values that are likely to be supported into the future
- in the light of these values, recommended how the cypress state forests and surrounding landscapes should be managed (and hence what land tenure and institutional arrangements should be in place) to best promote the government's stated objective of a NSW Forest Agreement delivering "conservation outcomes and a sustainable future for the forests, the forestry industry and local communities".

In completing Steps 1–4 of the analytical framework the NRC has drawn together the best available science and knowledge on the current health, uses and values of the cypress state forests, and the possible trajectories of change in these forests. This includes, to the extent possible, consideration of predicted climate change impacts in NSW and their implications for the cypress state forests.



Forest inspection



* Environmental, heritage (including Indigenous heritage), economic and social values will be considered and matters of regional, state and National Environmental Significance.

** Regard will be given to nationally agreed criteria for a comprehensive, adequate and representative reserve system and to other complementary methodologies for protecting conservation values.

*** Regard will be given to appropriate forest management practices to promote longterm productivity and health and to international or governmental obligations, agreements or arrangements.

Figure 1.1: Analytical framework for making recommendations to NSW Government for south-western cypress state forests of NSW

1.4 Consultation and submissions

The NRC undertook consultations with a diverse range of groups and individuals who have interests in the south-western cypress state forests in NSW. The NRC's communication and consultation on the south-western cypress forest assessment included meetings, inviting written and verbal submissions, tours of state forests and other consultations with stakeholders. The NRC communicated and consulted on the process for assessment as widely as possible, given the timeframe of the assessment.

1.4.1 Consultation process

On receipt of the terms of reference, the NRC circulated a 'Notice of Assessment' to forestry industry representatives, relevant government agencies and their Ministers, and posted it on the NRC's website. The notice outlined the timeline, terms of reference and process for the assessment, and invited people to register their interest.

A 'Summary of available information and call for submissions' was circulated at the end of February 2010. This document sought submissions from stakeholders on any further information and insights that could contribute to the assessment. It was sent directly to 98 stakeholders and was also posted on the NRC's website.

The NRC also invited public submissions through our website. Individuals, interest groups and organisations representing a broad cross-section of the community made submissions, which the NRC reviewed and considered as part of the assessment. An overview of the submissions received is provided in **Section 1.4.4**. **Table 1.1** shows the timeline for consultation and communication.

1.4.2 Organisations consulted

Under the terms of reference, the NRC was required to consult with relevant state and Commonwealth agencies, local Indigenous communities, forest industries, local government and other community representatives.

The NRC contacted a range of organisations and community stakeholders regarding our assessment. Consultation with these stakeholders occurred through telephone calls, face-to-face meetings and via email. Additionally, a number of stakeholders made contact with the NRC following the release of the 'Summary of available information and call for submissions'.

The people we consulted gave generously of their time and expertise to help the NRC understand the issues concerning the south-western cypress state forests. **Table 1.2** lists organisations consulted.

1.4.3 Consultation visits and forest tours

To better understand the issues facing the south-western cypress state forests, and the communities which rely on them, the NRC made several consultation visits between February and May 2010. These visits included tours of a number of the cypress state forests, travelling stock reserves and private properties. **Table 1.3** shows the sites visited by the NRC.

1.4.4 Overview of submissions

Consultation helped the NRC understand the cypress state forests from a diversity of perspectives and values, develop an appreciation of the specific issues of communities and industries, and better understand the local and regional context of the assessment.

The NRC received 75 unique submissions following the release of the 'Summary of available information and call for submissions'. These submissions addressed a range of social, economic and environmental issues. **Appendix 6** contains a list of the 55 organisations that provided submissions, with the remaining 20 being from individuals.

A total of 36 submissions were from groups and individuals closely associated with the cypress timber industry, such as:

- sawmilling companies and their employees
- peak industry representative bodies
- haulage and service providers
- customers within the construction, landscaping and hardware sectors.

A further 26 submissions were received from representatives of the wider community including local businesses, Indigenous Elders, shire councils and sporting organisations.

Six submissions were from stakeholders taking a predominantly environmental perspective, ranging from national and state level environmental groups to members of the local community with a strong interest in the environment.

Table 1.1: Timeline for consultation and communication

Date	Activity
12 August 2009	Government provided terms of reference
14 August 2009	NRC issues Notice of Assessment
29 January 2010	Public submissions close on terms of reference
February – May 2010	Consultation and forest tours
28 February 2010	Release of 'Summary of available information and call for submissions'
26 March 2010	Public submissions close on summary of available information on the forests
30 May 2010	Release of final assessment and recommendations report to government

Table 1.2: Organisations consulted

Organisations consulted / contacted	
Government agencies	
Australian Government Department of Environment, Water, Heritage and the Arts	Department of Industry and Investment
Australian Government Department of Agriculture, Fisheries and Forestry	Forests NSW
Department of Environment, Climate Change and Water	Department of Premier and Cabinet
Land and Property Management Authority	Treasury
Catchment Management Authorities	
Central West Catchment Management Authority	Murrumbidgee Catchment Management Authority
Lachlan Catchment Management Authority	Western Catchment Management Authority
Murray Catchment Management Authority	
Local Indigenous representatives	
Cobar Local Aboriginal Land Council	Mudgee Local Aboriginal Land Council
Condobolin Local Aboriginal Land Council	Murrin Bridge Local Aboriginal Land Council
Coonamble Local Aboriginal Land Council	Trangie Local Aboriginal Land Council
Dubbo Local Aboriginal Land Council	Wagga Wagga Local Aboriginal Land Council
Lachlan Aboriginal Natural Resource Management Group	West Wyalong Local Aboriginal Land Council
Forest industry representatives	
NSW Forest Products Association	Millabill Timbers
Grants Holdings Co Pty Ltd	R Austin Pty Ltd
Baradine Sawmilling Company	RJ & JR Stephenson
Hay's Wholesale Timber Supplies	
Local government	
Griffith City Council	Narrandera Shire Council
Lachlan Shire Council	Wagga Wagga Shire Council
Lockhart Shire Council	
Other	
NSW National Parks Association	Australian Honeybee Industry Council
Lachlan Valley National Parks Association	NSW Apiarists Association Western Plains
Dubbo Field Naturalist and Conservation Society	Monsons Honey and Apiary Products
Orange Field Naturalist and Conservation Society	Greg Roberts – Apiarist, Goulburn
Condobolin Visitor Information Centre	Parkes Visitor Information Centre
Griffith Visitor Information Centre	Condobolin Rifle Club

The submissions received reinforced the strong local values associated with the cypress state forests. Most submissions focused on the socio-economic importance of the cypress timber industry to local communities. However, a number of submissions described other significant commercial, recreational and ecological values supported by the cypress state forests.

Industry and local community views

The central theme of submissions from industry and local community representatives was the social and economic value of the cypress timber industry to local and regional communities,

particularly Narrandera and Condobolin. Submissions focused on the contribution of forestry and related service industries to the viability of local towns. The cypress timber industry is seen to be particularly important during periods when other agricultural industries are adversely affected by drought. Local business owners and community groups pointed out that the timber industry invests heavily in the local community, particularly through sponsorship of local sporting clubs and events. They raised concerns about the viability of community services such as clubs, schools and health services should the timber industry decline.

Table 1.3: Consultation visits and forest tours

Date	Event and groups consulted	Forests and other locations visited
10–11 February 2010	Tour of forests with representatives of: <ul style="list-style-type: none"> • Forests NSW • Grants Holdings Co Pty Ltd • NSW Forest Products Association 	<ul style="list-style-type: none"> • Buckingbong State Forest • Matong State Forest • Tabratong State Forest • Yarranjerry State Forest • Condobolin sawmilling operation • Narrandera sawmilling operation
2 March 2010	Discussion and forest visit with representatives of: <ul style="list-style-type: none"> • Lachlan Aboriginal Natural Resource Management Group 	<ul style="list-style-type: none"> • Back Yamma State Forest • Lachlan CMA office in Forbes
10–11 March 2010	Tour of forests with representatives of: <ul style="list-style-type: none"> • Department of Environment, Climate Change and Water (including NSW National Parks and Wildlife Service) • Forests NSW 	<ul style="list-style-type: none"> • Back Creek State Forest • Binya State Forest • Bland Creek • Blue Mallee State Forest • Bretts State Forest • Cocoparra Nature Reserve • Conapaira South State Forest • Coradgery State Forest • Gunning Gap State Forest • Ugobit State Forest
16–17 March 2010	Tour of forests with representatives of: <ul style="list-style-type: none"> • Central West Catchment Management Authority • Lachlan Catchment Management Authority 	Areas with Invasive Native Species Property Vegetation Plans, including: <ul style="list-style-type: none"> • Four private properties • Two travelling stock reserves • Barrow State Forest
6–7 May 2010	Tour of forests to gather additional information	<ul style="list-style-type: none"> • Beckom State Forest • Buckingbong State Forest • Coreen State Forest • Cullivel Creek State Forest • Gillenbah State Forest • Jerilderie State Forest • Kentucky State Forest • Lonesome Pine State Forest • Matong State Forest • Moombooldool State Forest • Ringwood Tank State Forest • Widgiewa State Forest

Most industry and community submissions emphasised the importance of the cypress timber industry in providing permanent employment and training opportunities. These submissions argued that maintaining the existing level of employment within the timber industry and associated businesses should be a priority. As context, some submissions indicated that employment opportunities have been declining within the region, due to the extended drought period and relocation of a number of major employers. This has impacted on the viability of communities and on community demographics, with a significant number of young people leaving the region in search of employment.

In addition to direct job losses in the industry, there is concern that any reduction in access to cypress timber resources would have flow-on effects on employment within other service providers in the community. Some proponents also noted that, owing to the specific skills base within the cypress timber industry, it may be difficult for timber employees to find alternative employment without investment in retraining or relocation.

The cypress timber industry is cited as providing important current and future employment opportunities for members of local Indigenous communities. Indigenous employment in the cypress timber industry allows members of the Indigenous community to contribute to the management of, and maintain cultural connections to, the land and its natural resources.

In addition to these economic and employment benefits, submissions from local community representatives state that Forests NSW's management of the cypress state forests support sustainable ecological and recreational values. As a result, there is widespread support within these submissions for current tenure and multiple-use management arrangements to continue. Many proponents argued that current productive forestry practices are ecologically sound, and that the present condition of the cypress state forests is evidence of sustainable management. Thinning operations to sustain tree regeneration and improve growth rates for timber production are seen as beneficial to the overall health and structural diversity of these forests, thus supporting environmental and social values.

Further, a number of submissions state that Forests NSW are maintaining the south-western cypress state forests by controlling feral animals, minimising the spread of weeds and actively managing fire risk. As such, there is concern that a change in management or tenure may lead to less forest maintenance and increased pest, weed and fire risks.

Table 1.3: Consultation visits and forest tours continued

Date	Event and groups consulted	Forests and other locations visited
10–13 May 2010	Tour of forests to gather additional information	<ul style="list-style-type: none"> • Bimbi State Forest • Buggajool State Forest • Calleen State Forest • Combaning State Forest • Cookamidgera State Forest • East Cookeys Plains State Forest • Euglo South State Forest • Hiawatha State Forest • Limestone State Forest • Little Blow Clear State Forest • Manna State Forest • Narraburra State Forest • Reefon State Forest • Weddin State Forest • Weelah State Forest
11–12 May 2010	Tour of forests to gather additional information	<ul style="list-style-type: none"> • Balowar State Forest • Banandra State Forest • Bedooba State Forest • Bourbah State Forest • Carrabera State Forest • Grahway State Forest • Merri Merri State Forest • Nangerybone State Forest • Narraway State Forest • Sandgate State Forest • Tallegar State Forest

Environmental views

Submissions from environmental stakeholders emphasised the importance of the south-western cypress state forests in maintaining ecological values across the wider landscape. They discuss the role of the cypress state forests as central islands of vegetation, contributing to the ecological resilience of the landscape by providing refuge areas for wildlife and supporting habitat connectivity networks. The proponents identify a wide range of threatened species, particularly threatened birds and flora, which have been found within the cypress state forests in this assessment. These submissions argued that current wood supply arrangements should not compromise the application of JANIS reserve principles, and that these reserve principles become more important in the context of climate change impacts.

Some of these submissions recognise that cypress state forests' ecological values are maximised by structural and floristic diversity. For this reason, some proponents have voiced support for ecologically sound active management within white cypress forests and associated woodland on both public and private land. However, other proponents have strong concerns about the impact of harvesting practices on ecological values, particularly impacts on threatened bird species.

These submissions argue that even under DECCW Threatened Species Permits, current harvesting activities are having an impact on protected plants and birds. Some submissions call for a review of silvicultural practices and reduction of harvest intensity to ensure that cypress harvesting does not compromise ecological function of remnant forests. For example, one submission argued that while larger forests can be harvested in sections to allow birds and other fauna to relocate within the forests, the disturbance from harvesting activities in small forests forces fauna to attempt high-risk migrations to other scattered forest remnants. Proponents for change also call for improved review and management responses in instances where forests may have been improperly or too severely harvested.

There are concerns expressed within these submissions about the impact of grazing on the state forests, particularly problems with erosion and weeds due to domestic and feral goat grazing. The proponents argue that management of stock agistment and grazing within state forests needs improvement to prevent environmental damage.

Further, some submissions have proposed that ecological outcomes could be enhanced by assessing, and potentially expanding, the cypress resource base across the landscape, including forests on private land. Proponents argue that developing a wider resource base could reduce threatening processes like land clearing and encourage better management of white cypress forests and associated woodlands to support both economic and environmental values.

Other commercial interests

A number of submissions provided information about other commercial uses of the forests, including apiary, broom bush harvesting and livestock grazing. All submissions relating to these commercial uses of the forest request that current access arrangements are at least maintained.

Submissions from apiarists indicate that use of cypress forests, while periodic, is highly valued by the industry. Submissions describe how apiarists use the south-western cypress state forests to give their bees a place to shelter over winter or rest

after pollination. They also access stands of eucalypts and wattle understoreys that may be flowering in the cypress state forests. A modest industry based on broom bush harvesting was also identified as relying on access to the south-western cypress state forests.

Submissions were received from several occupation permit (OP) holders for grazing. These submissions indicate that the OP holders generally own and manage the pastoral lands surrounding the state forests for which they hold OPs. The OP holders have stated that they contribute to forest maintenance by maintaining (and in some cases providing) fences and stock watering points and by controlling pests, weeds and fire risks.

1.5 Structure of this report

The remainder of this report outlines the NRC's process for determining its recommendations to the NSW Government in more detail. The structure of the report is as follows:

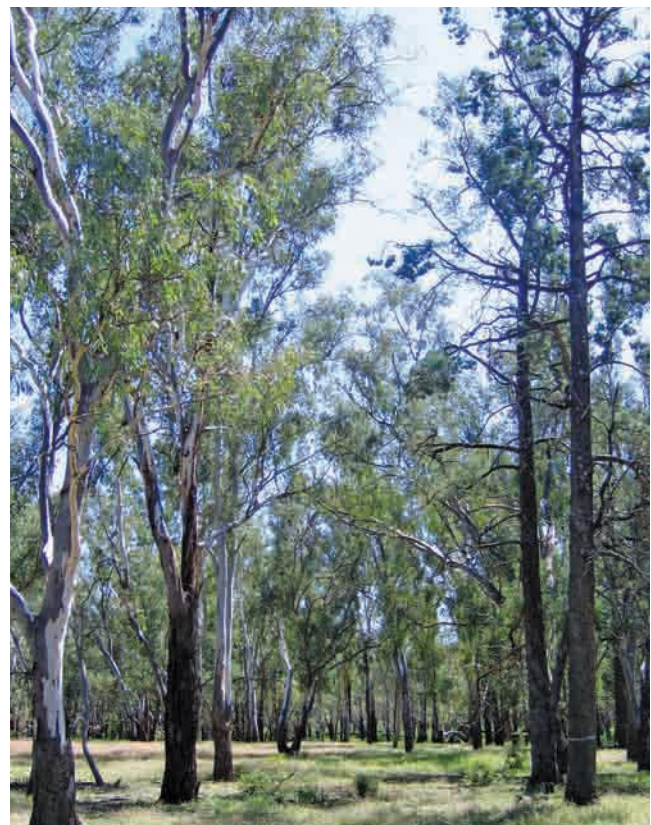
Chapter 2 – provides the landscape, historical and institutional context for the assessment.

Chapter 3 – outlines the environmental values supported by the forests.

Chapter 4 – outlines the cultural, social and economic values supported by the forests.

Chapter 5 – describes the cypress timber resource on public and private land, and the characteristics of the cypress timber industry.

Chapter 6 – outlines current management arrangements and proposes ways to improve how cypress is managed across different landscapes.



Gunning Gap State Forest

Chapter 2

Context for this assessment

2.1	Overview	22
2.2	Scope of this assessment	22
2.3	Cypress forests in the landscape	25
2.4	Institutional context	27
2.5	Historical context	28
2.6	The Brigalow decision	32
2.7	Landscape change	35



2.1 Overview

The NRC has assessed the south-western cypress state forests within their broader landscape, institutional and historical context so as to explain how they function, how they are managed, how they support community values and how resilient they are.

Indigenous management and European settlement have shaped the forest landscapes of today. The landscapes that the cypress state forests and their associated communities are found in have been subject to stress from prolonged drought, water scarcity and institutional reform. However, the south-western cypress state forests and the industries they support appear to be quite resilient, recovering from these disturbances and functioning effectively at local scales.

This chapter describes the scope of the assessment and supports **Steps 1, 2 and 3** of the analytical framework by:

- defining and mapping the south-western cypress state forests and their surrounding landscapes
- outlining the institutional arrangements that govern both the state forests and other land tenures where cypress is found
- describing historical land use and its impacts on the state forests and surrounding landscapes
- detailing the specific changes in the cypress timber industry as a result of the 2005 Brigalow decision
- describing the historical and possible future changes in the socio-economic and ecological systems of which the south-western cypress state forests are a part.

The key findings of this chapter are:

- The NRC is assessing 197 cypress state forests, most of which are smaller than 1,000 hectares and are scattered across south-western NSW.
- These cypress state forests contain a relatively small extent of white cypress forest and associated woodland compared to that which occurs on other Crown and private land in the surrounding landscape. For example:
 - around 134,750 hectares of white cypress forest and associated woodland are found in the south-western cypress state forests
 - this compares with over 1,500,000 hectares on other Crown leasehold land, 794,000 hectares on private land and 230,000 hectares in the reserve system.
- The majority of the south-western cypress state forests are found in the central division where most of the white cypress forest and associated woodland is fragmented in a cleared agricultural landscape.

- Eight of the south-western cypress state forests are found in the western division. In the western division much of the white cypress forest and associated woodland forms large, contiguous tracts of vegetation.
- There is already a diversity of institutional arrangements in place to manage white cypress forests and associated woodlands across both public and private land. These arrangements, as well as the reorganisation of the forestry industry following the Brigalow decision, are promoting more resilient and better functioning landscapes.

2.2 Scope of this assessment

2.2.1 The cypress state forests under assessment

This assessment covers 197 cypress state forests in the south-west of NSW, as shown in **Figure 2.1** (and listed in **Appendix 23**). These are state forests that are not currently covered by a NSW Forest Agreement or IFOA.

Individually, most of the cypress state forests are smaller than 1,000 hectares; however, in total the cypress state forests cover an area of approximately 195,750 hectares. Of this total area, an estimated 134,750 hectares are white cypress and associated woodlands. The remainder is other vegetation or incompletely mapped vegetation.¹



Buckingbong State Forest inspection

¹ See **Section 2.3.1** for a definition of these vegetation categories.



1890 cohort trees and cypress regeneration

The NRC originally identified 202 state forests for this assessment. This group included seven state forests that had been included in the NRC's recommendations on the river red gum and woodland forests of the Riverina Bioregion (NRC, 2009).² Since then, the NSW Government changed the tenure of five of these state forests³ and deferred two state forests⁴ for consideration in this assessment.

2.2.2 Assessing the cypress state forests within a wider landscape context

The 197 south-western cypress state forests are scattered across south-western NSW. The NRC considers that it is important to view these cypress state forests as components in a wider, integrated socio-ecological system (or 'landscape'), rather than in isolation. Therefore, the cypress state forests have been assessed within a landscape context and this assessment provides some comment on other land tenures where cypress is found, and their associated management arrangements.

2.2.3 The assessment area

The NRC has not specified a definitive spatial boundary for this assessment. Instead, we have identified and applied a number

of different assessment scales, depending on which is most appropriate for each of the various values and management issues discussed in this assessment.

For example, this assessment discusses ecological and management aspects of cypress state forests across the central and western land divisions, as there are different land uses and management practices in these divisions (refer to **Section 2.3.2**). In contrast, when discussing the cypress timber industry and sustainable yields, the south-western cypress state forests are assessed as part of a single wood supply area, integrated with the other cypress state forests in NSW (see **Chapter 5**).

Many previous forest assessments in NSW have used bioregions defined under the Interim Biogeographic Regionalisation of Australia (IBRA) as their study boundary area. However, the NRC's terms of reference require an assessment of the south-western cypress state forests only, rather than the entire seven bioregions in which they are found.⁵ This is sensible because the resultant scale of assessment would have been too coarse. The use of bioregion boundaries would overstate the size of the assessment area, as the total area of state forests under consideration makes up less than 0.5 per cent of the seven relevant bioregions.

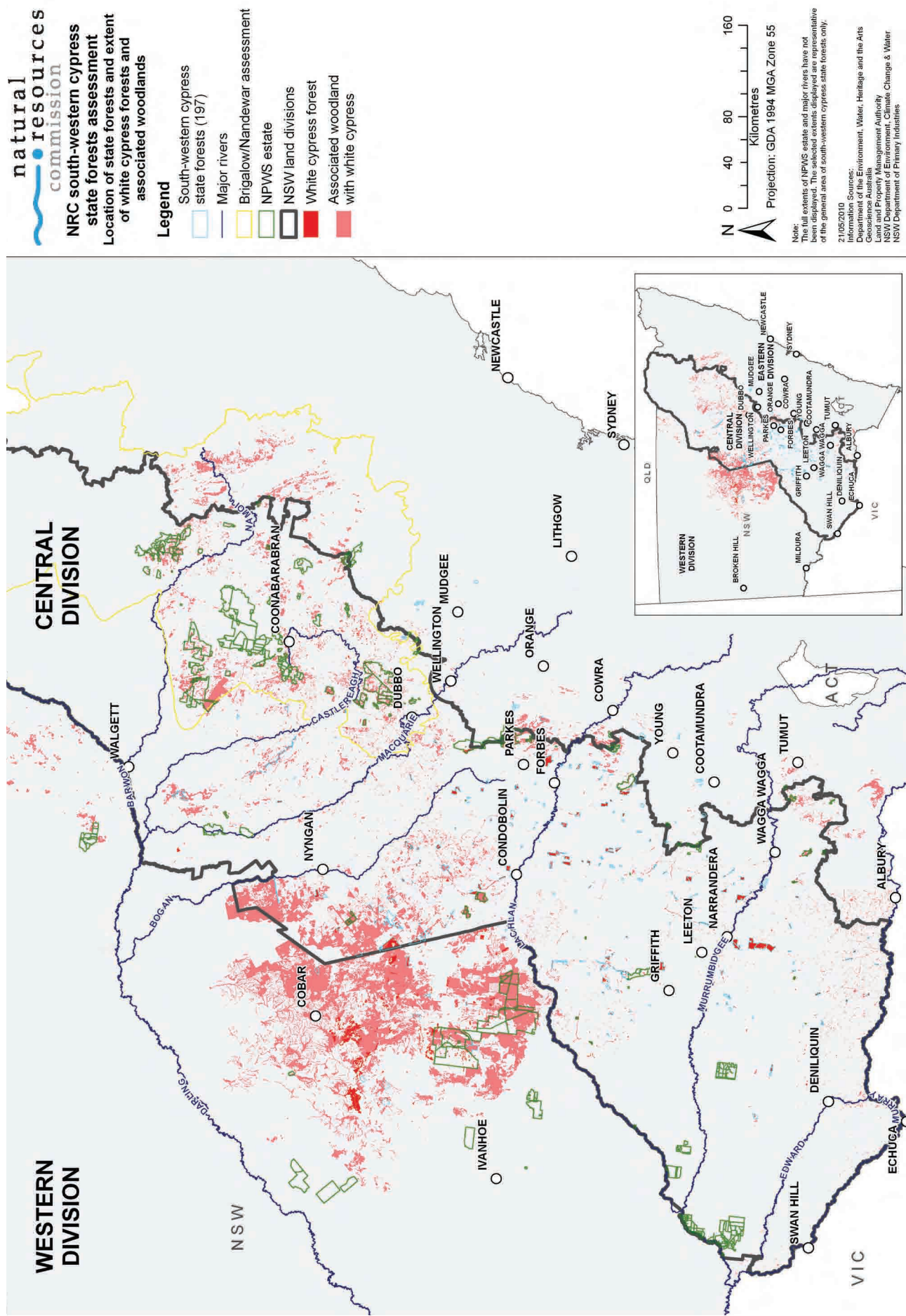
² At the initial request of Forests NSW.

³ Booligal, Billenbah, Hilston, Narrandera and Tholobin State Forests.

⁴ Banandra and Puckawidgee State Forests.

⁵ Brigalow Belt South, Cobar Peneplain, Darling Riverine Plains, Murray Darling Depression, NSW South-western Slopes, Riverina and Sydney Basin bioregions.

Figure 2.1: Location of south-western cypress state forest and extent of white cypress forest and associated woodland



2.3 Cypress forests in the landscape

2.3.1 What is a cypress forest?

There are 16 species of cypress (*Callitris*) found in Australia. They occur in a wide variety of vegetation types, commonly found with *Eucalyptus*, *Casuarina* or *Acacia* species. Pure stands of cypress are rare.

While different species of cypress can be harvested for timber, the NRC has focused on white cypress (*Callitris glaucophylla*)⁶, as it is the only cypress species of commercial interest to Forests NSW. In this report, all references to cypress refer to white cypress, unless noted otherwise.

For the purpose of this assessment, the NRC has classified and mapped the south-western cypress state forests, and other forests in the surrounding landscape, into four broad categories:

1. **White cypress forest**, which means white cypress dominates the forest.
2. **Associated woodland**, which means that white cypress is found in association with other species (mainly with *Eucalyptus* species).
3. **Other vegetation**, which means other vegetation that is not considered to represent white cypress-dominant or associated woodland.⁷ This includes all non-cypress types mapped in state forests (see **Appendix 16**). White cypress may be scattered through these types, but is not considered to be a common associate. This category also captures areas of cleared or semi-cleared derived native grassland or low shrubland.
4. **Incompletely mapped vegetation**, which means all areas where mapped vegetation data are not available, or not covered by the composite vegetation mapping.

Appendix 11 explains the datasets and decision rules used to classify and map these categories.

2.3.2 Location of white cypress forests and associated woodlands in the landscape

White cypress forest and associated woodlands extend from central Queensland to Victoria, with extensive stands in most parts of central Queensland and NSW.

In NSW, white cypress forest and associated woodlands occur mainly west of the Great Dividing Range and are broadly associated with two major land divisions and their associated land-use activities:

- the **central division**, characterised by predominantly freehold title with cropping and sheep meat and wool production
- the **western division**, characterised by predominantly perpetual leasehold title and livestock grazing in semi-arid rangelands.

For this assessment, the NRC has identified the central and western divisions as important landscape units in which to examine the function of white cypress and associated woodland communities in the landscape.

The characteristics of these landscape units reflect the fact that different land-use and management practices in these divisions have had different impacts on white cypress and associated woodlands. Consequently, white cypress forests and associated woodlands in the two divisions support different social, economic and ecological values.

In the central division, most white cypress forests and associated woodlands are fragmented in a cleared agricultural landscape (**Figure 2.2**). In the western division (and the western areas of the central division), much of the white cypress forest and associated woodland forms large, contiguous tracts of vegetation.

Figure 2.1 illustrates the current extent and distribution of white cypress forest and associated woodland and the relationship between these two divisions.

2.3.3 Extent of white cypress forests and associated woodlands in the landscape

The NRC estimates the total area of white cypress forest and associated woodland across all land tenures in the central and western divisions is 2,704,260 hectares,⁸ with an almost even extent in each division. **Table 2.1** shows the extent of white cypress and associated woodlands across all tenures.

The combined area of the south-western cypress state forests is approximately 195,750 hectares. Nearly 90 per cent of the total area of the cypress state forests assessed by the NRC is in the central division (see **Figure 2.1**).

Within the south-western cypress state forests, there are:

- 80,970 hectares (41 per cent) of white cypress woodlands
- 53,780 hectares (27 per cent) of associated woodlands
- 36,280 hectares (19 per cent) of other vegetation.⁹

The remaining 13 per cent of vegetation within the cypress state forests has not been mapped.

Approximately 134,750 hectares of the south-western cypress forests are covered with white cypress and associated woodlands. This amount accounts for around 5 per cent of the total extent of white cypress and associated woodlands found in the central and western divisions.

Appendix 11 explains the methodology used to map and calculate the vegetation extent and provides a more detailed breakdown of vegetation extent across tenures.

⁶ Sometimes referred to as the eastern coastal *Callitris columellaris*.

⁷ Mainly comprising poplar box grassy woodlands, inland grey box grassy woodlands and black box woodlands.

⁸ Based on the NRC's composite mapping (see **Appendix 11**).

⁹ Black box woodlands comprise almost 20,000 hectares of this.

Figure 2.2: Fragmentation of south-western cypress state forests in the central division

South-western cypress state forests are surrounded by other tenures in a predominantly agricultural landscape cleared of native vegetation. In this image a number of south-western cypress state forests provide links (from south to north) with other remnants, such as Cocoparra Nature Reserve, Cocoparra National Park and travelling stock reserves.

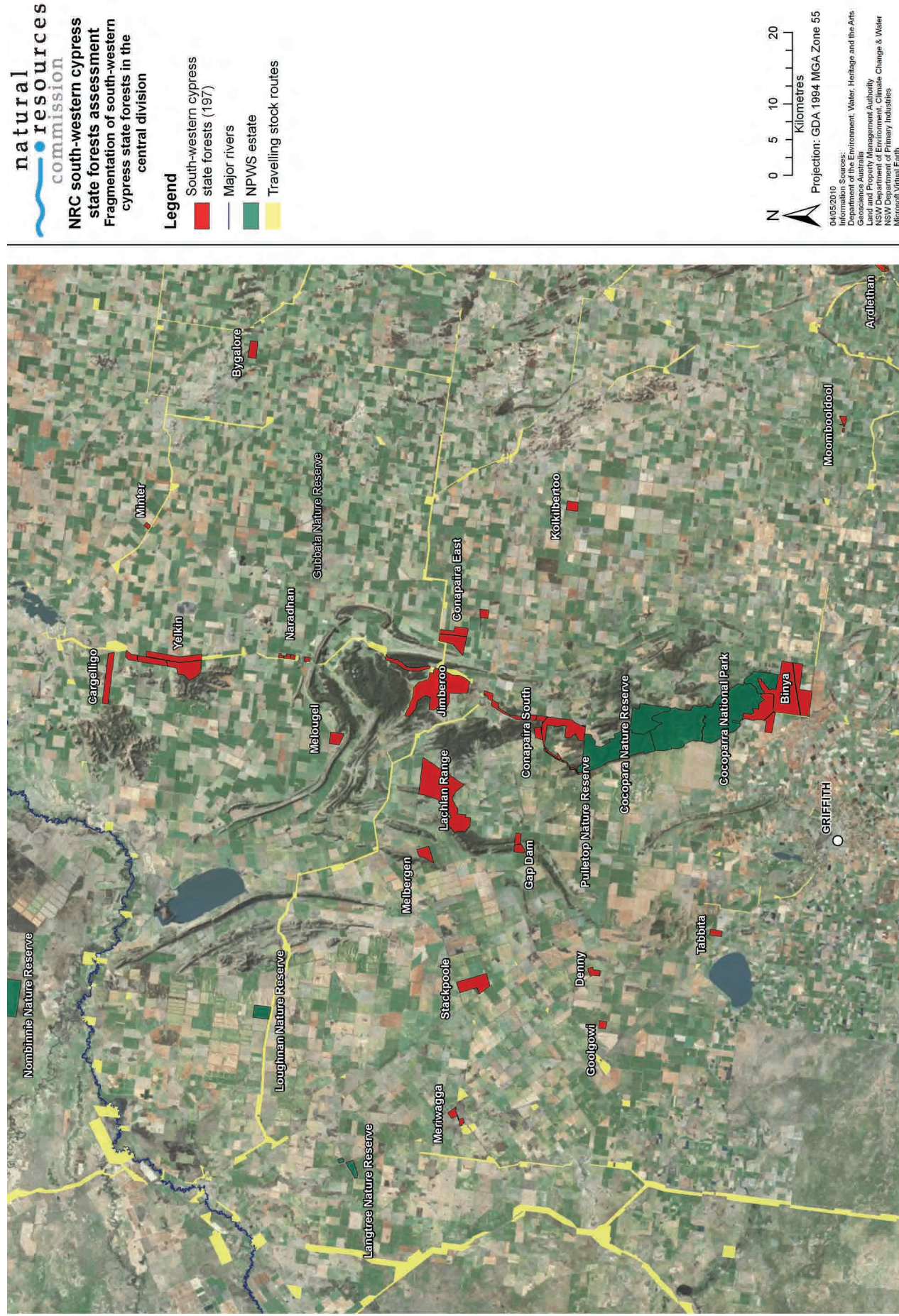


Table 2.1: Extent of white cypress forest and associated woodland across all tenures

Tenure type	Extent of white cypress and associated woodlands
Crown leasehold land, including western land leases (excluding state forests and travelling stock reserves)	1,502,220
Private land	794,620 ^a
Reserve system	230,400
South-western cypress state forests	134,750 ^b
Travelling stock reserves	42,270
Total	2,704,260

^a This figure is only indicative as it also includes other tenures, such as Crown land, permits, roads.

^b Total area of south-western cypress state forests is approximately 195,750 hectares, of which approximately 134,750 hectares is covered with white cypress forests and associated woodlands.

2.4 Institutional context

While this assessment focuses on the south-western cypress state forests, white cypress forests and associated woodlands are found across a diverse range of tenures on both public and privately held land. There is also a range of institutional arrangements in place to manage cypress on these different tenures in a way that promotes resilient and functioning landscapes. **Chapter 6** describes this in more detail.

White cypress forests and associated woodlands on public and private land are governed by a range of policies, legislative instruments and government programs at national and state levels.

At the national level these include:

- the *National Forest Policy Statement* (Commonwealth of Australia, 1992)
- the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- the *National Reserve System Strategy* (Commonwealth of Australia, 2009).

At the state level these include:

- the *Native Vegetation Act 2003* (white cypress is a species classified as invasive native scrub under this Act in some catchment management regions, see **Chapter 6** for more information)
- the *Forestry Act 1916* and the *Forestry and National Park Estate Act 1998* (FNPE Act)
- *NSW Environmental Planning and Assessment Act 1979* (EP&A Act)
- priorities in the NSW Government's *State Plan – Investing in a Better Future* (NSW Government, 2009)
- regional *Ecologically Sustainable Forest Management Plans* (ESFM Plans) prepared by Forests NSW

- NSW Forest Agreements and IFOAs (in regions where they have been drafted and finalised)
- conservation policies, including the *NSW Biodiversity Strategy* (due for release end of 2010) and the *National Parks Establishment Plan 2008* (NPWS, 2008)
- land-use planning strategies and instruments.

The specific responsibilities of national and state government agencies for the south-western cypress state forests are outlined in **Appendix 8** and relevant NSW and Commonwealth legislation is listed in **Appendix 2**. **Appendix 20** sets out where the requirements of the EPBC Act and FNPE Act are considered in this assessment.

2.4.1 Integrated Forestry Operations Approvals

A NSW Forest Agreement, following from this regional forest assessment, would inform any IFOA for the south-western cypress state forests.

An IFOA has been negotiated by the NSW Department of Environment Climate Change and Water (DECCW) and Forests NSW relevant areas within the Brigalow and Nandewar Community Conservation Area, but is yet to be signed by the responsible Ministers.

2.4.2 Requirements of the EPBC Act

Under its terms of reference, the NRC was required to ensure that this assessment meets the requirements of the EPBC Act. The NRC consulted with the Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) to understand and implement this requirement during its assessment.

There is no Regional Forest Agreement for the south-western cypress state forests. This means the EPBC Act potentially applies to forestry operations if they entail significant impacts on any matter of National Environmental Significance.

The NRC's assessment meets the requirements of the EPBC Act by identifying:

- matters of National Environmental Significance
- environmental values such as biodiversity
- activities occurring in the south-western cypress state forests, such as forestry and livestock grazing
- ways in which impacts can be avoided, controlled and/or reduced below the level of significance
- residual significant impacts that can be addressed through specific measures under the EPBC Act.

There are several measures in the EPBC Act to protect matters of National Environmental Significance if significant impacts are likely. These include:

- standard assessment and approval processes (Parts 7, 8 and 9)
- Strategic Assessments (Part 10)
- Conservation Agreements (s 305).

The NRC assessment could be used to inform any of the above measures. In particular, a Conservation Agreement could be closely aligned to the development of a NSW Forest Agreement.

In practice, a Conservation Agreement would be an agreement between the NSW and Australian Governments and could be made in conjunction with a NSW Forest Agreement prepared under NSW's *Forestry and National Park Estate Act 1998*. These agreements would not 'switch-off' the operation of the EPBC Act. However, a Conservation Agreement may include a declaration to the effect that actions in a specified class do not need approval under Part 9 of the EPBC Act, provided they are not likely to have significant impacts on the relevant matters of national environmental significance. The declaration may specify conditions relating to the taking of actions in that class.

For a Conservation Agreement to be suitable for use with a NSW Forest Agreement, the Federal Environment Minister would need to be satisfied that the agreement would protect and conserve biodiversity and any listed threatened species.

In the context of ongoing activities, such as forestry, in the south-western cypress state forests, both the NSW Forest Agreement and Conservation Agreement would:

- protect, conserve and manage EPBC-listed threatened species and ecological communities, and their associated habitats
- provide a net benefit to the conservation of biodiversity of the south-western cypress state forests.

2.5 Historical context

2.5.1 Indigenous land use and impacts

Indigenous people have had a long history of management of the landscape and use of the forest resources in the area. The map in **Figure 2.3** shows the Indigenous nations in the region of the south-western white cypress state forests.

Jones (1980) argued that throughout Australia, Indigenous people managed the environment through systematic burning regimes. He suggests that Indigenous people managed a shift from rare, high-intensity, natural fire regimes to more frequent, low-intensity fire regimes (Boutland, 1988). In this way the Indigenous people maintained a regional mosaic of vegetation over hundreds of years (Norris et al., 1991; Benson & Redpath, 1997; Allen, 1998).

When first seen by Europeans, the central west of NSW was not a vast open plain covered with grass and a scattering of trees. Rather, it was a mosaic of vegetation cover, including open and myall plains, thick scrub, open and dense forest. It is thought this mosaic was in part the result of Indigenous burning and in part related to variations in soil type, seasonal moisture availability and other characteristics (Norris et al., 1991; Benson & Redpath, 1997; Allen, 1998; Curby, 1997; Croft et al., 1997).

Indigenous people were known to have utilised the cypress forests in many ways. A single white cypress tree could provide:

- timber for firewood, torches, spears, spear throwers, ceremonial objects, paddles and music sticks
- resin to make glues
- cones, bark, leaves and ash as components of various medicines
- bark to make rope and mosquito repellent (DAFF, 2009).

Both white and black cypress are known to have significant historical and contemporary cultural uses. The Wiradjuri name for white cypress is *Burradhaa* and *Garraa*. It is used for tools, medicine, food and fire. The resin is used as glue for binding tools and other implements. Its bark is used around broken limbs as a splint, and is also used to carry fire (Simpson, G, personal communication, 6 April 2010).

The Wiradjuri name for black cypress is *kara*. Kara was also used for making tools, medicine, food and fire, as well as for spiritual and ceremonial purposes. The black cypress trees were used to make spears and light fires, while the resin is sticky and useful as glue and medicine (Simpson, G, personal communication, 6 April 2010).

Only a limited amount of archaeological work has been done on the Indigenous occupation of the south-western white cypress state forests (Curby, 1997). In the Narrandera area, the Wiradjuri people were noted to have cleared plains adjoining swamps using fire (Gammage, 1986; Curby, 1997). These swamps would have provided a rich source of food, including mussels, yabbies, fish and water fowl (Curby, 1997).

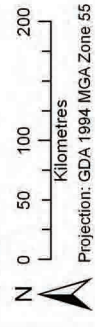
Chapter 4 contains more information about historical Indigenous connections to the south-western cypress forests.

NRC south-western cypress state forests assessment
Map of Indigenous nations in the region of the south-western cypress forests

Legend

- South-western cypress state forests (197)
- Major rivers
- Indigenous nations where state forests for assessment are located

Indigenous nations are from N.B. Tindale's 1974 map of indigenous group boundaries existing at the time of the first European settlement in Australia. This illustration does not intend to represent contemporary relationships to land or denote definitive boundaries.



Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

21/05/2010
Information Sources:
Department of the Environment, Water, Heritage and the Arts
Land and Property Management Authority
NSW Department of Environment, Climate Change & Water
N.B. Tindale

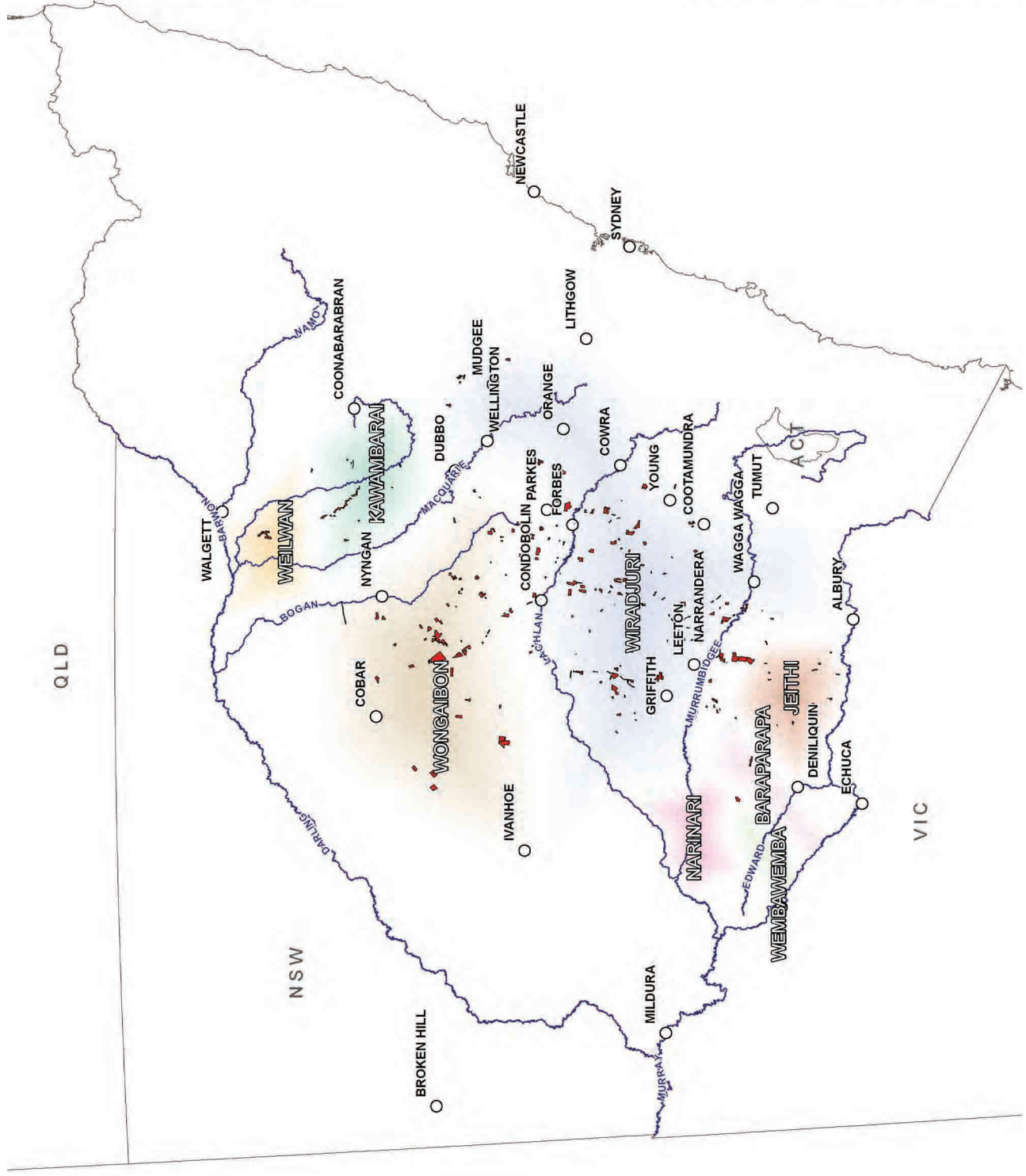


Figure 2.3: Map of Indigenous nations in the region of the south-western cypress forests

This map is indicative only and is not to be used for native title purposes

2.5.2 Non-indigenous historical land use and impacts

Colonial settlement, and the ensuing human intervention and management of the landscape, influenced the forest landscapes of today.

Earliest settlement of rural lands in the central and western divisions of NSW, beginning in the early 1800s, was driven by the demand for livestock grazing areas. By 1850, squatters had taken up blocks with river frontages along all major rivers. By the end of the 1870s, the great majority of the back country was occupied and settled (with a few exceptions, for example the lower Bogan area) (Jervis, 1956).

These early pastoral runs covered all the lands included in today's cypress state forests. Most were vast, unsurveyed and largely unfenced blocks of Crown land. From the mid-1830s onwards, a series of Acts initially provided some security of tenure for squatters on these Crown lands. However, in the latter part of the century early livestock grazing leases began to expire or were forfeited. These lands were often subsequently purchased, leased or held under other tenures, leading to a gradual decrease in the size of pastoral runs. There was also a steady increase in areas of lands reserved from sale for many different public purposes, among them travelling stock reserves and forest reserves.

Most of the forest reserves were gazetted in the late 1800s and early 1900s. The gazetting of forest reserves called for numerous surveys and led to major land tenure changes across the landscape. Livestock grazing in these reserves generally continued unrestricted, while outside these reserves clearing continued unabated in the sheep–wheat belt of the central division through the 1900s.

In the 1890s, pastoralists observed that cypress and other 'scrub' regeneration that had first established in the 1870s–80s was reducing the livestock grazing value of

pastoral holdings. Improvement leases and scrub leases were created that permitted holders to ringbark or cut down cypress and other species to specified stand densities, even in forest reserves. A major episode of cypress regeneration also occurred in the 1950–60s, following a significant rabbit-control program and temporary cessation of livestock grazing. A silvicultural management regime was again developed and implemented that aimed to thin regrowth cypress, and remove other species (principally *Eucalyptus*) to encourage growth of large, merchantable cypress trees (Allen, 1998; Forests NSW, 2008b).

Following passage of the *Forestry Act 1909* and *Forestry Act 1916*, many of the earlier forest reserves became dedicated state forests. State forest tenure conflicted with the contemporary interests of farmers, who were eager to use the same land for cropping as wheat cropping extended westward. Despite this conflict, conversion of different land tenures to state forests continued throughout the 20th century, as has revocation of state forest tenure in areas considered more suited to other uses.

Over the past 20 years, clearing regulations under the *State Environmental Planning Policy No. 46 1997* (within the EP&A Act), *Native Vegetation Conservation Act 1998* and more recently the *Native Vegetation Act 2003* have reduced the clearance rate of cypress woodlands. The estimated area of original cypress forest cleared since the late 1800s ranges from 30 per cent clearance in the western division, up to 74 per cent clearance in the central division (NSW Vegetation Classification Assessment database, see **Chapter 3**).

A comprehensive chronology of exploration and land use in the area, and the impact of this use on the forests, is presented in **Table 2.2**. Non-Indigenous heritage associated with the south-western cypress forests is also described further in **Chapter 4**.



Remains of crutching shed – Cumbine State Forest – Photo courtesy of Mark Allen

Table 2.2: Chronology of non-Indigenous land use and impacts on south-western cypress state forests

Year	
1813	<ul style="list-style-type: none"> Blaxland, Wentworth and Lawson find way across the Blue Mountains and return to Sydney to inform Governor Lachlan Macquarie (Barker, 1965).
1815	<ul style="list-style-type: none"> Town of Bathurst formally proclaimed by Governor Lachlan Macquarie, the first town in the central western region of NSW (Barker, 1965).
1817–1845	<ul style="list-style-type: none"> Slopes and plains explored by Oxley, Sturt and Mitchell (Mitchell, 1991) providing a rich set of landscape descriptions and other observations. For example, Mitchell (1839) provides insight into the slopes and plains landscape during this period.
1830–50s	<ul style="list-style-type: none"> Pastoral settlement followed the rivers, with some of the early pastoralists getting ahead of the later explorers (Mitchell, 1991). Cattle were the pioneer stock, followed by sheep (Mitchell, 1991). Livestock grazing may have started in areas that are now state forests.
1860s	<ul style="list-style-type: none"> Sheep had replaced cattle in most parts by the 1860s (Mitchell, 1991). Introduction of the European rabbit into Victoria by wealthy grazier for hunting purposes (CSIRO, 2010). Cypress growth had started in the Lachlan district in 1865–66 (Mitchell, 1991; von Lendenfeld, 1885). Fire became a tool of settlers and prospectors for clearing, and also as a management tool promoting 'green pick' for graziers (Jacobs, 1957).
1870s	<ul style="list-style-type: none"> High wool prices in the 1870s encouraged increased stocking for large profits (Mitchell, 1991). Ringbarking, clearing and cropping began in the mid-1870s (Mitchell, 1991; Allen, 1998). Likely utilisation of forest areas for farm timbers near the area of Euglo South State Forest (Allen, 1998). Major regrowth event in the Pilliga (Rolls, 1981). Livestock grazing began in the rangelands of the western division (Iwaszkiewicz & Semple, 1988). Gold and copper mining commenced at Cobar and Mt Hope (Iwaszkiewicz & Semple, 1988). Spread of cypress and commercial timber operations commenced.
1880s	<ul style="list-style-type: none"> Ringbarking, clearing and cropping accelerated with closer settlement and expansion of the railways (Mitchell, 1991). <i>Crown Lands Act 1884</i> forced a trebling of land rent which in turn forced an increase in production to service loans. Stocking went from one sheep per hectare to 3-8 sheep per hectare (Beadle, 1948; in: Mitchell, 1991). All of NSW was claimed by the mid-1880s (Mitchell, 1991). In 1883 cypress was rapidly superseding the angiosperm trees, which previously formed the forest in the Lachlan district (von Lendenfeld, 1885). In 1885, a year of low rainfall in the Lachlan encouraged the prevalence of a beetle, <i>Diadoxus erythrus</i>, which subsequently was correlated with the dieback in cypress (von Lendenfeld, 1885). Cessation of Indigenous burning in the late 19th century led to dense regeneration (Allen, 1998). Proclamation of first forest reserve, at Matong near Narrandera in 1885 (Allen, 1998). Notification of forest reserves provides additional control of ringbarking, but not of livestock grazing (Allen, 1998). Gold and copper mining commenced at Nymagee and Melrose, (Iwaszkiewicz & Semple, 1988).
1890s	<ul style="list-style-type: none"> 1895–1902 drought Establishment of forests reserves on lands not previously selected because of poorer soils, or thick scrub and timber (Mitchell, 1991). Government employment relief scheme (1895) to mitigate the impact of 1890s depression included thinning programs. Pastoral lease holders required to thin cypress as a condition of lease. Rapid expansion of wheat growing in central west region (Allen, 1998). Gold and copper mining also commenced at Bobadah and north of Condobolin (Iwaszkiewicz & Semple, 1988).
1900–1950	<ul style="list-style-type: none"> Government employment relief scheme to mitigate the impact of 1930s Great Depression included thinning programs.

Table 2.2: Chronology of non-Indigenous land use and impacts on south-western cypress state forests continued.

Year	
1950s	<ul style="list-style-type: none"> • Summer of 1950-51 saw the spread of myxomatosis, a viral disease that was introduced to control the rabbit plague, which allowed prolific regeneration (1950s cohort) (Forests NSW, 2008a; 2008c). • Natural regeneration event over most of the natural range of cypress from the 1952 seed year. The survival of these seedlings was probably enhanced by subsequent wet years in 1955-56 (Mitchell, 1991). • A large fire in the Pilliga was recorded in 1951-52, and although a subsequent establishment of seed followed this fire, other parts of the state established cypress seed in the absence of fire (Mitchell, 1991). • Grazing livestock withdrawn from state forests. • 1080 rabbit poisoning program began 1959.
1960–1970	<ul style="list-style-type: none"> • Extensive culling of eucalypts in cypress forest (Forests NSW, 2008a; 2008c). Poisoning of ‘competing’ eucalypts and other hardwoods, culling of non-commercial cypress, thinning of stands to favour vigorous cypress growth (Allen, 1998). • Livestock grazing allowed under grazing permits (Curby, 1997). • Various policy initiatives implemented that included silviculture, for example, the Unemployment Relief Fund and the Indigenous Relief Program (and into the 1980s).
1980s	<ul style="list-style-type: none"> • In state forests, thinning of dense cypress regeneration using brush cutters (Forest NSW, 2008a; 2008c). • Cessation of hardwood poisoning in state forests (Allen, 1998). • Return to livestock grazing under occupation permits (Curby, 1997).
1990–2010	<ul style="list-style-type: none"> • Management of cypress on private land as invasive native scrub through regional vegetation committees, made possible under the <i>Native Vegetation and Conservation Act, 1997</i> (none of the committees actually finalised an invasive native scrub plan before the introduction of the <i>Native Vegetation Act 2003</i>). • The <i>Native Vegetation Act 2003</i> provided two mechanisms for controlling dense regeneration of cypress, Invasive Native Scrub Property Vegetation Plans (PVPs) and Thinning PVPs. • Private Native Forestry (PNF), previously unregulated in NSW, came under the regulation of the <i>Native Vegetation Act 2003</i> through the PNF Code of Conduct, providing a third mechanism for managing cypress on private land. • NSW Government’s 2005 Brigalow decision led to changes in land tenure for cypress state forests in the Brigalow Belt South and Nandewar bioregions, and impacted on Forests NSW’s management of cypress timber supply across NSW.

2.6 The Brigalow decision

The Brigalow Belt South and Nandewar bioregions are areas in northern NSW with significant cypress timber resources. In 1999 the NSW Government initiated regional forest assessments in these regions. In May 2005, the NSW Government announced a suite of proposals for the Brigalow Belt South and Nandewar bioregions (the Brigalow decision), including:

- changes in land tenure (**Table 2.3**)
- a regional wood supply commitment of 57,000 cubic metres per year for mills in the Brigalow Belt South and Nandewar bioregions
- new 20-year wood supply agreements between the NSW Government, Forests NSW and timber mills (which also included mills outside the region)
- the Brigalow Assistance Fund, a funding assistance package for both the cypress timber industry (including mills harvesting from outside the Brigalow Belt South and Nandewar bioregions) and reservation outcomes.

The Brigalow decision affected the management, economic values and uses of the cypress timber resource and associated industry within the south-western cypress state forests. This was because some timber supply from the south-western cypress state forests was required to meet the wood supply commitments for the Brigalow Belt and Nandewar regions (subsequent consolidation of the cypress timber industry has largely rebalanced this situation (see **Appendix 19**)).

The NSW Government converted state forest areas in the Brigalow Belt South and Nandewar bioregions into a Community Conservation Area, which reduced the area supporting sustainable harvesting of cypress timber in these regions. Prompted by reduced yields, Forests NSW created a single wood supply area for managing cypress: the Western Region Supply Area. This was achieved by merging 14 former management areas, including the south-western cypress state forests and sections of the new Community Conservation Area that remained available for productive forestry.

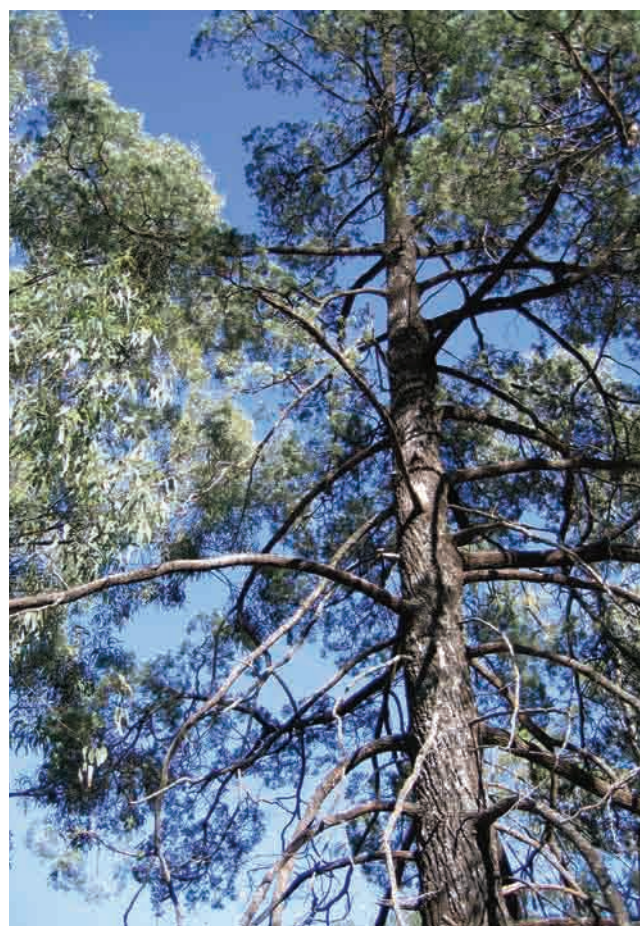
The NSW cypress industry was also consolidated. Prior to the Brigalow decision, 17 mills relied on timber supplied by Forests NSW from state forests across NSW, including the south-western cypress state forests. Of the 17 mills operating

in 2005, 12 either exited the industry or changed the nature of their business. The NSW Government entered into 20-year wood supply agreements with five cypress harvesting and milling companies, including one company in the south-western area operating two mills.¹⁰ **Figure 2.4** shows the extent of the consolidation across the NSW cypress timber industry, particularly with reference to mills harvesting cypress directly from state forests.

Two mills located in south-western NSW (in Narrandera and Condobolin) source most of their cypress timber from the south-western cypress state forests. The new 20-year wood supply agreements and access to the Brigalow Assistance Fund encouraged these mills to invest in value-adding and modernisation of milling equipment.

Table 2.3 outlines the changes in land tenure as a result of the Brigalow decision. It increased the area of land managed for reservation and Indigenous use by **173 per cent**, and reduced the area of land managed for forestry by **56 per cent**.

Further information on the current industry is set out in **Chapter 5. Appendix 19** describes the outcomes of the Brigalow decision in more detail.



Coradgery State Forest

Table 2.3: Changes in land tenure as a result of the Brigalow decision

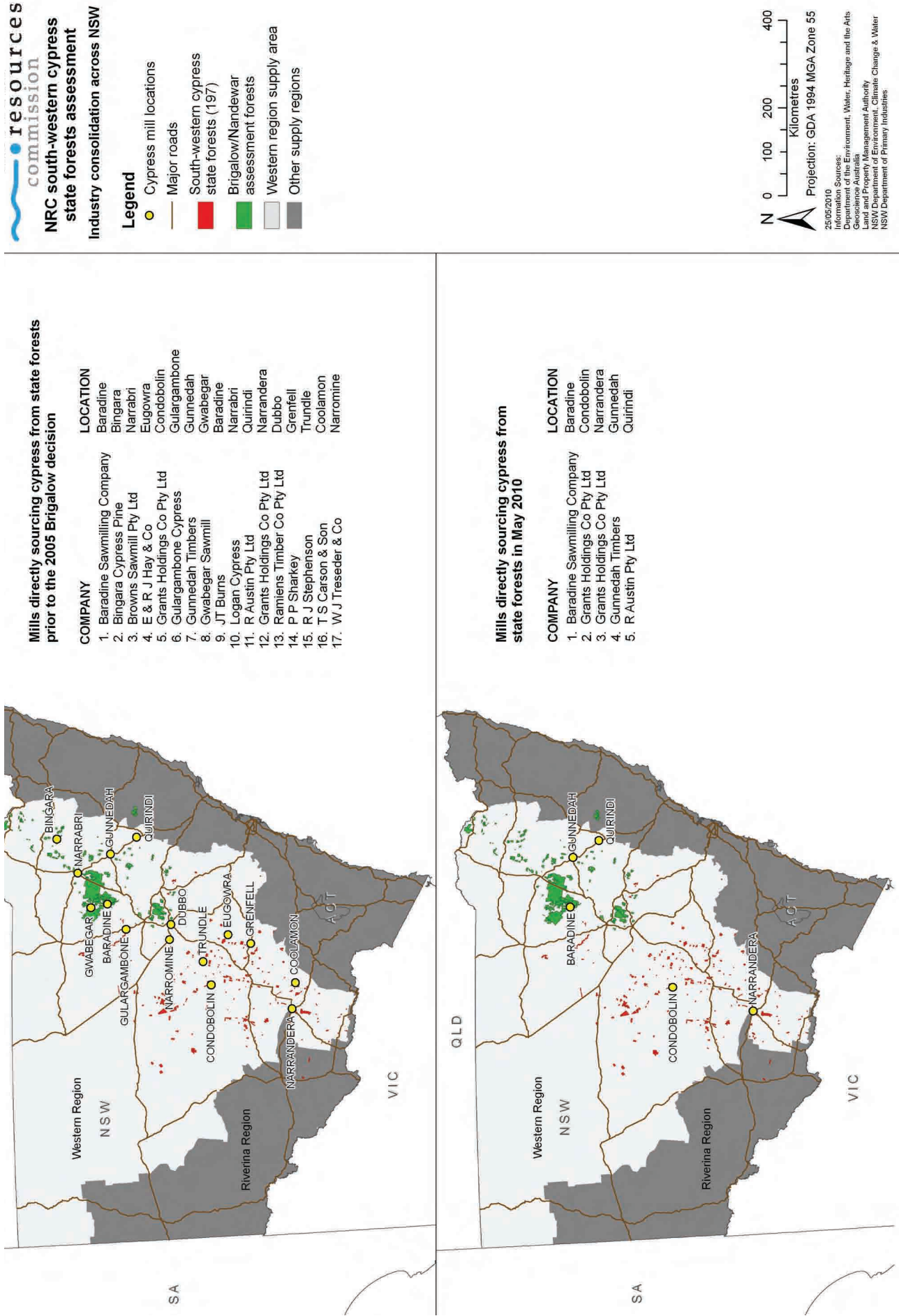
Tenure	Management objective	Relevant legislation	Area (hectares)	
			Pre-2005	Post-2005
CCA – Zone 1 (National Park)	Conservation and recreation	<i>National Parks and Wildlife Act 1974</i>	-	120,000
CCA – Zone 2 (Aboriginal Area)	Conservation and Indigenous culture	<i>National Parks and Wildlife Act 1974</i>	-	22,000
CCA – Zone 3 (State Conservation Area)	Conservation, recreation and mineral extraction	<i>National Parks and Wildlife Act 1974</i>	-	185,000
CCA – Zone 4 (State Forest)	Forestry, recreation and mineral extraction	<i>Forestry and National Park Estate Act 1998 and Forestry Act 1916</i>	-	273,000
State forest	Forestry and multiple uses	<i>Forestry and National Park Estate Act 1998 and Forestry Act 1916</i>	620,000	-
Reserve system	Conservation, recreation and mineral extraction	<i>National Parks and Wildlife Act 1974</i>	208,000	240,000 ^a

^a Includes Crown leases vested in DECCW (~18,000 hectares) and other formal reserves (~222,000 hectares).

¹⁰ Since the original wood supply agreements were signed, one milling company has divided and traded its wood supply agreement allocations to remaining sawmill operations within the Western Region Supply Area. This means there are currently four wood supply agreements in place.

Figure 2.4: Industry consolidation across NSW

Source: Cypress Industry Strategic Plan Group (2003)



2.7 Landscape change

2.7.1 Landscapes and resilience

The NRC considers it important to view the south-western cypress state forests as part of a dynamic, interlinked system between humans and nature. These systems are sometimes referred to as socio-ecological systems; here we refer to them as landscapes.

Resilient landscapes have an inherent capacity to “absorb disturbance and reorganise while retaining a similar identity including structure, function and feedbacks” (Walker et al. 2009). However, in landscapes with low resilience, disturbances may cause thresholds (or tipping points) to be exceeded such that the system may begin to function in entirely different ways. When these thresholds are exceeded, the landscape is said to have undergone a regime shift to an alternative state.

2.7.2 Historical and possible future trajectories of change

Over time, different land uses and management practices have had different impacts on landscapes in the area (see **Section 2.5**). In many cases, regime shifts have been deliberately managed so that people can derive different values from that landscape. For example, vegetation has been extensively cleared in the central division for agricultural activities.

In cases where thresholds have been exceeded, the landscape has begun to function differently, often affecting the values derived from that landscape. For example, changed management regimes in the western division have caused many vegetation species, including white cypress, to colonise areas in dense thickets. Where these thickets have been extensive, this has impacted upon biodiversity and soil health and requires intense active management to transition these back into former states.

Figure 2.5 illustrates the historic, current and possible future state of the socio-ecological systems in the western and central divisions. The horizontal axis represents time from pre-European settlement to the present day, and looking forward to the future. The vertical axis represents how the landscape functions at different scales, from individual woodlands to regional scale.¹¹

In their pre-development state (**Point 1**), the woodlands of the central west and western divisions were dominated by eucalyptus and box species with white cypress as a sub-dominant species. Indigenous people were culturally connected to the woodlands, while also extracting resources and using fire to manage the landscape. During this period, the socio-ecological system was likely to be functioning with a good capacity to absorb a normal range of disturbance and readily self-reorganise into a similar function and structure.

Since European settlement, these landscapes and woodlands have undergone transition from their previous state (towards **Point 2**). For example, woodland structure and floristic diversity began to decline through clearing, land settlement, timber extraction and livestock grazing. Droughts and the explosion in the rabbit population limited cypress regeneration during the early to mid-20th century. Indigenous access to the

woodlands for resources and cultural practices was beginning to be compromised.

Dense cypress regeneration occurred across the landscape from the 1950s, coinciding with effective rabbit-control programs. Woodland structure and diversity continued to decline with increasing settlement, the legal imperative to clear land and increasing timber extraction. More state forests were gazetted during this period, with increasing application of cypress-specific silvicultural techniques. Towns were founded and thrived around agricultural activities and timber mills. The fortunes of these towns ebbed and flowed around fluctuating commodity prices and seasonal variations such as drought (**Point 2**).

During the latter part of the 20th century, Australian governments refocused legislation and regulations on environmental issues, addressing growing concerns in the community about the impacts of human activity on environmental values. In NSW this included forestry activities, with a number of forest agreements being formalised to protect environmental values and to provide certainty for long-term investments by industry. Legislation such as the *Native Vegetation Act 2003* was also introduced, which aims to better protect and manage vegetation on privately managed land.

After 2005, there was significant restructuring of the cypress timber industry following the NSW Government’s Bragalow decision. As part of the decision, non-commercial thinning programs were funded in the south-western cypress state forests, promoting production values and ancillary environmental benefits, such as increased structural diversity of vegetation. In addition, forestry management systems and third-party licensing were already aiming to improve or maintain floristic diversity through a range of management prescriptions. In the landscape surrounding the south-western cypress state forests, catchment management authorities continued to work with landholders to increase their knowledge of landscape function and management practices to promote more resilient properties and landscapes (**Point 3**). This situation has moved the white cypress forests and woodlands and their associated industries towards a more robust and functioning system.

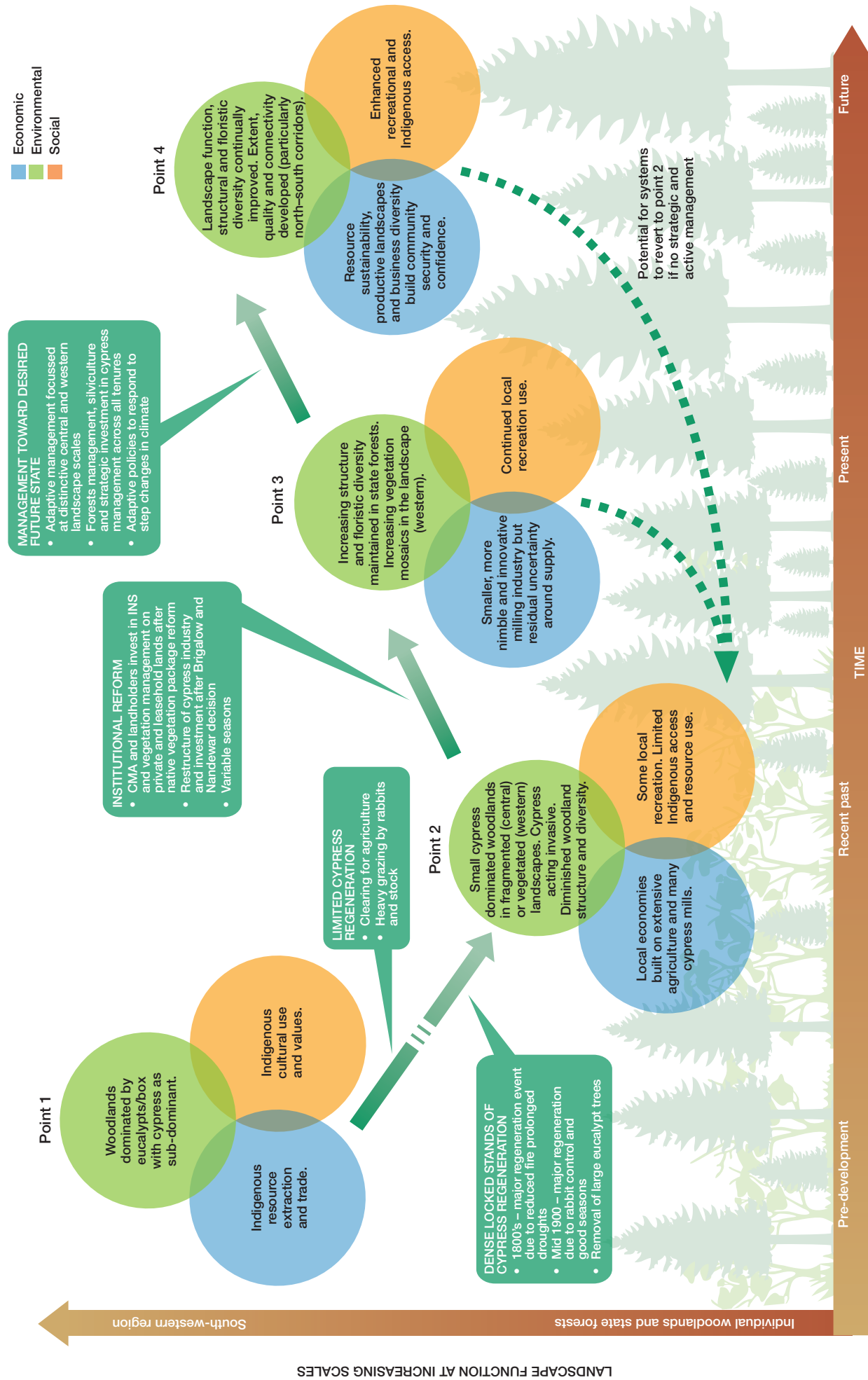
There is now opportunity to build on this progress and move towards a more resilient future (**Point 4**). This would mean continuing to increase vegetation structural and floristic diversity in south-western cypress state forests, and improve connectivity and vegetation mosaics between these state forests. Our confidence in timber resource sustainability should improve through the application of remote sensing technologies, allowing more timely and targeted silviculture. Industry should then be better placed to make long-term investment decisions, promoting the social wellbeing of the communities in which they reside.¹²

However, this future will not happen of its own accord and there is always a risk we will revert to old ways and former conditions. We need to consider our actions in a landscape context and apply active adaptive management by trialling and testing innovative approaches, monitoring and learning as we go forward.

¹¹ **Figure 2.5** illustrates a generalised account of how these systems have changed through time. More detailed discussion and references on the state and condition of social, economic and environmental components of this system can be found in the following chapters of this report.

¹² **Chapter 6** provides more detail around some of these proposals.

Figure 2.5: Landscape change in the south-western cypress forests



Environmental values

3.1	Overview	38
3.2	Ecology of white cypress forests and associated woodlands	38
3.3	Endangered species and ecological communities	42
3.4	Condition of white cypress forests and associated woodlands	43
3.5	Threatening processes and impacts	48
3.6	Assessing environmental values and key threats	52



3.1 Overview

Cypress is found over a large geographical area of NSW. It is a hardy species that can withstand periods of drought and regenerate in large numbers and dense stands. Prior to colonial settlement, cypress functioned to provide floristic and structural diversity in vegetation communities that were largely dominated by eucalypts. Many of these ecosystems have now transitioned into cypress-dominated vegetation types.

White cypress forests and associated woodlands support many environmental values, including a number of threatened species and endangered ecological communities. They provide important areas of remnant vegetation across the landscape, particularly in the central division. The cypress state forests are, however, subject to a number of threatening processes, including livestock grazing, inappropriate fire regimes and activities that reduce the structural variability of vegetation in small, isolated forests.

This chapter supports **Steps 1, 2 and 3** of the analytical framework by:

- describing the ecology and condition of white cypress and associated woodlands across the landscape
- outlining the status of threatened and endangered species and ecological communities
- explaining projected climate change scenarios for the assessment area and possible impacts on white cypress and associated woodlands
- assessing the environmental values within each of the south-western cypress state forests.

The key findings of this chapter are:

- Over time, some eucalypt-dominated woodlands in the central and western divisions have transitioned to cypress-dominated woodland types. The current extent and condition of these woodlands have been influenced by long-term changes in livestock grazing, fire regimes, land clearing and forest silviculture.
- Around 74 per cent of white cypress forests and associated woodlands have been cleared in the central division and around 30 per cent in the western division.
- A total of 57 threatened fauna and flora species and seven endangered ecological communities listed under Commonwealth or NSW legislation have been recorded in the south-western cypress state forests.
- In the central division, the south-western cypress state forests provide some of the largest patches of native vegetation in a largely cleared landscape. They provide habitat for a variety of woodland fauna and flora species, some of which are regionally or locally threatened. They function as refugia, provide connectivity, and help to maintain soil condition. Biodiversity values are greatest where there is floristic and structural diversity.

- Particularly in the western division, cypress can establish large dense stands as it is highly tolerant of competition, can recruit in large numbers, and lacks mechanisms for rapid self-thinning. Extensive areas of dense young cypress have more limited environmental values than structurally diverse stands, and impede agricultural production.
- The most threatening processes for environmental (as well as cypress timber values) in many south-western cypress state forests are likely to be livestock grazing, ecologically-inappropriate fire regimes, and inappropriate harvesting and thinning that reduce spatial variability in vegetation structure of small isolated forests.
- White cypress is expected to continue to persist at all scales under predicted climate change scenarios because of its large geographical range and inherent hardiness, provided livestock grazing and other disturbances are appropriately managed.

Appendix 16 profiles the environmental values for each of the 197 south-western cypress state forests covered by this assessment. It describes their vegetation composition, threatened species and endangered ecological communities and forest management zoning.

3.2 Ecology of white cypress forests and associated woodlands

3.2.1 Vegetation types

White cypress forests and associated woodlands grow on a wide range of freely draining, light-textured soils. Cypress usually occurs in association with other canopy species, such as eucalypt species (Ross et al., 2008). White cypress becomes more dominant where the soil has a sandy or sandy-loam surface horizon, and in some cases may form pure stands (Beadle, 1981; Moore, 1953a; Biddiscombe, 1963).

In the central and western divisions cypress usually forms open woodland in association with eucalypts and other species such as:

- Bimble box (*Eucalyptus populnea*)
- Gum coolibah (*E. intertexta*)¹
- Narrow-leaved ironbark (*E. crebra*)
- Pilliga box (*E. pilligaensis*)
- Silver-leaved ironbark (*E. melanophloia*)
- White box (*E. albens*)²
- Belah (*Casuarina cristata*)
- Ironwood (*Acacia excelsa*)³
- Mulga (*A. aneura*).

¹ Sometimes known locally as red box.

² See Beadle (1981); Boland et al., (1992); FCNSW (1988); Lindsay (1967); Thompson & Eldridge, (2005b) for *Eucalyptus* spp.

³ See Beadle (1981) for remaining spp.

The NRC has identified 267 vegetation types in the landscape where the south-western cypress state forests are found (**Appendix 9**).⁴ Of these, the NRC has identified 37 vegetation types containing cypress as either a dominant or sub-dominant species (**Appendix 10**).

3.2.2 Recruitment and regeneration of cypress

Cypress is a slow-growing, coniferous Australian native tree species. It is fire-sensitive and highly tolerant of crowding (Lacey, 1972, 1973; FCNSW, 1988). The regenerative behaviour of cypress following recruitment events has implications for the ecology of the species throughout its life cycle.

Cypress produces copious quantities of seeds that are dropped shortly after maturity, usually between October and January (Thompson & Eldridge, 2005b). Recruitment is highly episodic and is constrained by multiple factors including rainfall, grazing, fire, canopy competition and health of the mature stand (Thompson & Eldridge, 2005a, b). Recruitment episodes tend to follow periods of good conditions, defined primarily by one or two years of wet summers with below-average temperatures (Nicholson, 1997; Wilson et al., 1997). Recruitment is encouraged by ample autumn-winter rainfall for at least one season, a sufficiently open canopy, and an absence of fire and grazing particularly grazing, by rabbits and sheep (Lacey, 1972; Ross et al., 2008).

Following colonial settlement, cypress in central-western NSW underwent episodic recruitment events. Current stands are typified by distinct cohorts of even-aged trees dating from the 1890s, 1950s and 1974 onwards (**Chapter 5** describes these cohorts in more detail).

The capacity to recruit readily in large numbers under suitable climatic conditions and a subsequent tolerance of crowding enables the species to establish extensive stands of dense growth-locked regeneration. The species can tolerate intense intra-specific competition at high densities, surviving for long periods in growth-locked stands with negligible growth in either height or stem diameter (Horne, 1990a, b). These stands may persist for over a century as the species lacks a mechanism for rapid self-thinning (Lacey, 1972; Horne, 1990a, b; Thompson & Eldridge, 2005a). For example, stands dating from the 1950s can today support densities from 10,000 to more than 100,000 stems per hectare, with heights as low as 3–5 metres (Lacey, 1972; Ross et al., 2008).

Extensive areas of dense cypress regeneration can impede agricultural production and have lower ecological benefits than structurally diverse stands. Therefore, cypress is recognised as an invasive native scrub species under the NSW *Native Vegetation Act 2003* (NSW Government, 2007). **Chapter 6** describes how cypress, which behaves as invasive native scrub, is managed.

Dense cypress regeneration has occurred in much of the western division. However, very little recruitment has occurred in south-west NSW, particularly in the Riverina region, south of Broken Hill and Ivanhoe, and west of Ivanhoe to Hay (west of the assessment area). The future viability of the cypress stands in these south-western areas is uncertain (Cohn, J, personal communication, 2010).



Growth-locked stand

3.2.3 Flora and fauna

White cypress forests and associated woodlands in central NSW have a rich floristic composition (Thompson & Eldridge, 2005a,b). Shelly (2001) recorded 150 vascular flora species in the Tottenham–Bobadah region. Forests NSW (1996) recorded 90 species in Wahgunyah State Forest near Finley. Other studies have identified a rich diversity of non-vascular plants (lichens, mosses, liverworts) in white cypress forests and associated woodlands (Thompson & Eldridge, 2005b).

White cypress forests and associated woodlands provide habitat for a variety of fauna species, some of which are regionally or locally threatened. In the grassy box woodlands of eastern Australia, cypress often represents the only midstorey element of the ecosystem, providing an important habitat component for woodland birds (Thompson & Eldridge, 2005b).

Mammals, birds, reptiles and invertebrates use all levels of white cypress forests from the canopy to the soil (Thompson & Eldridge, 2005b). Surveys of both isolated and remnant vegetation have also demonstrated the ecological importance of retaining old, hollow-bearing eucalypts and coarse woody debris in white cypress forests and woodlands (Date et al., 2000; Law et al., 2000; Woldendorp et al., 2002).

Table 3.1 provides an overview of the major fauna groups that use white cypress forests and associated woodlands.

⁴ Based on the New South Wales Vegetation Classification and Assessment (NSWVCA) database (Benson 2006, 2008; Benson et al., 2006; Benson et al., in preparation) within 11 IBRA subregions – Barnato Downs, Bogan Macquarie, Canbelego Downs, Castlereagh–Barwon, Darling Depression, Lachlan Plains, Lower Slopes, Murray Fans, Murrumbidgee, Nymagee, Upper Slopes.

Table 3.1: Major fauna groups and species found in white cypress forests and associated woodlands

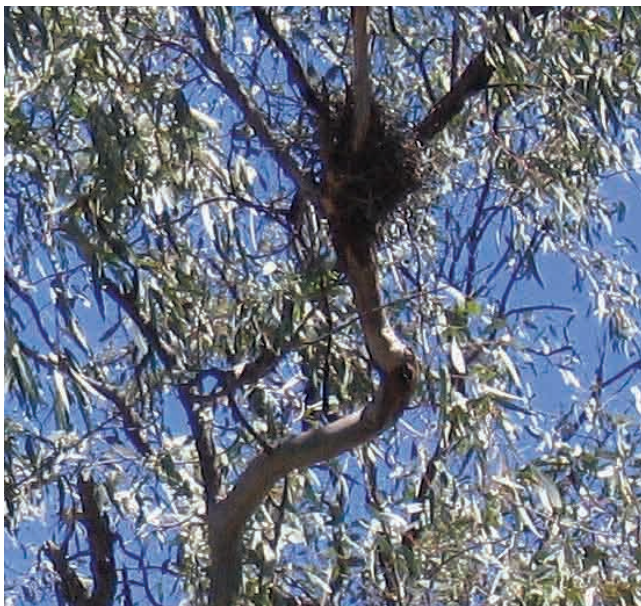
Fauna group	Comment
Mammals	A number of studies have recorded native mammals in white cypress forests and associated woodlands, including species such as common brushtail possum <i>Trichosurus vulpecular</i> , delicate mouse <i>Pseudomys delicatulus</i> , eastern grey kangaroo <i>Macropus giganteus</i> and various micro-bats (studies cited in Thompson & Eldridge, 2005b).
Birds	The studies of both Major et al., (2001) and Antos & Bennett (2005) highlight the value of white cypress forests and associated woodlands for the ongoing conservation of the birds of the sheep–wheat belt, most notably in the diversity of small, ground-dwelling, insectivorous birds found in these cypress vegetation types compared with other remnant vegetation types. Many of these species are considered threatened or declining (Reid, 1999; Garnett & Crowley, 2000). Species include chestnut-rumped thornbills <i>Acanthiza uropygialis</i> , red-capped robins <i>Petroica goodenovii</i> , hooded robins <i>Melanodryas cucullata</i> and jacky winters <i>Microeca fascinans</i> , regent honeyeaters <i>Anthochaera phrygia</i> , Gilbert's whistlers <i>Pachycephala inornata</i> , and small, ground-foraging granivores, such as diamond firetails <i>Stagonopleura guttata</i> .
Reptiles and amphibians	Reptiles and amphibians are relatively common in white cypress forests and associated woodlands, including species such as the ornate burrowing frog <i>Limnodynastes ornatus</i> , red-groined toadlet <i>Uperoleia rugosa</i> , and golden-tailed gecko <i>Diplodactylus taenicaudus</i> (studies cited in Thompson & Eldridge, 2005 b.)
Invertebrates	Like most woodland systems, there is little knowledge of the invertebrate fauna associated with white cypress forests and associated woodlands. The sandy soils favoured by cypress support various ground-nesting ants and spiders (Martin & Major, 2001). A number of native insects such as the gall midge <i>Diplosis frenelae</i> , cypress pine sawfly <i>Zenarge turneri</i> , cypress pine aphid <i>Cinara tujaefilina</i> and cypress pine jewel beetle <i>Duidoxus scalaris</i> are known to inhibit cypress reproduction and development (Lacey, 1973). Thompson and Eldridge (2005b) discuss the benefit of soil biota on soil condition in white cypress forests and associated woodlands, demonstrating the positive relationship between invertebrate activity and soil infiltration. Soil organic matter, structure and porosity are enhanced by the activities of soil biota including ants, termites and earthworms, resulting in improved infiltration (Lobry de Bruyn & Conacher, 1990). Long-term studies of ant nest dynamics within a cypress woodland in Yathong Nature Reserve have found that ants bring to the surface over 3 tonnes of soil per hectare per year, and that the total soil surface is likely to be converted to a nest entrance every 200 years (Eldridge & Pickard, 1994).

3.2.4 Refugia and connectivity

A basic requirement for conservation of biological resources is presence in the landscape of patches of natural habitat, or 'refugia', of a quality and spatial configuration suitable for maintenance of ecological function and diversity. Accordingly, habitat loss and fragmentation are often cited as the main factors contributing to the decline in biodiversity worldwide (Bennett, 1998; Dobson et al., 1999; Lindenmayer, 2006; Noss et al., 1997). Studies have recommended habitat preservation and restoration, including enhanced habitat continuity and/or functional connectivity as priorities for conservation planning (Bennett, 1998; Dobson et al., 1999 ; Lindenmayer & Nix, 1993; Lindenmayer & Franklin, 2002).

The benefits of functional corridors are to:

- provide habitat, including resident habitat for some species and supplementary habitat for other wide-ranging species
- assist species, including dispersing individuals and nomadic and migratory species, to move through the landscape
- increase immigration rates to habitat isolates, for example, by maintaining or enhancing genetic interchange between, and allowing recolonisation of, spatially separated populations of the same species
- facilitate the continuity of ecological processes, such as flow of energy, nutrients, biota and abiotic matter via wind, water and animal vectors
- provide increased resilience against climate change through provision of a climate gradient across which species may respond and adapt (Bennett, 1998; Noss et al., 1997; Beier & Noss, 1998; Lindenmayer & Franklin, 2002).



Eucalypt providing habitat for birds

Two important goals for preventing further loss of biodiversity in the central division relate to protecting existing refugia and enhancing functional connectivity.

Many of the remaining areas of refugia in the central land use division are the cypress state forests themselves, which were reserved for cypress timber resources in the early 1900s while much of the surrounding vegetation was cleared. In general, larger remnants tend to possess a greater diversity of flora and fauna than smaller remnants (Murphy, 1999). Travelling stock reserves also provide many of the remaining links across the landscape and are critical to landscape function.

Facilitating species movement between and along these important remnant patches is critical for remaining woodland bird and other native fauna populations. In the highly modified landscape of the central division, initiatives on private land that aim to protect paddock trees and smaller remnants, encourage canopy recruitment, and undertake strategic revegetation are highly important.

In the semi-arid rangelands of the western division, habitat islands or micro-refuges are relatively abundant, allowing biota to move readily. The variegated and contiguous vegetation of the Cobar Peneplain and similar areas provides a major block of refugia-enabling habitation and movement of the many native species that persist in the rangelands. Potential illegal clearing, inappropriate livestock grazing and feral predators are the major ongoing threats in these areas.

3.2.5 Vegetation mosaics

The pattern of vegetation types within an area is referred to as the vegetation mosaic. While some animal species may exist within a single vegetation type, most rely on vegetation mosaics to complete their life cycle (Lambeck & Saunders, 1993). Vegetation mosaics may provide foraging and roosting habitat, pathways for movement and dispersal, or act as a refuge during a sudden depletion of resources caused by, for example, fire, flood, or drought (Burbidge, 1985; Webster & Ahern, 1992).

Mosaics of cypress woodlands, box woodlands, riverine woodlands and open wetlands provide a diversity of ecological habitats in central NSW. These mosaics facilitate co-occupancy by different fauna assemblages, providing ecosystem resilience and buffering against attrition of biodiversity in the region (Doerr et al., 2009). Several organisms require either micro- or macro-habitat variation.

Fauna movement between vegetation types occurs on a variety of spatial and temporal scales (Law & Dickman, 1998). Some bird species migrate seasonally between hemispheres, while other species will utilise different habitats on a daily basis. For example, the diamond firetail *Stagonopleura guttata* is known to rely on cypress woodland and grassy eucalypt woodland as part of its ecology (Antos & Bennett, 2005; NSW Scientific Committee, 2001), while some woodland birds such as the turquoise parrot *Neophema pulchella* use ecotones (transitional zones) between different vegetation types.

3.2.6 Hollow-bearing trees and coarse woody debris

Hollow-bearing trees and coarse woody debris are important for biological activity in white cypress forests and associated woodlands. Within these forests, eucalypts provide the majority of these nest hollows and coarse woody debris, as white cypress trees form few hollows.

Tree hollows provide places for animals to shelter, roost, rear young, feed and thermoregulate (Forests NSW, 2009). Hollow-bearing trees are usually the oldest and largest members of the tree community, with some species taking up to 300 years to develop large hollows (Wormington et al., 2003). Standing eucalypts can continue to provide functional hollows after they die (Lindenmayer et al., 1993). For many species, including arboreal marsupials, bats, owls and parrots, the use of tree hollows is obligate, that is, no resource other than hollows can be used (Gibbons & Lindenmayer, 2002).

Occupancy of hollow-bearing trees is related to their position and spatial configuration in the landscape. Birds that nest colonially (such as the superb parrot *Polytelis swainsonii*) or in clusters across the landscape (such as the glossy black-cockatoo *Calyptorhynchus lathamii*) require a local abundance of hollow-bearing trees (Gibbons & Lindenmayer, 2002; Cameron, 2006). Territorial species, such as the pink cockatoo *Cacatua leadbeateri*, require an even distribution of hollow-bearing trees if all pairs are to breed (Rowley & Chapman, 1991).

Many species move between hollows over time. Frequent movements may serve to reduce parasite infestation, minimise risk of predation, provide appropriate thermal microclimates and allow energy-efficient access to foraging areas (Lewis, 1995).

Coarse woody debris is dead woody material on the forest floor caused by tree fall or dropped limbs and branches. It is used by various woodland birds as perching places or foraging substrate (Antos & Bennett, 2006) and is often used by reptiles to hibernate or incubate eggs. It is pivotal to invertebrate ecology.

Coarse woody debris can protect native herbs from grazing by stock, provide microhabitat for seed germination, assist in soil nutrient cycling, and enhance soil aeration and structure. Organisms such as termites, fungi and bacteria reassimilate macro-nutrients such as nitrogen from dead timber into living biomass and forest production.

3.2.7 Role in soil condition

Litterfall in eucalypt–cypress woodlands appears to play a major role in maintaining soil condition (Scanlan et al., 1996; Thompson & Eldridge, 2005). Studies near Cobar have demonstrated that patches of trees including cypress trap run-off and sediment to a much greater extent than patches devoid of trees (Harrington et al., 1981), facilitating accumulation of greater levels of leaf litter and soil nutrients under tree canopies (Thompson & Eldridge, 2005). This litter is known to enhance infiltration and reduce run-off and soil erosion (Scanlan et al., 1996).

For example, dense stands of cypress produce significant amounts of litter and dead woody debris (over 2 tonnes per hectare per year (Hart, 1995)), which accumulate in litter-dams following significant rainfall events. These dams form miniature catchments that stimulate germination of vascular plants and prevent loss of sediment (Thompson & Eldridge, 2005).

Biological soil crusts formed by associations of mosses, lichens, liverworts and other micro-biota are common components of white cypress forests (Thompson & Eldridge, 2005). Soil crusts provide a physical barrier at the soil surface that reduces the erosive energy of raindrops and overland flow. They provide an uneven surface that ponds water and reduces flow rates, and they support microbes that produce substances which bind soil particles and stabilise the soil surface (Eldridge & Greene, 1994; Thompson & Eldridge, 2005; West, 1990). Removal of the soil crust may lead to soil compaction and reduction in productivity (Eldridge, 2002).

The physical structure of cypress root systems is also likely to promote healthy soils. Surface roots are likely to enhance the formation of macropores in the soils and thus maintain or improve the stability of soil aggregates (Degens, 1997).

3.3 Endangered species and ecological communities

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an action requires approval of the Minister for the Environment if the action has, will have, or is likely to have, a significant impact on a matter of National Environmental Significance. The matters of National Environmental Significance are:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- World Heritage properties
- national heritage places
- Great Barrier Reef Marine Park
- nuclear actions.

In this assessment, the primary matters of National Environmental Significance are listed threatened species and ecological communities.

In NSW, the *Threatened Species Conservation Act 1997* (TSC Act) fulfils a similar role. The Act has dedicated schedules listing threatened species, populations and ecological community and key threatening processes.

Appendix 16 lists each of the 197 south-western cypress state forests, describing their vegetation composition, threatened species and endangered ecological communities, and forest management zoning.

3.3.1 Listed endangered ecological communities

A total of 15 endangered ecological communities, listed under the EPBC (seven) and/or the TSC (12) Acts, occur within the landscape containing white cypress woodlands (**Appendix 12**).

In summary:

- Five are considered to be part of white cypress woodlands; box–gum woodland, Carbeen Open Forest community in the Darling Riverine Plains and Brigalow Belt South bioregions, inland grey box woodland, sandhill pine woodland in the Riverina, Murray-Darling Depression and NSW South-western Slopes bioregions, and fuzzy box on alluvials of South West Slopes, Darling Riverine Plains and the Brigalow Belt South.
- Two of these are found in the south-western cypress state forests; box–gum woodland and Inland grey box woodland.
- Two woodlands that are not dominated by commercial stands of white cypress are found in the south-western cypress state forests; Sandhill pine woodland in the Riverina, Murray-Darling Depression and NSW South-western Slopes bioregions, and fuzzy box on alluvials of South West Slopes, Darling Riverine Plains & the Brigalow Belt South.
- The most extensive endangered ecological communities are associated with the central division; box–gum woodland, coolibah–black box woodland and inland grey box.

Within the south-western cypress state forests, seven endangered ecological communities listed under the EPBC (two) and/or the TSC (seven) Acts, have been mapped or recorded (refer to **Appendix 14**).

3.3.2 Listed flora species

A total of 51 threatened plants, listed under the EPBC and/or the TSC Acts⁵ or presumed extinct occur within the landscape containing white cypress woodlands (refer to **Appendix 12**). These may occur either within the south-western cypress state forests, or within 10 kilometres of the cypress state forests. This constraint was imposed to capture species associated with the main areas of white cypress woodlands.

⁵ Most species are duplicated between Acts.

In summary:

- 46 are listed under the TSC Act – 78 per cent as vulnerable and 22 per cent as endangered
- 27 are listed under the EPBC Act – 63 per cent as vulnerable and 37 per cent as endangered
- 9 are either confirmed or presumed to be extinct (regionally in some cases)
- 3 are regionally extinct but not listed under either Act (Briggs & Leigh, 1996).

Within the south-western cypress state forests, 12 threatened flora species, listed under the EPBC (nine) and/or the TSC (12) Acts, have been mapped or recorded (**Appendix 14**).

3.3.3 Listed fauna species

A total of 78 threatened fauna species, listed under the EPBC and/or the TSC Acts or presumed extinct, occur within the landscape containing white cypress woodlands (**Appendix 12**). These may occur either within the south-western cypress state forests, or within 10 kilometres of the cypress state forests. Again, this constraint was imposed to capture species associated with the main areas of white cypress woodlands.

In summary:

- 73 are listed under the TSC Act – 81 per cent as vulnerable and 19 per cent as endangered
- 12 are listed under the EPBC Act – 75 per cent as vulnerable and 25 per cent as endangered
- 2 are either confirmed or presumed to be extinct (regionally in some cases)
- 2 are regionally extinct but not listed under either Act.

Within the south-western cypress state forests 45 threatened fauna species, listed under the EPBC (five) and/or the TSC (45) Acts, have been mapped or recorded (**Appendix 14**).

3.3.4 IUCN status

The threat status of each white cypress woodland type is drawn from the NSW Vegetation Classification and Assessment (VCA) database, which employs International Union for the Conservation of Nature (IUCN) threat status criteria including pre-European, extant and reserved area estimates, and current condition and land-use context.

The IUCN status for all white cypress vegetation types, and for all other NSWVCA types mapped within the south-western cypress state forests, is listed in **Appendix 13**.

Most of the vegetation types mapped within the cypress state forests of the central division are threatened (critically endangered, endangered or vulnerable) as a result of extensive removal of vegetation from the mid-1800s. Most of the threatened vegetation types include the eucalypt-cypress

woodlands which are likely to have dominated this landscape in the past.

Most types associated with cypress state forests in the western division have a lower threat status as the majority of their former extent remains intact, albeit in a modified state as a result of livestock grazing and invasive native scrub.

3.4 Condition of white cypress forests and associated woodlands

The condition of native vegetation at the time of colonial settlement is often used as a benchmark against which the current condition of vegetation can be assessed. The departure of a native vegetation type from its likely former structure provides an indication of the current condition of that type, or alternatively its level of disturbance.

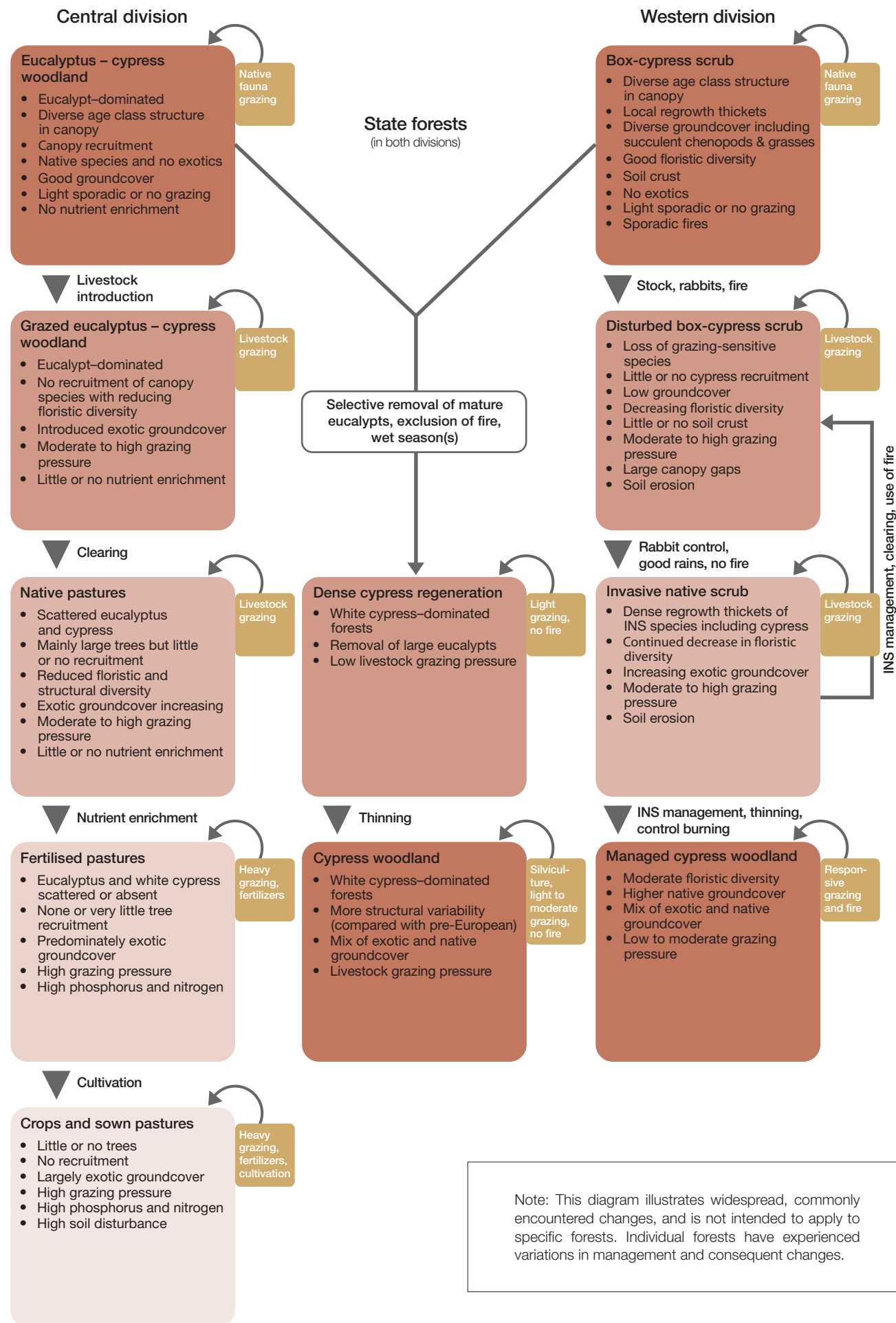
Relatively good condition native vegetation may still persist even where the landscape has been modified through livestock and feral animal grazing, invasion of exotic plants, invasion of native scrub, or changes in fire regimes. This is particularly so in the semi-arid rangelands of the western division where vegetation cover remains relatively intact.

However, where vegetation has been removed and replaced by other vegetation cover, for example in the cropland and exotic pastures of the central division, the level of disturbance is high and native vegetation condition is usually poor.

Compared with many other ecosystems, comparatively detailed information is available on stand structures in *Callitris-Eucalyptus* woodlands in the region at the time of European settlement. Evidence suggests these landscapes were predominantly woodlands (and woody scrub) dominated by eucalypt species, with white cypress as a sub-dominant species in eucalypt woodlands and as a locally dominant species in areas such as sand rises (Lunt et al., 2006; Jurskis, 2009). Historical land use decisions and management practices have caused these eucalypt-dominated woodlands to transition to either cypress-dominated types, or to form much smaller scattered patches of woodland surrounded by cleared agricultural landscapes.

⁶ Chapter 2 also provides a broader explanation on how the landscape has changed in the central and western divisions, including commentary on social and economic changes.

Figure 3.1: Generalised model of changes in vegetation over time for the white cypress woodlands in the central and western divisions



3.4.1 Vegetation change at the landscape scale

Figure 3.1 depicts a generalised model for ecological changes in vegetation states over time for the white cypress forests and associated woodlands in the central and western divisions. The south-western cypress state forests are found in both these landscape units.

In the central division, most of the original woodlands were cleared for pastoral development or cropping (Benson, 1991; Sivertsen &, 1995; Lunt et al., 2006). Isolated areas of woodland probably still exist in some nature reserves and travelling stock reserves, where clearing was not undertaken and where historical livestock grazing pressure has been relatively low (Lunt et al., 2006). However, the total area of these stands is likely to be very low. Most of the remaining woodland in this division has been moderately to heavily grazed by livestock over the past century, although stocking levels are now relatively low in state forests (Curby, 1997).

In the western division, vegetation change is strongly influenced by livestock and feral animal grazing, fire, past ringbarking in some areas and episodic events that have led to mass recruitment and regeneration of woody species (Iwaszkiewicz & Semple, 1988). Pre-European vegetation had a variable structure, containing a mosaic of grassy and shrubby areas, various canopy age classes, and areas of thick shrubby regrowth (Norris et al., 1991; Benson & Redpath, 1997; Lunt et al., 2001; Lunt et al., 2006). Increased grazing pressure by livestock and feral herbivores resulted in a reduction in ground cover, including grasses, forbs and chenopods, and minimal cypress regeneration. This condition was prevalent from 1890 to 1950 when rabbits proliferated in the absence of effective control measures (Johnston, 1967; Mitchell, 1991; Forests NSW, 2008b). However, the introduction of myxomatosis and an associated rabbit control program in the 1950s had a major impact on total grazing pressure (Forests NSW, 2008b).

With a number of wet seasons and continued cessation of fire, recruitment occurred across large areas of the western division, leading to extensive areas of regrowth or invasive native scrub (Lacey, 1972; Mitchell, 1991; Norris et al., 1991). This state can be reversed to more open and structurally diverse woodlands via invasive native scrub management including use of fire or clearing (Hassall & Associates et al., 2006). Alternatively, it can be transitioned to a managed white cypress-dominated woodland, through appropriate silvicultural and livestock grazing management (Hassall et al., 2006).

3.4.2 Vegetation change in south-western cypress state forests

Historical sources indicate that most areas currently occupied by south-western state forests were originally dominated (in terms of basal area and crown cover) by eucalypt species, with sub-dominant *Callitris* (Lunt et al., 2006) – referred to in this assessment as white cypress. White cypress-dominated systems with few eucalypts occurred in some areas, especially in drier regions (Allan, 1998) and on deeper sandy soils (Jurskis 2009). Nevertheless, the bulk of the state forests in the central division are considered to have been dominated by eucalypt species at the time of settlement (Lunt et al., 2006).

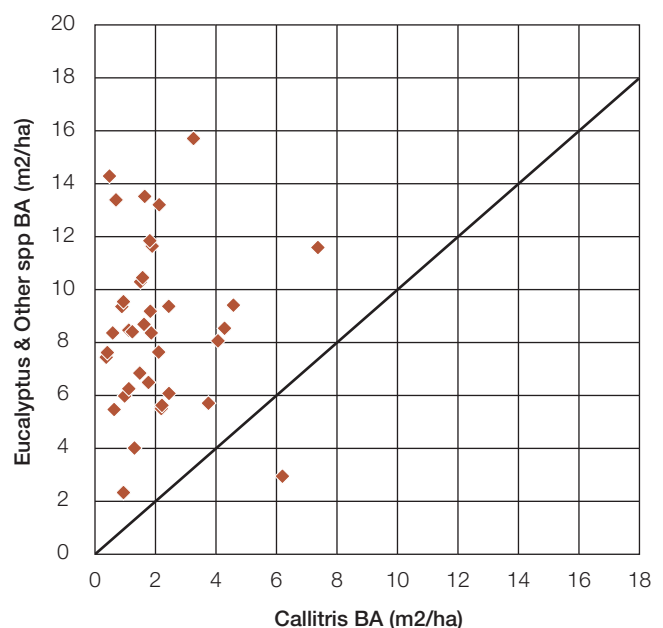
This section quantitatively assesses historical changes in stand structures in eucalypt–white cypress ecosystems (excluding other vegetation types) within state forests in the region, using data (from 39 sites) on historical stand structures from Lunt et al., (2006) and from comprehensive inventory plots (339 plots) of current stand condition collected by Forests NSW (2007). In both datasets, non-cypress species (for example *Allocasuarina*) have been grouped with eucalypts to allow rigorous comparisons with current data. Since both datasets were collected from state forests, this analysis is not necessarily transferable to other parts of the cleared agricultural landscape. The major proviso in interpreting the historical data is that the results represent minimum values, and actual values are likely to have been greater than the figures indicated here, particularly for eucalypts (Lunt et al., 2006).

At the time of colonial settlement, virtually all sampled areas in state forests were dominated by eucalypts, with lower proportions of white cypress, in terms of basal area and cover (Lunt et al., 2006). **Figure 3.2** illustrates the estimated basal area of white cypress and eucalyptus at the time of settlement (Lunt et al., 2006). When averaged across all sites:

- eucalypt species contributed 80 per cent of total stand basal area and 83 per cent of crown cover
- white cypress contributed 20 per cent of total stand basal area and 17 per cent of crown cover.⁸

These average figures hide considerable variation among sites (see **Figure 3.2**). Nevertheless, three main trends can be observed from the individual site records:

Figure 3.2.: Estimated basal area of white cypress and eucalypts at 39 sites at the time of settlement.



- Notes: a. Data shows minimum estimates
b. All points above black line were eucalyptus-dominated
c. From Lunt et al. (2006)

⁸ Based on 39, 1-hectare stands in 16 state forests. Site selection was biased in relation to current stand condition, but not in relation to historical stand condition. Data showed minimum basal area of each species and actual levels are assumed to have exceeded these values especially for Eucalyptus species as many eucalypt stumps were decayed.

Table 3.2: Comparison between white cypress and eucalypt species basal area in pre-settlement and current stands

	Average eucalyptus species basal area (per cent)	Average white cypress basal area (per cent)
Historical composition of woodland stand (Lunt et al., 2006)	80	20
Current composition of woodland stand (Forests NSW, 2007)	44	56

Notes: Other species (e.g. *Allocasuarina*) are grouped with *Eucalyptus* in both datasets, but make a minor contribution to figures.

- 97 per cent of sites were dominated by eucalypts at the time of settlement
- 92 per cent of sites had a eucalypt basal area greater than 5 square metres per hectare
- 95 per cent of the sites appeared to have a white cypress basal area less than 5 square metres per hectare (see **Figure 3.2**).

Analysis of recent inventory data provided by Forests NSW (unpublished data, 2007) shows that, when averaged across all plots, white cypress provided 56 per cent of the total basal area while eucalypts provided 44 per cent of the total basal area. Thus, this comparison confirms the long-known historical trend (Allen 1998; Lunt et al., 2006) for an increase in the proportion of basal area occupied by white cypress and a decline in the proportion of basal area occupied by eucalypt species in state forests since European settlement (see **Table 3.2**).

A comparison of the actual basal area (square metres per hectare rather than percentages) between pre-settlement and current datasets shows that on average the basal area

of eucalypt species has almost halved since European settlement, whereas the basal area of white cypress has more than doubled (**Table 3.3**). Since the historical data are thought to have under-estimated actual historical values, especially for eucalypts (Lunt et al., 2006), the real decline in eucalypt basal area may be greater than indicated in **Table 3.3**.

Broad historical changes in stand structure across state forests are well illustrated by comparing broad stand-structural categories between pre-settlement and current stands (**Table 3.4**). For example:

- 90 per cent of pre-settlement stands appear to have been dominated by eucalypt species (greater than 5 square metres per hectare) with little white cypress (less than 5 square metres per hectare)
- by contrast, only 24 per cent of current stands are in this category, and 65 per cent of current stands have very low basal area of eucalypt species compared with historical conditions (less than 5 square metres per hectare; see **Figure 3.1** and **Table 3.4**).

Table 3.3: Comparison of estimated white cypress and eucalypt species basal area in pre-settlement and current stands using different data sources

	Average eucalyptus species basal area (m ² /ha)	Average white cypress basal area (m ² /ha)
Historical composition of woodland stand (Lunt et al., 2006)	8.6	2.2
Current composition of woodland stand (Forests NSW (unpublished data, 2007))	4.6	4.7

Table 3.4: Proportion of stands in contrasting basal area categories in pre-settlement (black) and current times (red).

		White cypress basal area			
		<5 m ² /ha		≥ 5 m ² /ha	
Eucalyptus basal area	<5 m ² /ha	5%	35%	3%	29%
	≥ 5 m ² /ha	90%	24%	3%	12%

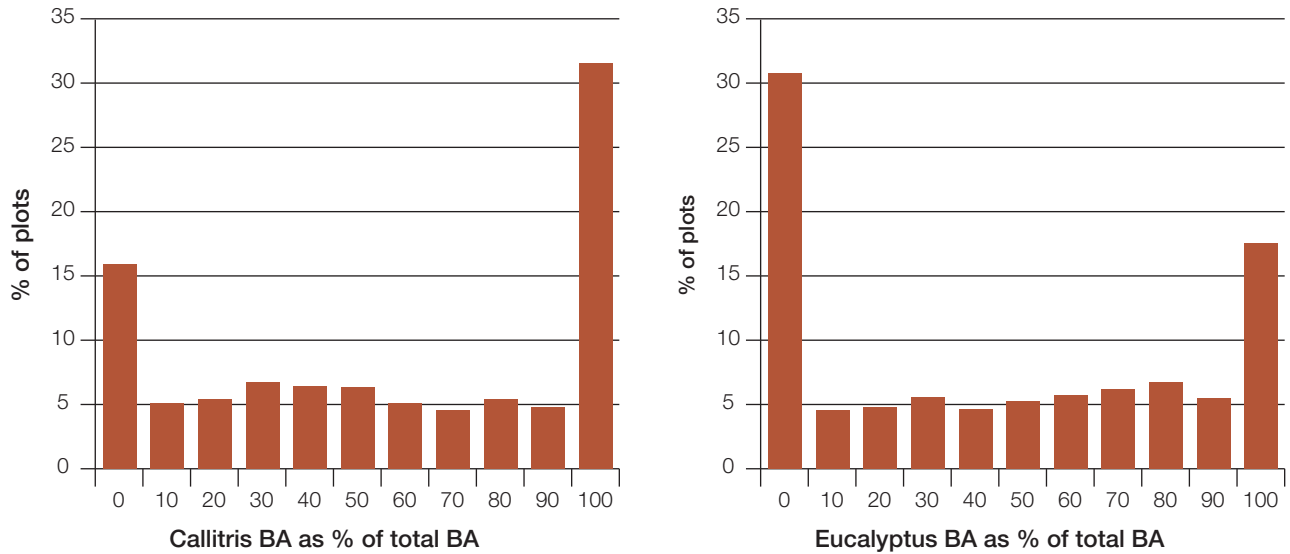
Notes: a. Category boundaries are based on pre-settlement patterns in **Figure 3.1**

b. Pre-settlement based on Lunt et al., (2006)

c. Current stands based on Forests NSW (unpublished data, 2007)

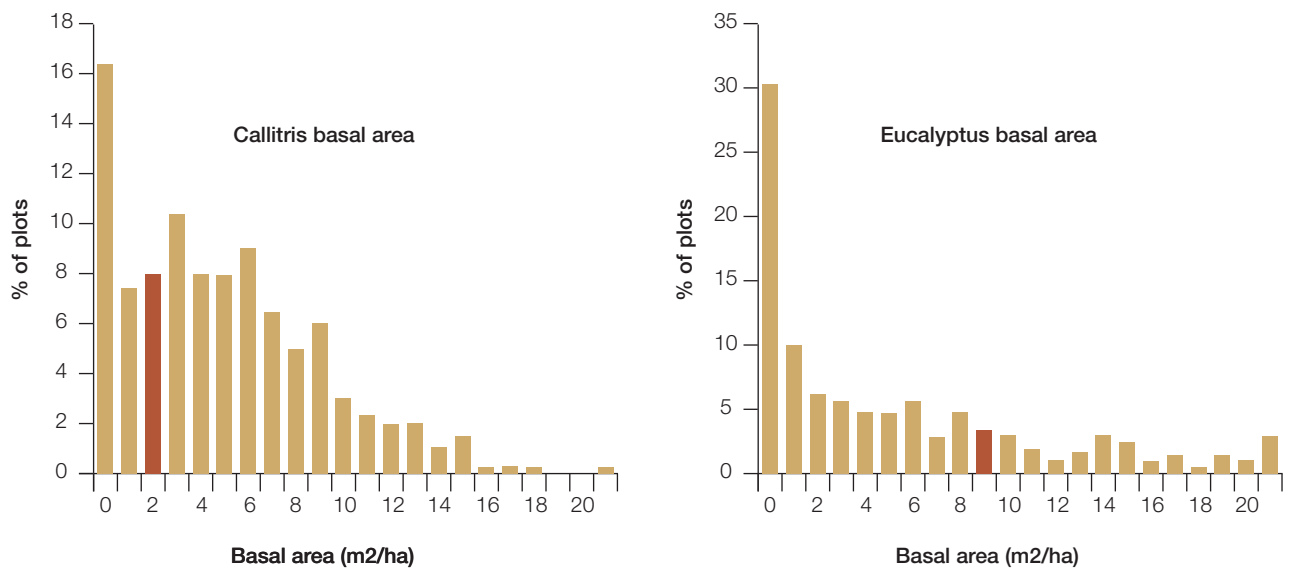
d. Figures do not add to 100% due to rounding

Figure 3.3: Percentage of inventory plots containing differing proportions of eucalypt species and white cypress basal area



Notes: Data source Forests NSW (unpublished data, 2007)

Figure 3.4: Percentage of inventory plots containing differing levels of basal area of eucalypt species and white cypress



Notes: a. Eucalypt values include other non-white cypress species
 b. Dark bars indicate average values for pre-settlement stands as shown in Table 3.3
 c. Data source Forests NSW (unpublished data, 2007)

Table 3.4 also illustrates that current stand structures in state forests are structurally more variable than in pre-settlement periods, owing to the presence of both eucalypt-dominated and white cypress-dominated areas, in contrast to a system that was primarily dominated by eucalypts at the time of settlement.

The historical decline of eucalypt representation in state forests is more strongly evident when individual plot data are examined (see Figures 3.3 and 3.4). For example:

- 32 per cent of current inventory plots, no eucalyptus basal area at all was recorded (small saplings too small to be recorded may have occurred)
- 38 per cent of the plots, white cypress basal area exceeded 80 per cent of total stand basal area.

3.5 Threatening processes and impacts

3.5.1 Vegetation clearance

According to the NSW VCA database, the majority of the prior extent of native woodland in the central division has been removed for development of the cropping and pastoral enterprises. This is well supported by other literature (Bauer & Goldney, 2000).

In contrast, much of the low native woodland and shrubland in the western division still persist but in a modified state. The key drivers for this change have been livestock and feral animals grazing pressure, changes to fire regimes and species behaving as invasive native scrub (Hassall & Associates et al., 2006). Most of the clearance in this division is relatively recent, occurring in the eastern Cobar Peneplain. However, there were also large areas of cypress woodland and other communities on the eastern Cobar Peneplain that were ringbarked in the late 19th century, and still evident until at least the mid-1980s (Allen, M, personal communication, 2010).

Table 3.5 contrasts the proportion of clearing of white cypress in the central and western divisions.

3.5.2 Livestock grazing

Historically, heavy livestock grazing has caused substantial damage to many Australian ecosystems (Noble & Tongway, 1983; Wilson, 1990; Lunt et al., 2007). More specifically, historical livestock grazing in white cypress forests and associated woodlands in central NSW has contributed to localised erosion, depleted grazing-sensitive plants and degraded ground vegetation (Prober, 1996), and prevented tree recruitment, including that of cypress (Lindsay, 1948).

Livestock grazing is permitted in Forest Management Zones 3 and 4 (see **Chapter 6**) in many cypress state forests. Livestock grazing is used in these zones to reduce ground fuel levels, protecting fire-sensitive cypress from fire, and provides a minor economic income. Current livestock grazing is carried out in accordance with a grazing strategy developed by Forests NSW.⁹ This strategy also includes a monitoring component to evaluate the performance of the strategy.

While Forests NSW's current grazing strategy undoubtedly reduces livestock grazing intensities below those historically

experienced, monitoring has not yet been undertaken to document the impacts of current livestock grazing levels on biodiversity values in cypress forests largely because of recent drought effects (although Forests NSW has suggested that biodiversity monitoring has recently commenced). Consequently, it is not possible to argue whether current levels of livestock grazing have benign rather than negative (or even positive) impacts on cypress forests. Similarly, inadequate information is available to suggest whether ecological condition of state forests is increasing, declining or remaining static following changes to historical livestock grazing levels.

In the absence of data from cypress forests, relevant insights may be obtained from the scientific literature on livestock grazing and conservation values. Notwithstanding the negative impacts on Australian ecosystems of historical heavy grazing by livestock, in different circumstances current livestock grazing regimes may have positive, neutral or negative impacts on environmental values (Lunt et al., 2007). Positive impacts are largely restricted to highly productive soils where livestock grazing may enhance small-scale vegetation diversity by reducing competition from dominant grasses. This mechanism is unlikely to occur in cypress forests in central NSW, owing to relatively low site productivities in most years.

Indeed, Spooner & Briggs (2008) found that fenced cypress stands on private property in central NSW had higher cover of native grasses, less bare ground and exotic weeds, and lower levels of soil compaction compared with unfenced and grazed stands on private land. While livestock grazing regimes on private properties in that study were likely to have been heavier than in many state forests, similar but less dramatic outcomes may be expected to occur in some state forests.

Consequently, there is little reason to suggest that livestock grazing may have widespread positive impacts on biodiversity or ecosystem functioning in cypress forests, other than – in specific times and places – through the potential mechanism of fire control. Given this paucity of information, the historical degradation of cypress forests by heavy livestock grazing, and the demonstrated improvement in vegetation condition in other cypress stands following livestock grazing removal, it is not possible to justify widespread grazing by livestock across state forests on solely ecological grounds, especially in listed threatened ecosystems.

⁹ Forests NSW (2006b) Grazing Management Plan 2006 - Western Region.

Table 3.5: Clearing statistics for white cypress types

Sub-region	Area estimates (ha) ^a		
	Pre-European	Current	% cleared
Central division	2,764,000	711,200	74
Western division (mainly Cobar Peneplain)	5,001,000	3,495,000	30
Total	7,765,000	4,206,200	46

Source: NSWVCA database

^a Includes total areas for cypress vegetation types represented in 11 IBRA sub-regions in central NSW, with ~ 35% error limits.

3.5.3 Fire

While many native flora species require fire to regenerate, white cypress is readily destroyed by fire (Cremer et al., 1990). Epicormic buds are found only in the living smooth bark of white cypress. In mature trees this smooth bark covers the finer branches and top of the main stem. In young trees (up to 2.5 centimetre diameter at breast height) it covers all branches and the main stem (Cremer et al., 1990). This smooth bark is readily killed by fire, meaning large trees with thick bark on the main stem and high crowns can tolerate light fires, but seedlings are killed by any fire. All trees are killed if the flames ignite their highly combustible crowns (Cremer et al., 1990).

The primary determinants of tree survival are fire intensity and length of time the fire burns the main trunk (Iwaszkiewicz & Semple, 1988). On trees over 40 years old, seed crops tend to be produced every three years or so, but are susceptible to fire both on the tree and on the ground (Cremer et al., 1990). Fire will reduce seed production for up to seven years after severe fire (Hawkins, 1966).

Cypress is much more sensitive to fire than eucalypt species and may be eliminated from eucalypt–cypress woodlands under severe burning pressure (Cremer et al., 1990). However, in the absence of fire, white cypress displays a greater capacity than eucalypt to regenerate from seed, so that cypress regrowth may become dominant. Grasses can be completely suppressed in dense regrowth stands, and cypress litter decays rapidly and does not accumulate as a fuel (unlike eucalypts). Therefore, fires may not be able to penetrate these stands, or may be of lower intensity compared with those in eucalypt or mixed cypress–eucalypt stands (Cremer et al., 1990). This understanding is supported by Lacey (1973), who observed that stands of white cypress naturally preclude low intensity fires by suppressing understorey plant cover and enhancing breakdown of litter.

Section 3.5.5 discusses the potential impacts of extreme fire events as a result of climate variability and change.

3.5.4 Activities that reduce spatial variability in vegetation structure of small forests

Spatial variability in vegetation structure makes a major positive contribution to biodiversity (see **Section 3.2.5**). This variability encompasses natural vegetation patterns (for example, mosaics of different vegetation types) and patterns imposed by human management, such as structural differences between different phases of the cypress silvicultural cycle (see **Figure 6.1** in **Chapter 6**). A major principle for sustainable forest management is to ensure that management creates spatially variable vegetation structures, in order to provide habitat conditions to benefit the broadest array of organisms (Fischer et al., 2006; Lindenmayer et al., 2006). This principle also underlies guidelines for invasive native scrub management on private and leasehold land (Hassall & Associates et al., 2006). Maintenance of spatially variable vegetation structures within each state forest is especially important in the small and fragmented state forests in cleared agricultural areas in the central division.

Prior to the commercial harvesting stage, stands in cypress state forests are dominated by increasingly mature, tall canopy trees with a relatively small understorey. After the commercial harvesting stage, stands are dominated by dense young cypress regeneration with emergent seed trees. From a conservation perspective, it is important to ensure that this

variability in stand structures is maintained within individual cypress state forests, particularly small and isolated forests surrounded by cleared farmlands. In cypress state forests that support a variety of vegetation types, including non-cypress types, this spatial variability will be maintained by natural vegetation patterns. By contrast, in cypress state forests that largely support production cypress–eucalypt forests, maintenance of structural variability is largely dependent on the retention of different phases of the silvicultural cycle within each cypress state forest.

The NRC considers it important that future cypress harvesting and thinning does not unduly reduce spatial variability in vegetation structure within each state forest.

3.5.5 Climate variability and change

Climate variability and shifts

South-eastern Australia has a highly variable climate. It can have inter-decadal shifts in both rainfall and temperature that can last for 40 or 50 years. In south-eastern Australia, a major shift to a wetter period took place around 1950 but there is evidence that the climate has again shifted to lower rainfall and higher temperatures than the long-term average (Garnaut, 2008).

European history of Australia is marked by repeated references to periods of drought. Pigram (1986) found that widespread droughts occurred in Australia in 1864–68, 1880–88, 1895–1903, 1911–16, 1918–20, 1939–45, 1957–58, 1965–68 and 1979–83. Khan (2008) explored similarities between past and present droughts in the Murray–Darling Basin and found that the most severe and prolonged drought in earlier times was between 1895 and 1903. This was the ‘Federation drought’, which affected most of Australia and led to the 1901 Royal Commission that investigated the conditions in the western division. The current drought appears to have some similarity in pattern and longevity to that of the Federation drought, with a monsoonal influence in early 2010 providing some of the best falls of rainfall in southern NSW for over a decade.

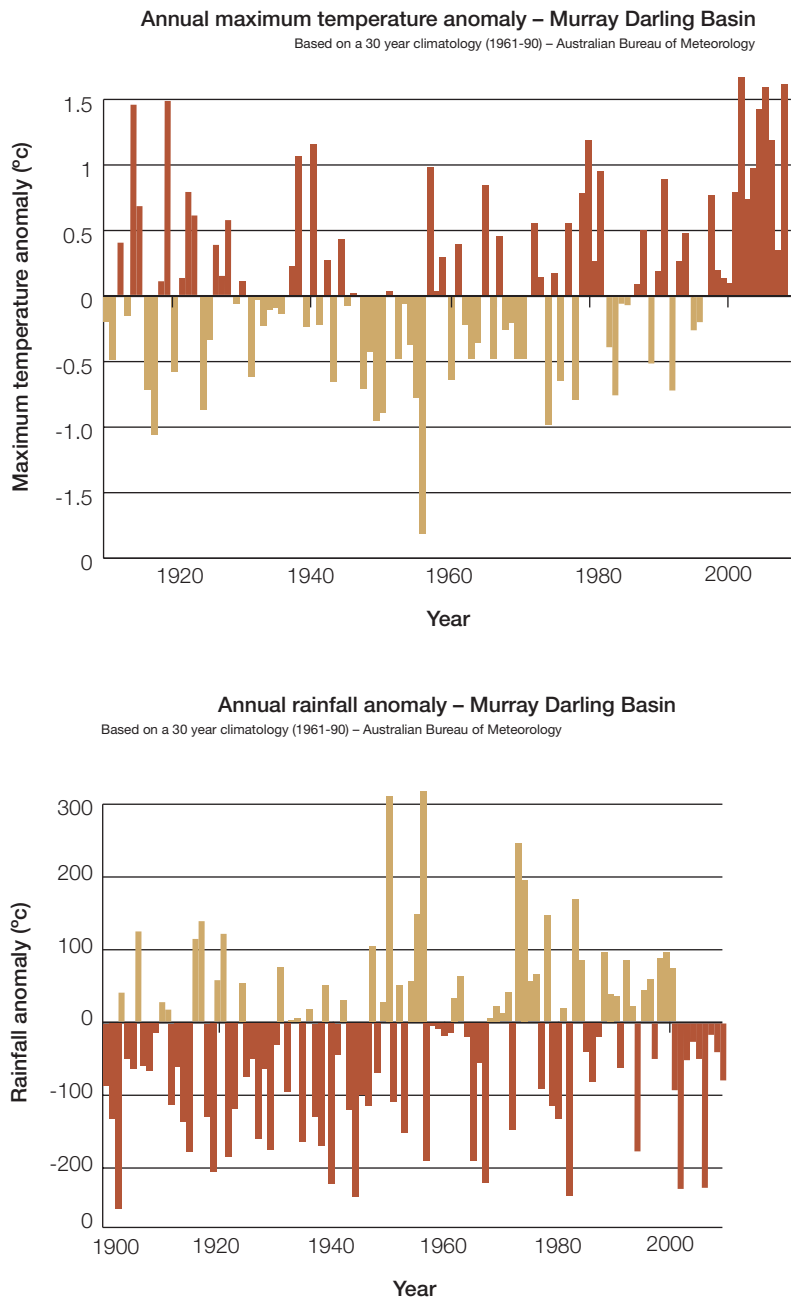
Many agencies are working to identify whether the observed rainfall and run-off patterns are part of an extended drought, or a shift to a lower average pattern similar to that which has occurred in the past. This form of climate shift is known as a climate ‘step change’ and is demonstrated in **Figure 3.5**, which shows a clear step increase in annual maximum temperature since 2000, and a less dramatic step decrease in annual rainfall over the same period. When examining historical changes to the NSW climate, a cool or even exceptionally hot month or year is less important than a multi-decadal trend (NRC, 2009).

Climate change

In 2007 the Intergovernmental Panel on Climate Change (IPCC) released its fourth assessment report, concluding that:

- warming of the climate system is unequivocal
- humans are very likely to be causing most of the warming that has been experienced since 1950
- it is very likely that changes in the global climate system will continue well into the future, and that they will be more significant than those seen in the recent past (IPCC 2007).

Figure 3.5: Temperature and rainfall anomalies in the Murray Darling Basin (1900–2008)



Source: <http://www.bom.gov.au/cgi-bin/climate/change>

These changes have the potential to have a major impact on human and natural systems throughout the world, including Australia, from both an ecological and commercial viewpoint.

The IPCC has developed a range of emissions scenarios to project future climate change. According to these scenarios, the temperature in central-west NSW is forecast to increase by 1–1.5°C for the projected 2030 summer for the 50th percentile, the midpoint of the model results, which provides a best-estimate result. However, the rate of global emissions growth since 2000 has been greater than for the most fossil-fuel intensive of the IPCC’s emission scenarios. The Garnaut Climate Change Review concluded that all of the IPCC’s emissions scenarios may underestimate the future growth in emissions in the early 21st century (Garnaut, 2008). Analysis of global mean surface temperatures also shows that the rate of warming is in the upper range of the IPCC’s climate projections.

Likely impacts of climate change on white cypress forests

There is evidence that the impacts of climate change on Australia’s biodiversity are already discernible at the genetic, species, community and ecosystem levels. The threat to Australia’s biodiversity is expected to increase sharply through the 21st century and beyond, due to the growing impacts of climate change, the range of existing stressors on biodiversity and the complex interactions between them (Commonwealth of Australia, 2009).

In 2009, the DECCW held expert panel assessments of the likely changes in biodiversity as a result of projected climate changes in NSW. The expert panel identified a number of potential impacts on biodiversity and ecosystem function (Table 3.6).

Table 3.6: DECCW expert panel assessments of likely changes in biodiversity in NSW

Impact	Comment
The structure, composition and function of ecosystems are likely to change	All ecosystems in NSW, even the most hardy and resilient, are expected to alter in response to climate change. The structure of ecosystems will be influenced by changes in fire regimes and hydrological flows. Changes in species' distributions and abundances will alter the composition of ecosystems.
Distributions of individual species are likely to change	The distribution of individual species is likely to shift in latitude and altitude in response to increased temperatures. Drier conditions over much of the west of NSW, as well as a shift in seasonal patterns of rainfall in the south-west are likely to cause range contraction in a number of species.
Changes in fire frequency and intensity are likely to have widespread impacts	Larger and more intense fires are likely to extend in the future into infrequently burnt wet forests and refuges such as canyons that are protected by their topography, changing forest structure and composition. Species that are highly sensitive to fire are likely to disappear, while those that depend on old or dead hollow-bearing trees and woody debris are likely to have fewer habitats. Small patches of fire-sensitive ecosystems in a matrix of extensive drier vegetation are most at risk. More extensive fire combined with drought stress is likely to decrease the flowering of plants such as banksias and eucalypts in dry forests and heaths, impacting on nectar-feeding animals.
Changes in invertebrate populations are difficult to predict but are likely to be substantial	Invertebrates have many functions in ecosystems – for example as pollinators, predators, herbivores, detritus feeders, disease vectors, biological controllers of pests, and food for other organisms. Invertebrate ecology and population dynamics are likely to change greatly, with consequences that are likely to be substantial but are generally hard to predict from current knowledge. Changes are already apparent in some of the better known and more significant invertebrates, such as the plague locust <i>Chortoicetes terminifera</i> . Breeding adults of this species were observed as early as July in 2008, and the species is expected to benefit from warmer and wetter summers and warmer night-time temperatures.
Rainfall decline and reversed seasonality are likely to cause major changes in the Murray Valley	The Riverina and Murray Valley are very likely to suffer major ecological changes as a result of reduced annual rainfall, a shift in rainfall seasonality from winter to summer dominance, declining overall river flows and a loss of spring snow-melt (DECCW, 2009b). Species adapted to 'Mediterranean' conditions (wet winters and hot, dry summers) are likely to be displaced or lost. Floodplain and wetland species that have already declined dramatically over the past decade are likely to decrease further. Many ecosystems are likely to collapse.
Species and ecosystems that are stressed by other factors are less likely to resist climate change	Many Australian ecosystems and species have evolved in highly variable climates and consequently are likely to have some capacity to resist expected climate changes. However, many ecological communities and species in NSW have declined severely because of land clearing, water extraction, habitat fragmentation, livestock grazing and introduced pests. Species and ecosystems that are stressed by non-climatic factors are less likely to be resilient to climate change impacts.

Source: NRC (2009)

Each of the issues identified in **Table 3.6** is relevant to white cypress forests and associated woodlands in the central and western divisions. However, the NRC considers the level of impact on these widespread forests is likely to be less than ecosystems which possess a narrow environmental range, or those which are directly dependent on floods.

The major threat that climate change poses to white cypress forests is probably extreme dryness and associated wildfires, and constraints on species migration between isolated forest patches in the cleared agricultural landscapes of the central division.

Prolonged dryness

The natural occurrence of the white cypress forests extends from central Queensland to Victoria, with extensive stands in most parts of the central and western divisions. Most of the distribution is within the warm sub-humid to warm semi-arid climatic zone. Within this zone, mean maximum temperatures of the hottest month range from 29–33°C and mean annual

rainfall varies from 380 millimetres to 750 millimetres (Boland et al., 1992), although the species tolerates areas of lower rainfall (Thompson & Eldridge, 2005b).

Evidence suggests that mortality of cypress attributed to periods of low rainfall is infrequent, as the trees are able to produce feeder roots and exploit subsoil moisture (Johnston, 1975). However, the species is susceptible to extended periods of low rainfall and drought (Thompson & Eldridge, 2005b), and significant mortality can occur with severe, prolonged drought (Hawkins, 1966; Lacey, 1972, 1973; Attiwill & Clayton-Greene, 1984; Fensham & Holman, 1999; Harris et al., 2003; Harris & Lamb, 2004). Moisture stress leads to a reduction in crown density, desiccation of bark, cracking of smaller branches, and eventual splitting of bark and wood (Iwaszkiewicz & Semple, 1988). Extended dry periods may also reduce the frequency of seedling recruitment. The risk to long-term sustainable cypress yields due to prolonged droughts is discussed in **Chapter 5, Section 5.2.5**.

This natural variation also suggests that the species is adaptable to a range of climates, and may be able to cope with the expected transitions to a hotter climate over coming decades.

While cypress may prove relatively resilient to extended dryness, many other species of plants and animals in white cypress forests and associated woodlands may experience significant changes in distribution and abundance as global warming intensifies. For instance, Mac Nally et al., (2009a) reported dramatic declines in eucalypt flowering during the recent drought period, and declines in the abundances of all groups of birds since the mid-1990s, with virtually no bird breeding in the most recent survey periods. The authors attributed declines in bird populations to low breeding success due to reduced food availability. Similar impacts are expected under ongoing global warming (Mac Nally et al., (2009a). Other organisms such as frogs are likely to experience similar declines (Mac Nally et al., 2009b).

Extreme fire events

Periodic fire was a natural phenomenon in white cypress forests and associated woodlands and played an important role in shaping the evolution, functioning and structure of these systems (Iwaszkiewicz & Semple, 1988). Suppression of fires following European settlement altered the floristics and structure of the community, with reduction in density of the grassy groundcover, and increase in density of shrubs, including white cypress (Iwaszkiewicz & Semple, 1988).

The impact of climate change on fire regimes in cypress forests is difficult to predict. While high temperatures and drier fuels may lead to more intense fires, slower rates of fuel accumulation (especially of fine grass fuels) may lead to less frequent fires (Bradstock, 2010). In the western region, large fires predominantly occur following wet years, when abundant grasses provide continuous fine fuels. Sparse ground fuels in intervening years prevent major fires from occurring (Harrington, 1979; Hodgkinson & Harrington, 1985).

Future fire regimes in this region, and across all tenures, are likely to reflect the frequency of wet 'big grass years', which is difficult to predict at present. Any identified fire risks during these periods may be reduced through strategic fuel management activities. Climate change impacts on fire regimes may also differ greatly between the extensive areas of native vegetation in the western division and the fragmented forest patches in the central agricultural zone. The high degree of isolation of many cypress forests in the agricultural region is likely to protect these forests from landscape fires, as it has over the past century, unless surrounding land uses change substantially.

3.6 Assessing environmental values and key threats

The NRC has largely assessed the south-western cypress state forests within their broader landscape context as they are part of an integrated socio-ecological system (**Chapter 2**). However, the NRC has drawn on the best available information to profile each of the 197 state forests, to assess their potential environmental values and their vulnerability against some particular threats (as described in **Section 3.5**).

Many of the state forests are smaller than 1,000 hectares and are scattered across south-western NSW. The environmental values of the south-western cypress state forests are related to both their place in the surrounding landscape, their internal structure, heterogeneity and condition, and the flora and fauna (including threatened species) they support.

3.6.1 Cypress state forest profiles

Appendix 16 (and Supporting Map Book) represents the best available information for each of the 197 south-western cypress state forests covered by this assessment. Each profile describes the:

- area of the forest in hectares
- vegetation composition
- proportion of forest management zoning
- proportions of endangered ecological and IUCN vegetation communities
- threatened species reordered both within each state forest and a 10-kilometre radius.

At the time of this assessment, there was no high-resolution mapping for south-western cypress state forests, except for some of the cypress state forests in the Riverina area. Instead, the NRC developed a composite map¹⁰ to provide a landscape perspective on the extent and location of the white cypress forests and associated woodlands. As such, the reliability of the profile mapping for each forest varies. This is because the mapping datasets used to develop the composite map were based on different methods, approaches and constraints.

Acknowledging these limitations, the NRC considers the information developed for this assessment provides a useful and practical starting point to consider management options and a platform for future research to better understand the function of these forests, both at a patch and landscape scales.

¹⁰ Shown in **Figure 2.1**, its methodology explained in **Appendix 11** and the statistic breakdowns for vegetation composition in each state forest shown in **Appendix 16**.

3.6.2 Values and threats

The NRC considers that the contribution of the south-western cypress state forests to biodiversity conservation is best assessed by documenting their contribution to landscape functionality rather than scarcity values alone, and managing the current threatening processes using the attributes described below.

The NRC has used a range of well established criteria¹¹ and best available information to identify the potential landscape function value of each south-western cypress state forest, and potential threats to these values.

Based on the analysis, the NRC has identified a list of south-western cypress state forests that potentially have high landscape function value (See **Appendix 22**). For example, these forests are relatively large, are likely to aid faunal movement through the landscape and have potentially good structural and floristic diversity. **Chapter 6** identifies a range of management objectives and principles that should address threats and ensure all the south-western these state forests continue to provide important landscape functions once they are codified into an IFOA.

However, the NRC has identified some cypress state forests that may be vulnerable to disturbances such as livestock grazing and timber harvesting, and warrant immediate management attention in the absence of an IFOA. These cypress state forests and suggested management actions are presented in **Chapter 6**.

3.6.3 Methodology

Information sources used in the analysis included the NRC's composite and connectivity mapping undertaken for this assessment, advice from agencies and submissions.

Appendix 22 describes the methodology used to identify the landscape function value for each state forest, and those that may be particularly vulnerable to disturbances such as livestock grazing and timber harvesting in small isolated forests. Broadly, the analysis included:

- assigning scores to a set of key ecological parameters and criteria, including vegetation mosaics, habitat patch size and broad land tenure, proximity to an identified corridor and the presence or absence of endangered ecological communities
- weighting and summing the scores to give each forest a simple ecological significance score
- calibrating and adjusting these scores against other advice provided from agencies and stakeholders
- applying simple decision rules to identify state forests that may be more vulnerable to grazing and harvesting.

Section 3.6.2 explained some of the limitations in the NRC's composite mapping and therefore its use in this analysis also has its limitations. The NRC conducted a rapid ground-truthing exercise of its mapping data at 70 sites across 29 forests and found that 70 per cent of the sites showed a reasonable correlation between its mapping data and vegetation units in the field – white cypress-dominated and associated woodlands. However, there were weaker correlations with finer resolution features such as endangered ecological communities.

¹¹ For example, composition of vegetation communities, patch size and associated vegetation, connectivity and threatened vegetation communities.



Chapter 4

Cultural, social and economic values

4.1	Overview	56
4.2	Identifying values and uses	56
4.3	Indigenous cultural values and heritage	57
4.4	Non-Indigenous cultural values and heritage	60
4.5	Social and economic values and uses	62
4.6	Communities linked to the south-western cypress state forests	70
4.7	Community capacity to adapt to change	72



4.1 Overview

The south-western cypress state forests support the cultural and heritage values of local Indigenous and non-Indigenous communities. Relationships and interactions between local people and these forests have shaped both the physical forest landscapes and the cultural identity and values of local communities. These forests, and the structures and relics within them, often provide an important physical link to the way of life of earlier generations.

There are a range of socio-economic values and uses attached to the south-western cypress state forests. Productive cypress forestry is a significant economic activity, while other productive uses (such as livestock grazing, apiary and broom bush harvesting) also contribute to and diversify local economies. A number of communities have links to south-western cypress state forests through the cypress timber industry. These forests are also valued at a local level for non-commercial uses, including recreation, hunting and nature-based activities.

This chapter supports **Step 2** of the analytical framework by:

- describing a range of Indigenous and non-Indigenous cultural heritage values associated with the south-western cypress state forests
- describing a range of social and economic values and uses of the cypress state forests
- identifying which communities have significant linkages to the cypress state forests, and assessing the relative capacity of those communities to adapt to change.

Key findings of this chapter are:

- There are many places in the south-western cypress state forests of cultural and historical importance to Indigenous people. Indigenous concerns include ongoing access to these forests, employment opportunities and improving communication about the cypress state forests.
- There are also non-Indigenous heritage values associated with the cypress state forests and the cypress timber resource. The cypress state forests contain structures and relics that provide insight into past activities in and around the forests, including livestock grazing, sawmilling, surveying and mining.
- A range of socio-economic values and uses are associated with the cypress state forests. This includes timber harvesting and milling, forest management, apiary and livestock grazing. There appears to be little tourism associated with the cypress state forests, but some forests have localised values and uses, for example hunting and other recreation and nature-based activities.
- Several communities have links and dependencies on the cypress state forests. Narrandera and Condobolin have the strongest linkages as they are the two communities in which key mills are based. Baradine also has a direct, though less significant, link to the south-western cypress state forests. These three communities may have a low capacity to adapt to change.

4.2 Identifying values and uses

The relationship between communities and forests is complex and diverse. There is a body of research focused on defining concepts of resource dependence and 'sense of place' associations for communities linked to a resource. The NRC considered these concepts when identifying the cultural heritage and socio-economic values, connections and dependencies described within this chapter.

4.2.1 Forest dependence

Communities may be dependent on forest resources in many ways. Forest dependence may stem from the presence of forest-based industries, or their employees, within the town. Additionally, communities may become dependent on forests through expenditure or service provision relating to these industries.

Measures of a community's dependence on natural resources have typically used simple indicators, such as the level of employment in the resource sector (Beckley & Sprenger, 1995). Other measures are based on broader, multi-dimensional indicators of dependence. For example, forest-dependent communities can include those that are immediately adjacent to forests, as well as those dependent on forest-based industries, such as tourism, and timber and non-timber forest product industries (Kusel, 2001). Changes in timber resource availability can also indirectly affect local and regional businesses, social services and other people not involved in timber production, (Cramer et al., 1993). These indirect effects can occur both in the towns in which primary production and resource processing takes place, as well as in the surrounding communities located in the same areas of trade and social services provision.

Section 4.6 outlines the NRC's definitions of directly and indirectly linked communities, and identifies communities with links to the south-western cypress state forests.

4.2.2 Sense of place

Community attachment to forests may also exist in the absence of an economic relationship with the resource, particularly when the forests are part of a human 'sense of place' through their aesthetic, symbolic and locality-based importance (Kusel, 2001). 'Sense of place' is the meaning and importance of a setting held by an individual, group, or community. It is based on individual or collective experience with the setting and its association with social relationships, emotions and thoughts (Stedman, 2003). As a place, forests can represent "an expression of communally held beliefs and values and of interpersonal involvements" (Relph, 1976).

Many communities may have a historical or cultural association with a natural resource rather than just a direct economic dependency on a resource. For example, many Indigenous communities are not economically dependent on a natural resource but have a strong association with the land. Similarly, communities may have an attachment to forests through a past tradition of forest management and harvesting, or through their appreciation of aesthetic values. As a playground, sacred place or resource, a forest "supports local residents and contributes to the definition they have of themselves and their understanding of who they are" (Kusel, 2001, p. 371).

Research on regionally significant places indicates that place meanings are more commonly reported for locations in close proximity to places of residence (Coakes, Fenton & Gabriel, 1999; Commonwealth of Australia, 1998, 1999a, 1999b, 2000). This suggests that a 'home-range', with associated meanings and values, exists around specific towns and communities. For example, long-term residents of Tottenham were known to have a strong sense of forest ownership, viewing the Tottenham State Forest as an extension of the township. This is thought to be less pronounced in recent generations (Allen, M, personal communication, 25 March 2010).

Given the state forests under assessment are relatively small and scattered, each forest is likely to be valued on a local scale by residents of nearby communities.

4.3 Indigenous cultural values and heritage

Landscapes, including landforms and sites, are intrinsically important to Indigenous people. The south-western cypress state forests, while small, represent components of an overall cultural landscape of interest to Indigenous communities. **Chapter 2** described some of the historical connections between Indigenous people and the forests in the area, and identified the Indigenous nations in the area.

Indigenous people are best placed to determine the significance of different landscapes and sites to their cultural heritage. Recognising this, the NRC contacted Indigenous organisations near the south-western cypress state forests to inform them of the assessment and to seek their insights on the cultural heritage significance of these forests. The NRC also sought their views on the communities' ongoing links with and uses of the forests. **Chapter 1** lists the Local Aboriginal Land Councils (LALCs), traditional owner groups and other Indigenous groups the NRC contacted.

In general, the Indigenous organisations indicated that there are many important sites in the south-western cypress state forests and that the forests themselves are important as part of a broader cultural landscape. Indigenous concerns include ongoing access to forests, employment opportunities and increasing efforts to survey and protect cultural heritage sites in the forests. There was broadly low awareness of some of the smaller forests. Where a relationship exists with Forests NSW, it is generally constructive.

The NRC recognises that the time frame for the assessment has limited the extent of its consultation. Further consultation would enable a more comprehensive understanding of the Indigenous cultural values and connections to the forests.

4.3.1 Access to public lands

The Indigenous organisations contacted during the assessment identified access to the forests as a priority issue. As discussed in **Chapter 3**, the south-western cypress state forests in the central division exist within a largely cleared landscape. Consequently, state forests and other public lands frequently represent areas that still hold Indigenous cultural values. In surrounding cleared areas, significant places have often been either removed or damaged, or are alienated from Indigenous people.

For Indigenous people, land use activities are often restricted to forestry areas and other accessible public lands including travelling stock reserves, national parks and lands owned by land councils (RACAC, 2002). Caring for 'Country' and spending time fishing, collecting bush foods and hunting are important ways for Indigenous people to continue practising their culture.

The south-western cypress state forests represent over 50 per cent of the publicly accessible land in the LALC areas of Condobolin, Narrandera and West Wyalong (Ridges, 2009). In Narrandera, West Wyalong and Condobolin the state forest contribution to public land is respectively 68.5, 61.2 and 55.8 per cent. Therefore, cypress state forests in these LALC areas are likely to be important areas for continuing cultural activities. **Appendix 21** provides further details of the cypress state forests' contribution to public land in the relevant LALCs.

Forests NSW has policies, plans and operational guidelines on how to manage cultural heritage and work with local Indigenous communities. With respect to providing access to the cypress state forests, Forests NSW's (2008a; 2008c) *Ecologically sustainable forest management plans* encourage staff to support proposals from Indigenous communities to use the cypress state forests.

4.3.2 Participation in land management

It is appropriate for Indigenous people to identify areas with culturally important values. Therefore, it is important to foster opportunities for their involvement in land management. From the NRC's consultations it appears that Forests NSW is involving local Indigenous communities in managing the south-western cypress state forests.

The NRC understands that a memorandum of understanding is being developed between Forests NSW and the Lachlan Aboriginal Natural Resources Management Group (Hill, R, personal communication, 2 March 2010). The intention of the memorandum of understanding is to foster a cooperative relationship between Forests NSW and the local Indigenous community and to outline the arrangements for access to ten state forests. This access arrangement will make cultural activities, such as cultural heritage camps, bush tucker collection and mosaic burning, possible. The creation of the memorandum of understanding is a positive step and reflects the NSW Government's intention for organisations to work more collaboratively, as articulated by the Two Ways Together policy (NSW Government, 2003).

4.3.3 Employment opportunities for Indigenous people

Indigenous people have been involved in the timber industry from the early colonisation of NSW, with the first cedar cutters moving into the Shoalhaven region in 1819 (Feary, 1988). Today, the timber industry remains a major employer of Indigenous people on the far south coast (Feary, 1988), the Riverina (NRC, 2009) and in other parts of NSW.

Within the cypress timber industry, Grants Holdings noted in their submission that they employ a number of Indigenous staff. Further, Narrandera Shire Council's submission suggested that employment of Indigenous people in land management industries such as forestry is effective due to Indigenous people's strong ties to the land.

In a submission on behalf of the Wiradjuri Elders of Condobolin, Elder Mrs Bonnie Merritt wrote about the importance of maintaining the current levels of Indigenous employment in cypress timber industries. The Wiradjuri Elders of Condobolin are concerned about the low participation and retention rates of Indigenous people in the timber industry. They saw increased Indigenous employment levels in the cypress timber industry as a way to:

- enhance individual financial security, which in turn helps local and regional economic independence and development
- encourage further employment opportunities and
- contribute to reconciliation and increased Indigenous cultural understanding within the industry (Merritt, 2010).

The Lachlan Aboriginal Natural Resource Management Group indicated that they have had discussions with Forests NSW about potential employment opportunities for young Indigenous people, as well as for experienced persons who could perform cultural heritage survey and monitoring work.

4.3.4 Recorded Indigenous heritage sites

A common concern expressed by the Indigenous organisations the NRC contacted was the need for appropriate protection of sites and increased surveying. While culture is by no means limited to sites, they provide a meaningful connection to the past and provide an indication of connections to Country.

The NRC sourced information about recorded sites from the Aboriginal Heritage Information Management System (AHIMS) database and Forests NSW's *Environmental impact statement for harvesting and associated roadworks of south-western NSW* (DPI, 2009).

AHIMS information is held across tenures. A limitation of AHIMS data is that only 1 per cent of the total corresponding area has been surveyed.¹ In our consultations with Local Aboriginal Land Councils (LALCS) the NRC heard of many culturally significant sites that were not recorded on AHIMS.

¹ For the purposes of modelling the AHIMS information, an area including the 16 Interim Biogeographic Regionalisation of Australia sub-regions where south-western cypress state forests occur was used.

Table 4.1: Description of Indigenous heritage site features

Site features	Description
Indigenous ceremony and Dreaming	Places where no physical evidence of previous use of the place may occur. Such places include natural features, ceremonial locations, creation stories, and birth/marriage/burial places.
Art	Visual images created on rock surfaces in rock shelters or on rock platforms. Includes images created using pigments or through engraving.
Burials	Location where Indigenous people were buried and/or where human remains have been found.
Grinding grooves	Grooves formed by rubbing stone, wood or bone pieces on a rock surface during implement manufacture or re-sharpening.
Habitation structure	Structure produced by, or for, Indigenous people for short- or long-term shelter.
Hearth	A fireplace or campsite represented archaeologically by concentrations of charcoal, ash and/or hearth stones or discoloured/burnt earth.
Modified tree	Tree carves are usually associated with burials, ceremonial or territorial markers. Scarred trees usually result from bark/wood removed to make tools or create footholds to climb the tree.
Open campsites (artefact scatters)	These sites are represented by scatters of stone artefacts lying on the ground surface. The remains of fire hearths may also be associated with the artefacts. They are almost always located near permanent or semi-permanent water sources.
Potential archaeological deposit	An area where surface artefacts may have been identified or where sub-surface artefacts/cultural materials are thought likely to occur.
Shell	Places where shells from beach, estuarine or river species have accumulated as a result of Indigenous gathering and food consumption.
Stone arrangement	Humanly arranged stones or rocks, which form lines, circles. These are associated with ceremonial activities, or used as markers for territorial limits or to mark/protect burials.
Stone quarry	Location from where stone has been removed by Indigenous people from a stone raw material source for use in the production of stone tools.
Waterhole	Natural/human-made cavities where fresh water could be obtained. May have had ceremonial or Dreaming significance and/or may also be used to the present day as a rich resource-gathering area.



Modified tree

As one example, Trangie LALC advised that there are a number of modified trees in Gin Gin State Forest that are culturally significant. Further, as explained to the NRC:

Sites occur across the landscapes. There are generally lots of sites near waterways, waterholes and rivers because that is where the people were. In high rocky country you'll often find ceremonial sites because of the high vantage points and sandy country is likely to contain burials. (Rebecca Shepherd, Condobolin LALC, personal communication).

Table 4.1 describes the different types of Indigenous heritage sites.

Of the areas surveyed within the forests listed in **Table 4.2**, there are a total of 82 sites recorded on the AHIMS database. The information from Forests NSW's *Environmental impact statement for harvesting and associated roadworks of south-western NSW* (DPI, 2009) is shown in **Table 4.3**.

Forests NSW's (2006) operational guidelines for Indigenous cultural heritage management include prescriptions for forestry activities to protect Indigenous sites, relics and places. Before a forestry operation begins, a heritage inspection and report should be completed. In addition a buffer of 10–50 metres around Indigenous sites is required.

The available information indicates that there is representation of Indigenous ceremony and Dreaming, habitation, stone arrangements and waterhole sites in the south-western cypress state forests (Ridges, 2009).

Of the surveyed areas within the listed cypress state forests, Binya State Forest has the highest number of sites. Of these sites, half are modified trees. Modified trees are trees that show the removal of trunk bark for the production of shields, canoes, boomerangs, burial shrouds, medicine and foot-holds. Trees were also marked in this manner to identify a significant landmark (DECCW, 2005).

Table 4.2: AHIMS recorded Indigenous heritage sites in some of the south-western cypress state forests

State forest	Number of sites
Back Yamma	7
Bendick Murrell	1
Bimbi	7
Binya	56
Bretts	2
Gunning Gap	1
Jerilderie	2
Merri Merri	4
Strahorn	1
West Cookeys Plains	1

Table 4.3: Recorded Indigenous heritage sites in Forests NSW's *Environmental impact statement for harvesting and associated roadworks of south-western NSW*

State forest	Number of sites
Back Yamma	7
Bendick Murrell	1
Bimbi	10
Binya	57
Momo	1

Indigenous communities are keen for greater surveying and protection of sites. Of all the types of sites found in the central and western divisions, ochre and stone quarries are generally less represented on public land. It is therefore harder for Indigenous communities to access ochre and stone quarries (Ridges, 2009). For this reason, if ochre and stone quarries were identified within the cypress state forests, they are likely to be significant sites requiring particular protection.

The West Wyalong LALC is working with DECCW and Forests NSW to protect a culturally significant site within the Manna State Forest. The site contains evidence of grinding grooves and will be an important location for local school groups learning about Indigenous culture. The NRC understands that DECCW has been involved in fencing, and previously Forests NSW assisted with the creation of fire breaks (Hampton, L, personal communication, 21 April 2010). This project is a positive collaboration project between agencies and the local Indigenous community.

4.3.5 Predictive mapping to identify cultural significance

While sites are important to Indigenous people, in recent times this has been balanced with recognition that landforms and landscapes are equally important (RACAC, 2002). The Aboriginal Sites Decision Support Tool uses predictive landscape mapping to describe potential distribution of sites across the whole landscape. It is increasingly being used for regional planning by DECCW and LALCs and provides a meaningful context to enable broader protection of cultural values through strategic, rather than site-based, management (Ridges, 2009).

Indigenous cultural heritage has been affected by cumulative impacts across the landscape. Modelling using the Aboriginal Sites Decision Support Tool indicates that, compared with the occurrence of other sites, there has been a high degree of loss (almost 70 per cent) of modified trees (Ridges, 2009). This loss has occurred across a range of tenures. Further, this modelling also suggests that Calleen and Balgay State Forests have a high likelihood of containing sites and should therefore be prioritised for surveying. This analysis is based on landscape gaps in AHIMS records; areas that have suffered low cumulative impacts; whether the cypress state forests contain AHIMS sites; their distance from the nearest town; and the proportion of state forest public land in the LALC area.

4.4 Non-Indigenous cultural values and heritage

Colonial settlement, and the ensuing human intervention and management of the landscape, has influenced and shaped the current cypress state forests and their surrounding landscapes. In turn, interaction with the cypress state forests has also contributed to the cultural identity and heritage of local communities.

Non-Indigenous cultural heritage values within the south-western cypress state forests are often linked to historical items, including structures, relics and artefacts. Some cultural heritage items are highly significant, but most are important as physical reminders of peoples' associations with the cypress state forests over the past 150 years.

To some extent, the cypress state forests can also be seen as artefacts of non-Indigenous manipulation within a cultural landscape. The modified forests and landscapes present today (particularly in the southern areas) reflect that European settlers

have valued and used this land for forestry, livestock grazing or, in particular, cropping.

4.4.1 Non-Indigenous sites and artefacts

The south-western cypress state forests have retained a substantial array of significant sites, structures, landscapes and artefacts because they have not been cleared for cropping. These sites and artefacts record the forestry activities and land uses in and around the cypress state forests over the past 150 years. Many similar sites on private land have disappeared, usually due to changes in land use and occupancy.

Sites and artefacts that are part of the non-Indigenous cultural heritage of the region often tend to be better preserved and survive longer in the south-western cypress state forests than in forest areas further east. Reasons include:

- the climate is drier
- fire is not used in productive cypress forestry or by graziers, and its use in neighbouring cropping paddocks is decreasing
- structures were commonly constructed from cypress, which is termite resistant and durable both in and above ground.

Information about items of non-Indigenous cultural heritage is well documented for only a handful of the many individual cypress state forests within this assessment. Neighbouring landholders, forest graziers and forestry workers hold a store of knowledge on the non-Indigenous cultural heritage values of the south-western cypress state forests. However, apart from early maps or plans, most of this knowledge is unrecorded.

Much of the cultural heritage described in the following sections is derived from the work of Allen (1995; 1998) and Curby (1997). These historians focus on state forests near the regional centres of Condobolin, Forbes, Parkes and Narrandera. However, because many of the other cypress state forests within this assessment have similar non-Indigenous history, it is likely that these forests will have similar cultural heritage items and values to those described in the following sections.

4.4.2 Livestock grazing heritage

Reminders of livestock grazing practices and of timber management aimed at improving pasture and stock carrying capacity are widespread throughout the area.

Water supplies

Most graziers excavated earth tanks with catch drains to channel overland flows. Nearly every cypress state forest has at least one such tank. Larger forests have up to a dozen, especially those that formerly comprised a number of separate landholdings.

Older Parish maps and Portion plans show principal tanks, which enable a minimum age to be determined. For example, Archie's and Hillman's tanks in Cumby State Forest are at least 130 years old, and tanks of similar age are known in Yathong, Mount Nobby and Back Yamma State Forests. Small dams on creeks in Nangerybone and Strahorn State Forests are also at least 130 years old.

Ringbarking

The use of the cypress state forests for livestock grazing was often accompanied by extensive ringbarking activities. In 1893, the local forester at Condobolin acknowledged that “the effect of ringbarking on the grasses is immediate and unmistakable, the thicker the timber killed, the greater the benefit” (Maiden, 1894). Land tenures such as scrub leases and improvement leases were particularly aimed at attaining the pastoral benefits of ringbarking.

Ringbarked trees of the late 19th and early 20th centuries were once numerous in the cypress state forests (Allen, 1998). However, there are now fewer examples of ringbarked trees. In both Nangerybone and Strahorn State Forests there are still notable areas of ringbarked cypress (Allen, 1995; 1998).

Fences

Boundary and internal fences in the cypress state forests reveal changes and trends in fence materials and construction over time. Stock management has always required some fencing, but in the mid- to late- 1800s boundary fencing became essential as early pastoral runs were broken up and sold or re-leased in smaller parcels.

Before wire was readily available, primitive wooden chock and log fences were common. Cypress was used in the construction of these fences as it was readily available, grew to an ideal size for such structures and was not too heavy. Nearly all original chock and log fences have now vanished, progressively replaced by post and wire fencing. However, there are clear remains of almost 1.3 kilometres of a chock and log fence traversing part of Albert State Forest, which can be directly related to 1880s map information. These remains are a rarity and one of the best examples of original chock and log fencing in the state.

For the last 100 or so years, most fences have been erected with wooden posts (nearly always of cypress), plain or barbed wire, and with or without netting. The use of netting on boundary fences was obligatory for many years (*Rabbit Act 1890*). Remnants of post and wire fences along original run boundaries can be seen in Back Yamma State Forest. Other examples of post and wire fencing that are better preserved, and also include rabbit pit traps at regular intervals, can be found within and around Nangerybone State Forest (Allen, 1995).



130-year-old chock and log fence Albert State Forest
Photo courtesy of Mark Allen

There are also remnants of fencing within Nangerybone State Forest that are associated with the Overflow Pastoral Holding, which is referenced in the well-known AB ‘Banjo’ Paterson poem ‘Clancy of the Overflow’.

Buildings and other structures

Remains of sheep and cattle yards, farm houses, outbuildings, windmills and woolsheds associated with livestock grazing activities are all present in the south-western cypress state forests. For instance, buildings and structures indicative of earlier occupation and land uses can be found in Back Yamma, Buckingham, Cumbine, Gillenbah and Tullamore State Forests. Stockyards are still common in many forests today, and are used by occupation permit holders.

Travelling stock reserves

In the late 19th and early 20th centuries, travelling stock reserves were an integral part of the livestock grazing scene of western NSW. In part or in whole, many of the modern-day cypress state forests were once travelling stock reserves.

Two major early travelling stock reserves intersected near the northern end of Nangerybone State Forest. The route of a former 1.6 kilometre-wide travelling stock reserve was later revoked to make up a major part of the northern area of Nangerybone State Forest. There is still evidence of a large stock camp just within the northern end of the forest, as well as smaller camp sites within the forest that are located along the revoked travelling stock reserve.

Mount Tilga State Forest is comprised entirely of parts of former travelling stock reserves and contains the site of at least one early dwelling associated with these reserves.

4.4.3 Forestry activities

Forest structure and composition

On most central division cypress state forests, forestry employees and/or relief gangs have occasionally carried out works to increase the productive timber yield of forest stands. Over time, these activities have changed the structure of the south-western cypress state forests.

Historically, forestry activities have included extensive ringbarking or poisoning of eucalypts to favour the growth of cypress; a practice discontinued in the early 1980s (see **Section 3.4** for further details). Forestry workers have also thinned dense patches of 1890s cohort cypress, and seedlings within the post-1950s cohort cypress regeneration, in line with the silvicultural cycle outlined in **Chapter 6**.

Forestry camps, huts and other structures

Transport to the forests has improved, meaning there is now little need for permanent camping facilities in the cypress state forests. Therefore, many structures associated with forestry activities have been demolished. A few remain, ranging from small huts (for example, in Tottenham State Forest) to more substantial buildings (for example, in Strahorn State Forest), though these are not well used.

Back Yamma State Forest contains remains of a major complex including a cottage, nursery, office, barracks, garage, storerooms, windmill and a lookout tower. Lookout towers



Cypress slab house in Tullamore State Forest (since collapsed)
Photo courtesy of Mark Allen

were uncommon in the cypress state forests of this region. Temporary camp sites are also known on Bulbodney and Nerang Cowal State Forests, among others.

Curby (1997) notes the presence over the years of a woolshed, stockyards and races, houses and later forest overseers' cottages and a windmill, as well as numerous ground tanks and fences on Buckingham and Gillenbah State Forests, south of Narrandera.

Sawmills

For over a century, the cypress state forests and earlier forest reserves have been a source of cypress for bush sawmills and mills located in towns and villages.

Relics of what were major bush mills and associated workers' huts and infrastructure can be found in several of the forests, including Euglo South, Bulbodney and Carawandool State Forests and, to a lesser extent, Back Yamma State Forest. Relics of sawmilling can also be found on Western Lands Leases (for example on the Tearn and Black Range leases) and travelling stock reserves (for example, Kerriwah Travelling Stock Reserve).

Some sawmills have become part of the local cultural heritage in their own right, as a significant local industry and employer.

Building and construction

Cypress timber has been used extensively in the construction of private dwellings within the region, ranging from major country homesteads and woolsheds to small town houses. It was also used to build many significant public and commercial buildings, including churches, railway stations, hotels, shops and halls. Cypress remains by far the most commonly used construction timber across much of south-western NSW.

4.4.4 Survey marks

The evolution of the cadastral landscape is dependent on surveys. Surveys, and the associated maps showing land tenure, started in NSW in the 19th century.

Early survey marks include corner reference trees and boundary line blazes. These marks are not uncommon within the cypress

state forests, and can be found along the portion boundaries in or near relatively undisturbed forest areas. These undisturbed areas are predominantly found in pastoral areas in the north-west of the central division, and also in the western division.

There are particularly good examples in Nangerybone State Forest, where they provide clear evidence of the location of early unfenced portions and of 19th century pastoral holding boundaries. In Cumbine State Forest, extant corner reference trees and boundary line blazes are the only visible reminders of the early subdivision of this country up to 120 years ago (Allen, 1995). Other cypress state forests known to contain clear early survey marks include Balgay, Mount Nobby, Murda and Strahorn State Forests.

4.4.5 Mining

Numerous cypress state forests contain evidence of small-scale mining, mostly shafts or mullock heaps probably of late 19th or early 20th century origin. These include Murda, Gilgunnia, Nerang Cowal and Back Yamma State Forests. A higher level of activity occurred in Tottenham State Forest, and shafts and open cuts from the 20th century remain.

A former copper mine, operating in the early 20th century, was almost entirely surrounded by Carolina State Forest. The deep shafts have recently been filled in and some associated mine structures destroyed, but there is still a wide scatter of occupation debris testifying to the presence of a small settlement. Also, it is possible to distinguish the route of a government railway line that ran for a short distance through the forest to the mine and was decommissioned around 1940.

In addition, the cypress state forests provided timber for local mines. Stumps of trees cut for this purpose as long ago as the 1890s are still standing in Cumbine State Forest. Gilgunnia, Tottenham and Carolina State Forests were also likely sources, as were the cypress state forests and early forest reserves around Forbes, Peak Hill and West Wyalong.

4.4.6 Other examples of cultural heritage values

There are a number of other links to the region's non-Indigenous heritage associated with cypress state forests in the area. These include, but are not limited to, the following:

- **Blow Clear West State Forest** – During World War II, sites in this forest were prepared with concrete aprons and tie posts for the attachment of camouflage nets to accommodate and conceal RAAF aircraft.
- **Manna State Forest** – Remains of a former church.
- **Tullamore State Forest** – A very early and evocative timber slab cottage stood in the middle of the forest until a couple of years ago, and a considerable spread of glass and other litter of old times but uncertain origin remains in the area. Also, there are remnants of a former gold extraction plant.

4.5 Social and economic values and uses

The south-western cypress state forests are valued for a wide range of productive, recreational and educational uses. In general, **Table 4.4** identifies the extent of possible values and uses within state forests.

Table 4.4: Values and uses of state forests

Values and uses of state forests		
Indigenous sites and cultural heritage	Timber supply and productive forestry	Wildlife and nature-related activities
Non-Indigenous sites and cultural heritage	Livestock grazing	Wildlife conservation
Aesthetic views	Beekeeping/apiary	Sustainability through forest preservation
Recreation	Fuel wood	Carbon absorption and credits
Education and research	Biomass/oil production	Salinity control
Bush foods and medicines	Seed collection	Water catchment (water quality and use)

Source: DPI (2008a)

4.5.1 Productive cypress forestry

Productive cypress forestry is currently the dominant revenue source from the south-western cypress state forests (Forests NSW, 2008c).

A number of businesses and communities have a reliance on cypress timber sourced from the cypress state forests, although the extent to which these businesses and communities rely on the resource varies.

Grants Holdings Co Pty Ltd (Grants Holdings) undertakes the majority of harvesting and haulage from the south-western cypress state forests, and operates mills in Narrandera and Condobolin.

Baradine Sawmilling Company, a harvesting and milling operation based in Baradine, sources a proportion of its sawlog supply from the south-western cypress state forests. However, the majority of sawlogs milled in Baradine are harvested from state forests in the Brigalow Belt South and Nandewar bioregions.

In addition to operations that harvest cypress directly from the south-western cypress state forests, a number of value-adding and retail outlets receive sawn timber that was originally sourced from the cypress state forests.

A more detailed account of the cypress timber industry associated with the south-western cypress state forests can be found in **Chapter 5**.

4.5.2 Broom bush harvesting

Forests NSW issues licences for harvesting broom bush, or broom honey-myrtle (*Melaleuca uncinata*), from the south-western cypress state forests. Broom bush is used predominantly for fencing and is distributed widely in NSW (Forests NSW, 2004). It occurs as a dominant shrub, or sub-dominant shrub, in mallee eucalypt and associated woodlands.

Public submissions have identified that the cypress state forests are currently being used for the harvesting of broom bush, for example, Yathong State Forest. A company that harvests broom bush from Yathong State Forest has indicated that reduced access to broom bush harvest areas in the

cypress state forests would significantly affect their business (KN Partitions, 2010).

4.5.3 Firewood, craft wood and other forest products

Unlike hardwood species, cypress does not yield high quality firewood. Cypress offcuts make useful kindling, but resin-rich cypress timber 'spits', and burns quickly and clogs chimneys, which consequently may cause house fires.

South-western cypress state forests have previously been managed to maximise cypress production, often through the removal of hardwoods. In the past, hardwoods suitable for firewood have been ringbarked and poisoned (**refer to Section 3.4**). Since the 1980s, Forests NSW has adopted an alternative policy of retaining eucalypts, including dead trees, to promote biodiversity. This retention of dead eucalypts has further limited the supply of suitable firewood from within the south-western cypress state forests.

Domestic collection of firewood within NSW state forests requires a s30I permit (DPI, 2008b). These permits are valid for up to 3 months and allow for the collection of up to 1 tonne of timber per permit (maximum of 6 tonnes per year). Commercial firewood, post cutting and craft wood collection requires a timber licence, which is usually valid for a period of 1 year. Forests NSW records show that in 2009, 350 tonnes of firewood was collected under domestic s 30I permits from 25 forests included in this assessment. There were no permits issued in this period for commercial post cutting or craft wood collection in the cypress state forests (Forests NSW, written communication, 17 March 2010).

Other forest products that may be obtained from cypress state forests include seeds, foliage and flowers. Forests NSW states that there is currently limited harvesting of these non-timber forest products in the cypress state forests in the western region; however, these activities may be undertaken in the future under appropriate permits (Forests NSW, 2008c).

4.5.4 Livestock grazing

The cypress state forests under assessment provide palatable species, some water and shelter suitable for both sheep and cattle production. Since cypress is fire sensitive and is not generally suitable for burning to reduce bushfire hazards, livestock grazing has been used as an alternative to hazard reduction burning in cypress state forests (Forests NSW, 2008c).

As described in **Chapter 2**, sheep and cattle grazing in current cypress state forests probably began in the 1850s. The practice has been relatively continuous at the landscape scale, although sporadic in individual forests, except for a brief period during the 1950s and 1960s. Domestic grazing animals were withdrawn from the forests at this time, coinciding with a major rabbit control program, to allow for cypress regeneration (Curby, 1997; Allen, 1998).

Livestock grazing in the south-western cypress state forests is licensed by Forests NSW and guided by the *Grazing Management Plan 2006 – 2011 Western Region*, (Forests NSW, 2006b). Graziers hold either issued short-term grazing permits, annually renewed occupation permits (OPs) or longer-term forestry leases (5 to 10 years, but now discontinued). OPs are the most common form of licensed grazing in the cypress state forests. They are currently issued on 98 of the state forests within this assessment, although not all of these forests are being grazed currently due to drought.

OP holders pay an annual lease fee to Forests NSW (Forests NSW, 2008c). Grazing leases provide a modest return every year. The total annual income Forests NSW receives from grazing OPs in the south-western cypress state forests (current 5 March 2010) is around \$125,000 (Forests NSW, written communication, 9 March 2010).

OPs for grazing are normally managed as adjuncts to neighbouring rural properties. They describe the area that is able to be grazed, stocking rates and the time of year when livestock grazing is permitted. They also outline management activities, such as weed and pest control, and maintenance of agricultural improvements, for example maintaining fences and watering points, that must be carried out.

South-western cypress state forests under OPs usually have few agricultural improvements, and relatively low natural fertility as a result of poor soils and competition from tree species. These factors typically lead to relatively light stocking rates in the cypress state forests (Curby, 1997). Stocking rates are particularly low in cypress state forests with thicker regrowth. OPs for grazing therefore provide a marginal additional value to graziers, rather than being a primary resource for the livestock grazing industry. Landholders adjacent to state forests generally use their grazing OPs on a seasonal basis.

Submissions received from pastoral OP holders support these findings. The OP holders report seasonal, short-term use of cypress state forests, and that they actively manage pest, weed and fire risks within the cypress state forests. Some OP holders have also invested in building new fences and watering points within the cypress state forests under permit.

South-western cypress state forests for which OPs are held are shown in **Figure 4.1**. The number of permits that can be issued for a forest is generally dictated by forest configuration



Cattle grazing in Bimbi State Forest

or the extent of internal fencing and subdivision within the forest. For instance, Paddington State Forest comprises three distinct forest sections, meaning each forest section can be leased under a separate permit. For this reason, the number of permits held does not necessarily provide an indication of a forest's livestock grazing value, size or stocking rates.

4.5.5 Apiary

The NRC received a number of public submissions attesting to the value of the south-western cypress state forests to the apiary industry.² According to these businesses, losing access to the cypress state forests would significantly impact on their ability to produce honey, maintain their hives and provide pollination services.

The apiary industry typically favours eucalypt-dominated state forests, meaning use of the south-western cypress state forests by apiarists in the past has been relatively limited in comparison with other eucalypt forests. However, over time the area of eucalypt-dominated forest available to the industry has contracted due to loss of access to national park sites, vegetation clearing, major bushfires and drought. As a result, the south-western cypress state forests have become more important to the apiary industry.

Apiarists use the south-western cypress state forests to provide warmth and shelter to bee colonies over winter. The cypress state forests are used to support colony build up, particularly after provision of pollination services to almond and canola crops. One submission also indicated that the cypress state forests may become increasingly important to the apiary industry in the future, as their dry climate may assist in the control of small hive beetle, an introduced pest (Monsons Honey and Apiary Products, 2010).






Until the 1980s, large eucalypts were periodically removed from the cypress state forests to favour cypress productivity (see **Chapter 2**). Subsequent eucalypt regeneration has increased densities of small eucalypts, although these are of lower value to apiarists than mature large trees. Despite these historical clearance practices, some south-western cypress state forests have retained pockets of eucalypt-rich forest. These pockets include stands of eucalypt species such as yellow box, poplar box, grey box, white box, mallee (green, grey, red and Christmas) and some areas of river red gums and ironbarks (mugga, broad-leafed and silver-leafed). Beekeepers value and use these pockets for honey production. For example, yellow

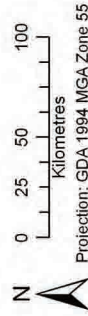
² Australian Rainforest Honey Pty Ltd, Monsons Honey and Apiary Products, Sterling Kershaw & Co.

Legend

-  South-western cypress state forests (197)
-  Major rivers

State forests with occupation permits (Number of permits)

-  1
-  2
-  3
-  4
-  >=5



Projection: GDA 1994 MGA Zone 55

Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

21/05/2010
Information Sources:
Department of the Environment, Water, Heritage and the Arts
NSW Department of Environment, Water and Heritage
Land and Property Management Authority
NSW Department of Environment, Climate Change & Water
NSW Department of Primary Industries

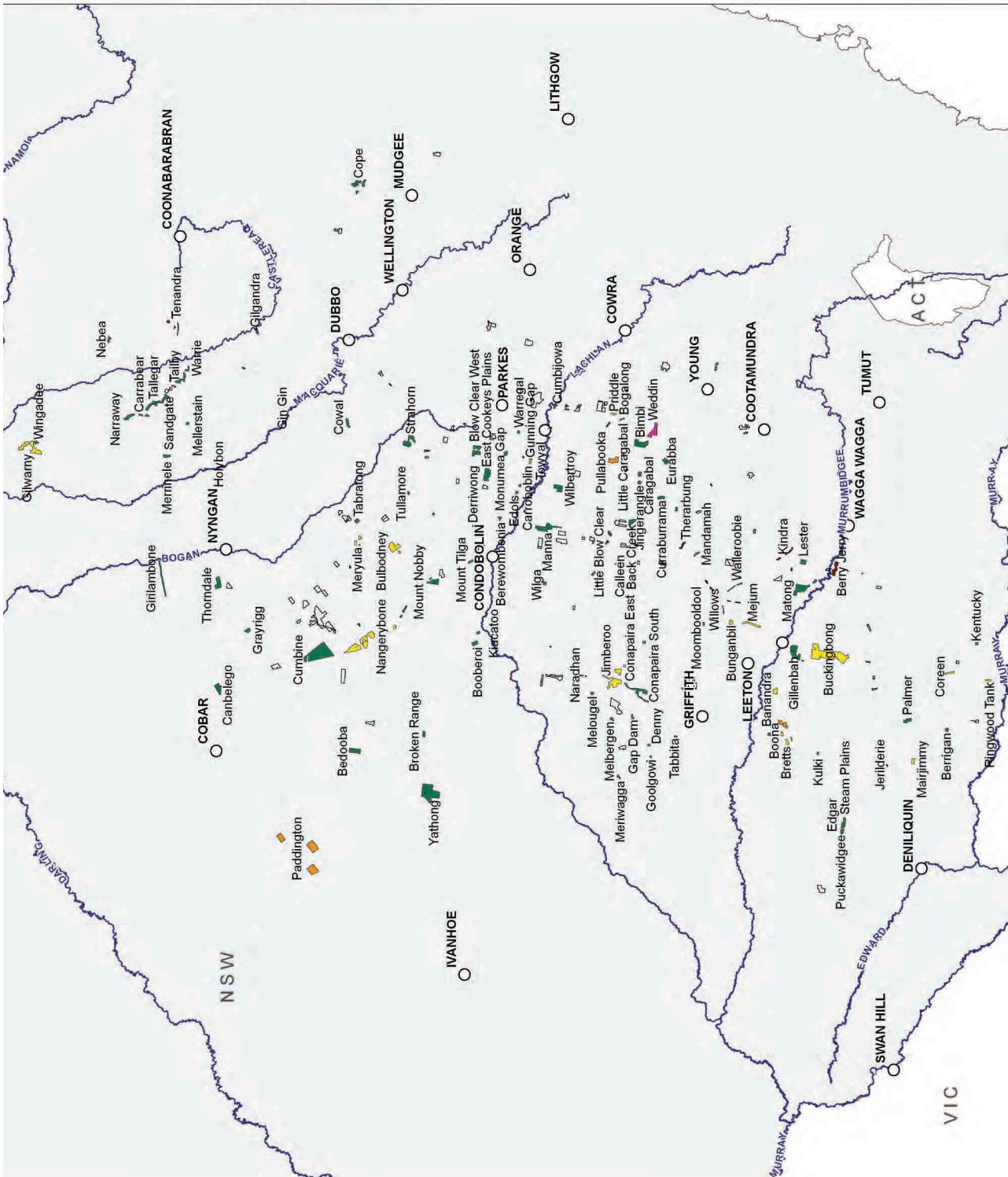


Figure 4.1: Location of state forests for which grazing occupation permits are issued

box stands are found in south-western cypress state forests in the Grenfell, Forbes and Cowra areas, and the resultant yellow box honey is a premium product (Roberts, G, personal communication, 8 March 2010).

In addition to eucalypts, other understorey species within the cypress state forests are important for bee breeding. Cypress state forests are also valuable if they are adjacent to areas of farmland that may contain Paterson's curse or eucalypt-rich forest, as bees forage relatively widely (2–3 kilometres is typical) in their search for pollen and nectar (Somerville, D, personal communication, 5 March 2010).

Submissions emphasised the importance of having access to a range of forest resources. Use of the south-western cypress state forests is dependent on external factors, such as rainfall, tree flowering and nectar flows, in combination with the shelter, feeding and breeding needs of the bees. The honey production process involves moving hives in and out of these forests as conditions change and favourable flowering occurs. The industry is highly mobile and apiarists making use of the cypress state forests under assessment may be local, from other parts of NSW or interstate beekeepers.

Forests NSW issues permits that allow an apiarist to set down hives in a defined area of state forest. The permit generally covers an area of 1.5 x 1.5 kilometres (2.25 square kilometres).

Based on records provided by Forests NSW, there are currently 74 permits on issue for apiary sites in the south-western cypress state forests, with the most permits being held for the Weddin State Forest. These permits cover 141 apiary sites, which fall within 64 of the state forests under assessment. Forests NSW derives total annual revenue of around \$14,000 from apiary permits within the cypress state forests (Forests NSW, written communication, 9 March 2010).

The locations of south-western cypress state forests in which apiary permits are held are shown in **Figure 4.2**.

4.5.6 Non-timber forest materials, mining and other extractive industries

There are two current forest products licences for extraction of forest materials within the south-western cypress state forests, both for gravel (Forests NSW, written communication, 18 February 2010). One is located in the Buddigower State Forest and the other is in the Kentucky State Forest. Forests NSW (2008c) indicates that these gravel quarries usually cover less than 2 hectares and are not constantly in use. The gravel is mostly used by Forests NSW, local governments and the Roads and Traffic Authority for road base and pavement dressing.

The south-west NSW region is rich in mining activity. Many of the towns in the area were founded on gold mining (Forbes, Parkes, Peak Hill, Temora, West Wyalong), copper mining (Tottenham, Nymagee) and tin mining (Ardlethan). Active gold, copper and tin mines adjoin some of the cypress state forests under assessment. For example, Limestone State Forest is adjacent to the Northparkes copper and gold mines. Forests NSW indicates that there is also active mineral exploration occurring in a number of the south-western cypress state forests. The state forests subject to current mineral exploration licences are Carawandool, Carolina, Euglo South, Fifield, Nerang Cowal, Strahorn, Tottenham and Warraderry State Forests.

4.5.7 Recreation and tourism

The south-western cypress state forests are valued for their recreational uses, primarily by communities located in close proximity to these forests. Bird watchers (see **Section 4.5.8**) and hunters (see **Section 4.5.9**) are among the most regular visitors, along with amateur botanists, picnickers who gather firewood, horse riders, fishers and fossickers. The cypress state forests within this assessment are also used for four wheel-drive training and expeditions, car rallies and trail-bike riding. There is an occupation permit currently on issue for an archery range in Cumbijowa State Forest. The permit-holder and a registered archery club, the Forbes Lachlan River Archers, are based in Forbes.

The south-western cypress state forests appear to hold little tourism value. This is probably due to their small and fragmented nature. The cypress state forests under assessment are thought to attract a relatively small number of visitors per year. Due to low visitor numbers, no accurate records of visitor numbers are kept. Visits are also believed to be extremely seasonal, given high temperatures in summer and occasional access difficulties due to wet roads during winter (Forests NSW, written communication, 17 March 2010).

Generally, Forests NSW focuses on providing tourism and recreational facilities in state forests close to urban populations, meaning the majority of state forest facilities are located in forests near coastal communities (Forests NSW, 2009). Within the south-western cypress state forests under assessment, Binya State Forest (located 25 kilometres from Griffith) has picnic and barbecue facilities as well as a marked forest drive (Forests NSW, 2008c).

4.5.8 Nature-based activities

Cypress state forests provide an opportunity for visitors and wildlife enthusiasts to observe a wide variety of species of flora and fauna. According to the NSW Bird Atlasers Inc, a state-wide bird monitoring group, some of the south-western cypress state forests are more highly valued for particular reasons. For example, Back Yamma State Forest is important because of regular sightings of regent honeyeater and Gilbert's whistler, while Cumbine State Forest shelters *Eucalyptus intertexta* and other rare flora.

Notable bird trails are located near Grenfell, West Wyalong, and Dubbo (Birds Australia, 2010). For example, there are 12 popular trails near Grenfell, three of which are located in cypress state forests, namely Weddin, Bimbi and Warraderry State Forests. These trails offer locations for observing birds in their natural habitat.

There are a number of naturalist groups within the study area, for instance the Murrumbidgee Field Naturalists, who are based in Griffith, Leeton and Narrandera. The group distributes a monthly newsletter and conducts regular meetings and events (approximately six per month), including field trips to some of the cypress state forests under assessment.

Recent Murrumbidgee Field Naturalists trips have included visits to Binya, Yelkin and Mejum State Forests. The group is primarily interested in bird watching and documents their sightings in their newsletter. In their most recent trip to Binya State Forest, the group observed hooded robins, rufous songfarks, white-winged trillers, crimson chats and red-capped robins (Murrumbidgee Field Naturalists, 2009). In their last documented trip to Yelkin State Forest, the group sighted

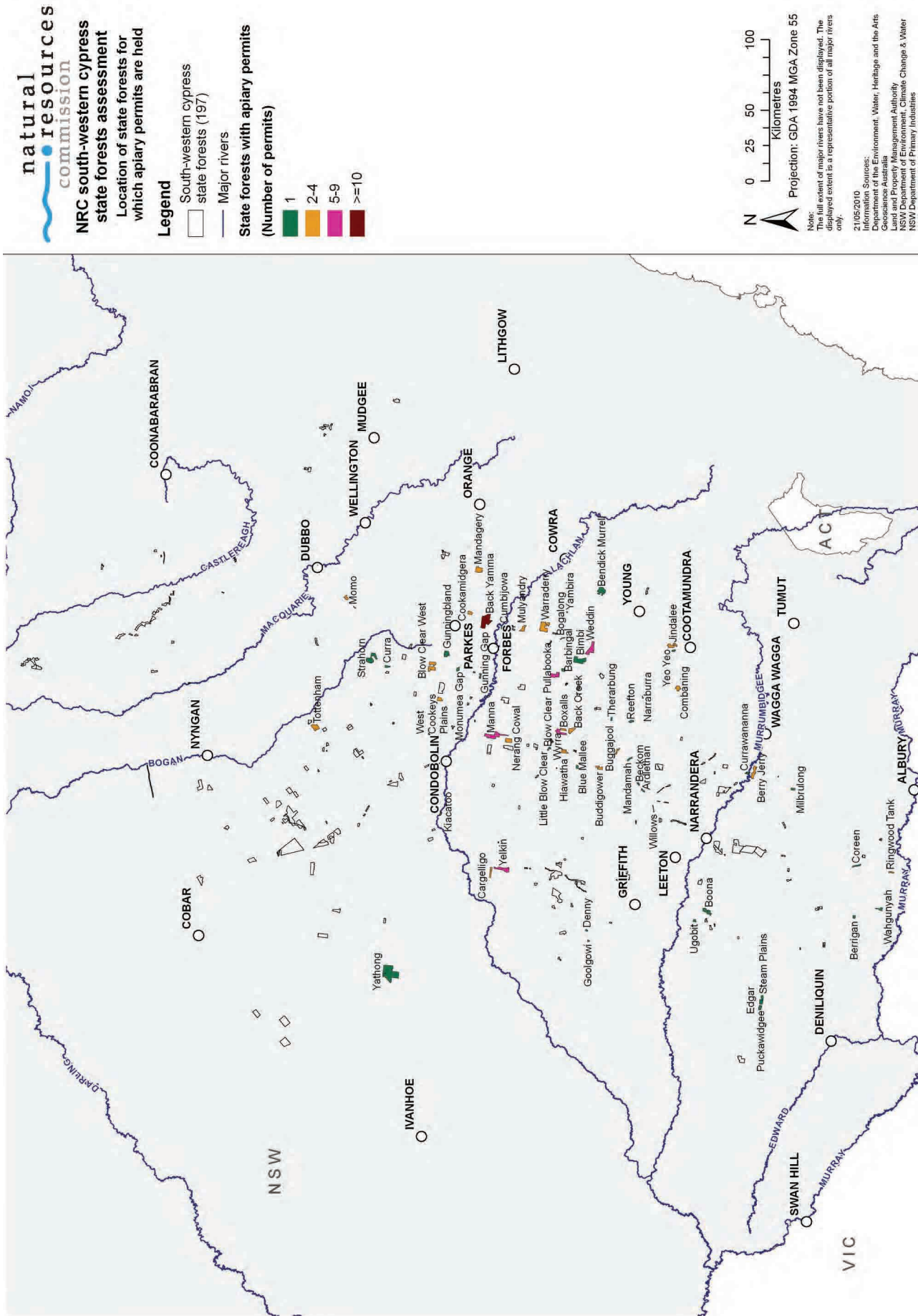


Figure 4.2: Location of state forests for which apiary permits are held

tree martins and various types of wattles and orchids, as well as an Indigenous stone tool-making site.

The National Parks Association, within a submission made in conjunction with the Nature Conservation Council of NSW and the Colong Foundation for Wilderness, have identified Bendick Murrell, Bimbi, Binya and Weddin State Forests as being of particular recreational value for people interested in nature-based activities.

4.5.9 Hunting

The recreational hunting of feral pigs and goats, foxes, rabbits, hares, wild dogs (not dingo) and deer is permitted in NSW state forests as a means to control pests. These pests are estimated to have a cost impact of \$720 million a year on the environment and industry (Game Council NSW, 2010).

Under the *Game and Feral Animal Control Act 2002*, 460 state forests in NSW are declared for conservation hunting, including 64 state forests within this assessment. Hunting in state forests is regulated by the Game Council NSW. The Game Council NSW is responsible for issuing hunting licences and permits, both of which are required in order to hunt in state forests. Hunting licences are issued annually, while the duration of a hunting permit is typically two days, after which time it expires.

Table 4.5 shows the 10 south-western cypress state forests that have the highest numbers of permitted hunters according to the Game Council NSW. These popular hunting forests are amongst the largest state forests under assessment. The Sporting Shooters Association of Australia identifies Buckingbong State Forest and Binya State Forests as key state forests in which pigs, foxes, goats and rabbits have been sighted or taken by licensed hunters (Sporting Shooters Association of Australia, 2010).

Figure 4.3 shows the south-western cypress state forests for which the Game Council NSW has issued hunting permits in the past.

4.5.10 Education and training

The cypress state forests within this assessment have significant Indigenous cultural heritage values, as described in **Section 4.3**. As such, the cypress state forests are used by local Indigenous groups for cultural heritage tours and camps. These programs may include activities that demonstrate traditional practices, such as bush tucker collection, and access to culturally important natural springs.

Access to south-western cypress state forests in the Forbes district for cultural educational purposes is currently supported within a draft memorandum of understanding between the Lachlan Aboriginal Natural Resource Management Group and Forests NSW (Hill, R, personal communication, 2 March 2010). Some schools within the Wilcannia and Forbes areas also have Indigenous education programs that make use of the south-western cypress state forests (Hill, R, personal communication, 2 March 2010).

In addition, other groups, such as scouting organisations and universities, may occasionally use the cypress state forests for education or research purposes (Forests NSW, 2008c).

Finally, some south-western cypress state forests are also used for military training purposes, for example, Buckingbong State Forest (Forests NSW, 2008c). Military use is regulated by Forests NSW under special purpose permits. Forests NSW has indicated that in 2007–08, six special purpose permits were issued for training exercises within the cypress state forests.

Table 4.5: The 10 state forests with the highest number of permitted hunters

State forest	Number of permitted hunters
Yathong	12
Back Yamma	11
Grahway	10
Gilwarny	8
Buckingbong	7
Jimberoo	7
Binya	7
Manna	6
Gillenbah	6
Matong	6

Source: Game Council of NSW (2010)

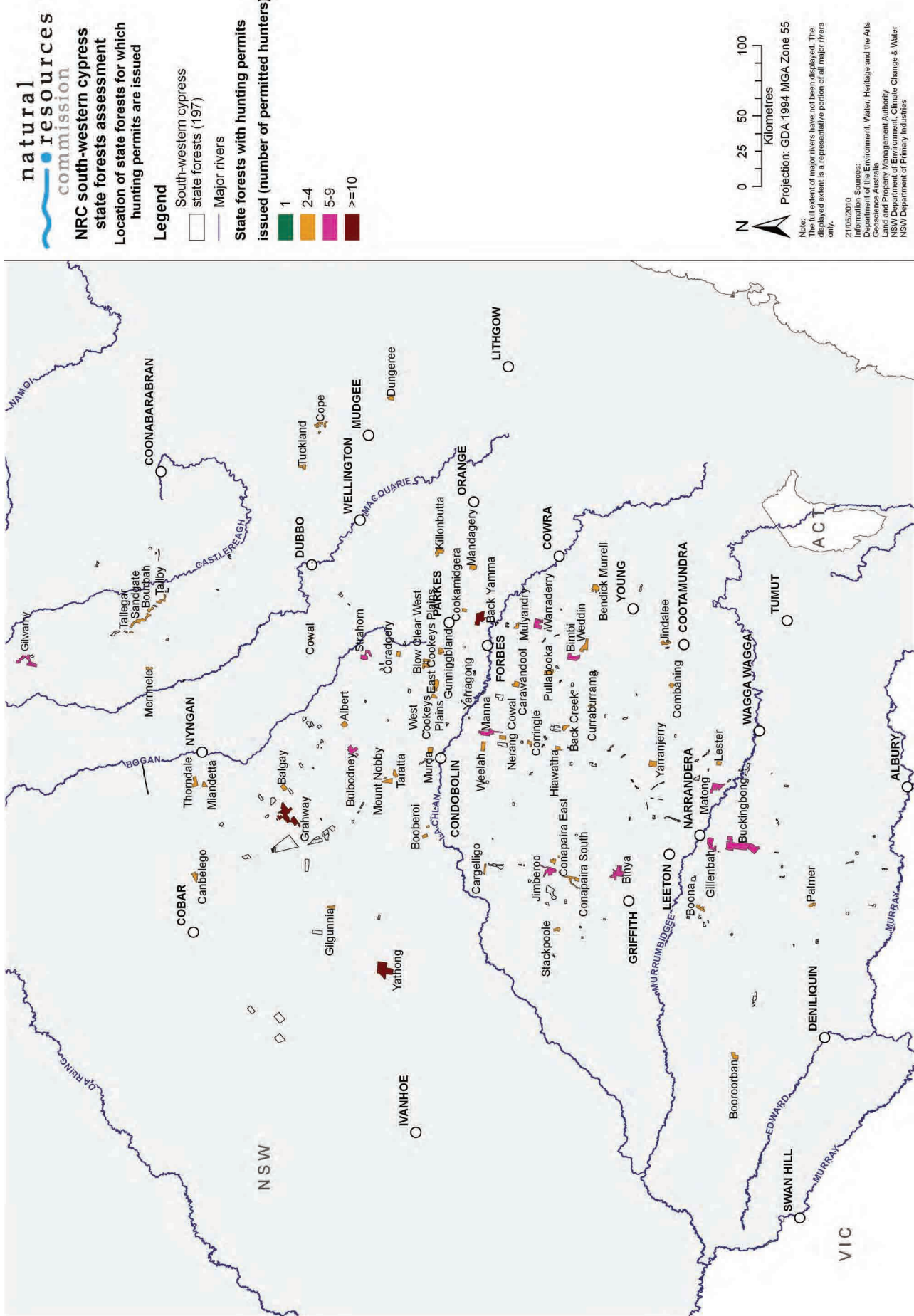


Figure 4.3: Location of state forests for which hunting permits have been issued in the past by the Game Council NSW

4.6 Communities linked to the south-western cypress state forests

Communities at several scales are linked to and dependent on the south-western cypress state forests in a variety of ways. Some communities are more strongly linked than others, and some communities may have a lower capacity to adapt to any future changes in the use of the cypress state forests.

The south-western cypress state forests extend from around Cobar in the north to Albury in the south, with a large proportion of the cypress state forests located in the area between Condobolin to Narrandera (see **Figure 2.1**). This area includes the catchment management areas of the Central West, Western, Lachlan, Murrumbidgee and Murray, and covers more than 30 local government areas.

The key industries in the area surrounding the south-western cypress state forests are agriculture (including irrigated agriculture), mining, manufacturing (including food processing) and tourism (DPI, 2009).

In the context of an agriculturally dominated regional economy, the cypress timber industry's economic contribution is most significant at a local or town level. For this reason, we have focused on assessing social and economic linkages to the south-western cypress state forests at an individual community scale.

Figure 4.4 shows the town communities that have direct or indirect economic links to south-western cypress state forests. The direct employment and expenditure provided by the two sawmills located in the towns of Narrandera and Condobolin may be particularly important to these towns.

The NRC used Town Resource Cluster analysis (Fenton, Coakes & Marshall, 2003) to identify the communities in **Figure 4.4** that have links to the south-western cypress state forests. The analysis drew on:

- secondary data collection and analysis (for example, Australian Bureau of Statistics data)
- consultation and surveys with cypress mills and other cypress value-adding or retail businesses
- consultation with Forests NSW and other key stakeholders
- submissions received as part of the assessment.

The NRC undertook a consultation process (outlined in **Chapter 1**) and received submissions outlining the many communities, and businesses within those communities, that have links to these forests. However, the NRC acknowledges that there may be additional communities and businesses with links to the cypress state forests that were not identified during the assessment.

Appendix 15 contains further explanation of Town Resource Cluster analysis.

4.6.1 Communities directly linked

Communities identified as having a direct link to the south-western cypress state forests include Narrandera, Condobolin, Baradine, Grong Grong, Griffith, Leeton, Wagga Wagga, Tumut, Forbes and Cootamundra.

The NRC defines towns as directly linked to the cypress state forests if they meet one or more of the following criteria:

- location of a mill processing timber from south-western cypress state forests
- mill employees' town of residence
- location of mill expenditure (for example, the location in which suppliers of goods and services to mills are based)
- key work-base location for Forests NSW employees responsible for managing the cypress state forests (refer to **Table 5.6**).³

In particular, Narrandera and Condobolin have strong links to the south-western cypress state forests, given that they meet all of the above criteria. As discussed in **Section 4.5.1**, operations in Narrandera and Condobolin harvest and mill the majority of cypress timber sourced from the south-western state forests. These two towns also benefit from a large proportion of the employment and expenditure generated by these mills.

The mills in Narrandera and Condobolin currently employ 30 people residing in Narrandera (not including a further four unfilled positions and three staff living in nearby Grong Grong) and 13 people residing in Condobolin.⁴ Additionally, Forests NSW employs four staff in Narrandera and one staff member in Condobolin for managing the south-western cypress state forests. Employment directly supported by the cypress state forests therefore amounts to 2.5 per cent of Narrandera's total workforce and 1.3 per cent of Condobolin's workforce.⁵

Grants Holdings indicated that most of their expenditure on goods and services occurs in Narrandera (43 per cent) and Condobolin (30 per cent), consistent with their policy of buying locally and actively supporting local organisations. Some expenditure by Grants Holdings also occurs in Wagga Wagga (15 per cent), Griffith (5 per cent), Tumut (5 per cent) and Leeton (2 per cent). The pattern of expenditure outlined by Grants Holdings is generally consistent with the 13 submissions from businesses supplying goods and services to Grants Holdings. The submissions also identified Cootamundra as a service provider location. Many submission proponents stated that their businesses would be adversely affected if the operations of these mills were to decline. This includes possible loss of employment that is at present indirectly supported by mill expenditure.

The Baradine Sawmilling Company has also been identified as sourcing some sawlogs directly from the south-western cypress state forests. Under Forests NSW's management arrangements for the Western Region Supply Area, there is

³ Peak Hill and Deniliquin are also locations for Forests NSW employees responsible for managing the cypress state forests. Each of these locations has only one or fewer full-time equivalent positions associated with managing the cypress state forests.

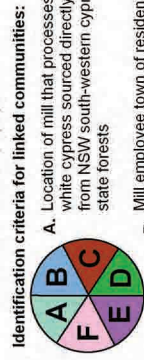
⁴ According to survey information provided by Grants Holdings.

⁵ The calculations are based on Coakes Consulting and ABS (2006) and include both mill employees and Forest NSW employees responsible for managing the cypress state forests.

NRC south-western cypress state forests assessment

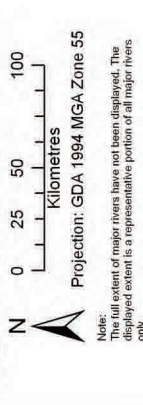
Communities with direct and indirect linkages to south western cypress state forests

- Legend**
- South-western cypress state forests (197)
 - LGAs
 - Town** Towns with direct linkages - Towns were included if they met one or more of criteria A, B, C, or D
 - Town** Towns with indirect linkages - Towns were included if they met either criteria E or F, but not one of criteria A, B, C, or D



- A.** Location of mill that processes white cypress sourced directly from NSW south-western cypress state forests
- B.** Mill employee town of residence (for mills satisfying Criteria A above)
- C.** Location of mill expenditure on goods and services (for mills satisfying Criteria A above)
- D.** Key work base location of Forests NSW employees that are involved in the management of state forests containing white cypress
- E.** Location of business that purchases processed white cypress sawlogs from a mill meeting Criteria A
- F.** Location of business that purchases woodchips or sawdust from mills that process white cypress sawlogs from NSW south-western cypress state forests (mills satisfying Criteria A)

The following indirectly linked towns were not included on the map, given they were outside the study area: Kurmond, NSW (F), Belconnen, ACT (F), Mornington, Vic (E), Rosebud, Vic (E), Waurn Ponds, Vic (E)



Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

21/05/2010
Information Sources:
Department of the Environment, Water, Heritage and the Arts
Land and Property Management Authority
NSW Department of Environment, Climate Change & Water
NSW Department of Primary Industries

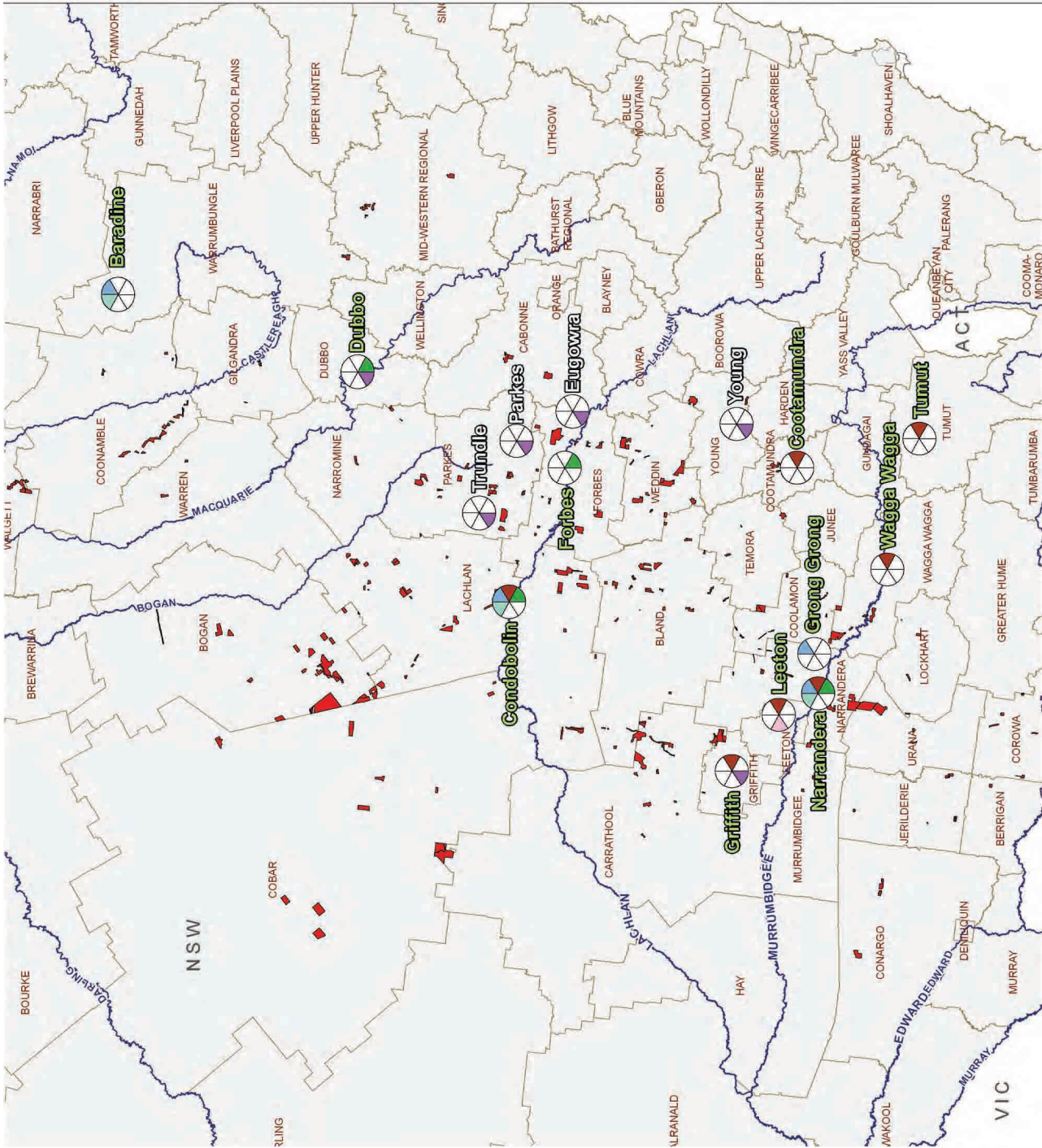


Figure 4.4: Communities with direct and indirect linkages to south-western cypress state forests

scope for some amount of timber to be supplied annually to mills that source the majority of their timber from the Brigalow Belt South and Nandewar bioregions. This may be appropriate from time to time, in both the short and long term. However, it is anticipated that Baradine Sawmilling Company will continue to harvest the majority of its sawlogs from state forests in the Brigalow Belt South and Nandewar bioregions.⁶

Community profiles for Narrandera and Condobolin are provided in **Appendix 15**. These profiles provide additional social, economic and demographic information about these communities.

4.6.2 Communities indirectly linked

Communities identified as having an indirect link to the south-western cypress state forests include Trundle, Young, Dubbo, Eugowra, Parkes, Kurmond, Belconnen (ACT), Waurin Ponds (Victoria), Mornington (Victoria) and Rosebud (Victoria).

Of these communities, seven are located within the south-western area, namely Trundle, Young, Dubbo, Eugowra, Parkes, Griffith and Leeton. The remaining five towns are located outside of the area: one in coastal NSW (Kurmond); and four outside NSW, including three in Victoria (Mornington, Rosebud and Waurin Ponds) and one in the ACT (Belconnen).⁷ The NRC defines towns as being indirectly linked to the cypress state forests if businesses within the town are purchasing milled cypress timber. That is, they meet one or more of the following criteria:

- location of a business purchasing processed sawlogs (originally sourced from the south-western cypress state forests) for manufacturing, construction and other uses
- location of a business purchasing other cypress timber products (originally sourced from the south-western cypress state forests), such as woodchips and sawdust for gardening, landscape and other uses.

Griffith and Leeton were identified as having both direct and indirect links to the south-western cypress state forests, as they are places of expenditure for Grants Holdings and the location of businesses that purchase milled cypress timber.

Submissions to this assessment confirmed the majority of these indirectly linked communities. The NRC received 10 submissions from businesses that purchase cypress timber from the mills in Narrandera and Condobolin. All of these submissions indicated that their business depended to an extent on sourcing cypress from the existing mills. Businesses in Trundle, Eugowra, Parkes and Dubbo purchase sawlogs for value-adding processing. Other businesses indicated they purchased milled sawlogs for construction, or sawmill residue for landscaping and gardening.

4.7 Community capacity to adapt to change

According to the Sustainable Livelihoods Framework (DFID, 1999), a community's capacity to adapt to change is enhanced by its access to:

- natural capital (for example, land and natural resources)
- economic capital (for example, financial resources)
- human capital (for example, skills and experience)
- physical capital (for example, infrastructure)
- social capital (for example, participation and cohesion within the community).

The NRC used Community Sensitivity Analysis (CSA), as developed by Coakes and Sadler (in preparation), to assess the adaptive capacity of the communities identified as linked to the south-western cypress state forests.⁸ **Appendix 15** contains further explanation of the CSA methodology.

Figure 4.5 illustrates the findings of the CSA for each community, as represented by Community Sensitivity Index (CSI) scores. The CSI scores provide an indication of a community's adaptive capacity relative to the other communities included in the analysis. A high score indicates relatively lower adaptive capacity, while a low score reflects relatively greater adaptive capacity.

As **Figure 4.5** shows, Baradine and Trundle had the highest CSI scores, indicating lower adaptive capacities relative to other communities in the analysis. Condobolin, Narrandera, Griffith, Eugowra and Young also had higher scores on the index.

Forbes, Cootamundra, Parkes, Leeton, Tumut, Dubbo, Wagga Wagga, and Grong Grong had lower scores, indicating greater relative adaptive capacity.

The NRC further investigated the communities' CSI scores by examining differences in their capital assets. This is represented in **Figure 4.6** where the capital vulnerability sub-indices illustrate the relative strengths and weaknesses of each community's economic, human, physical and social assets.

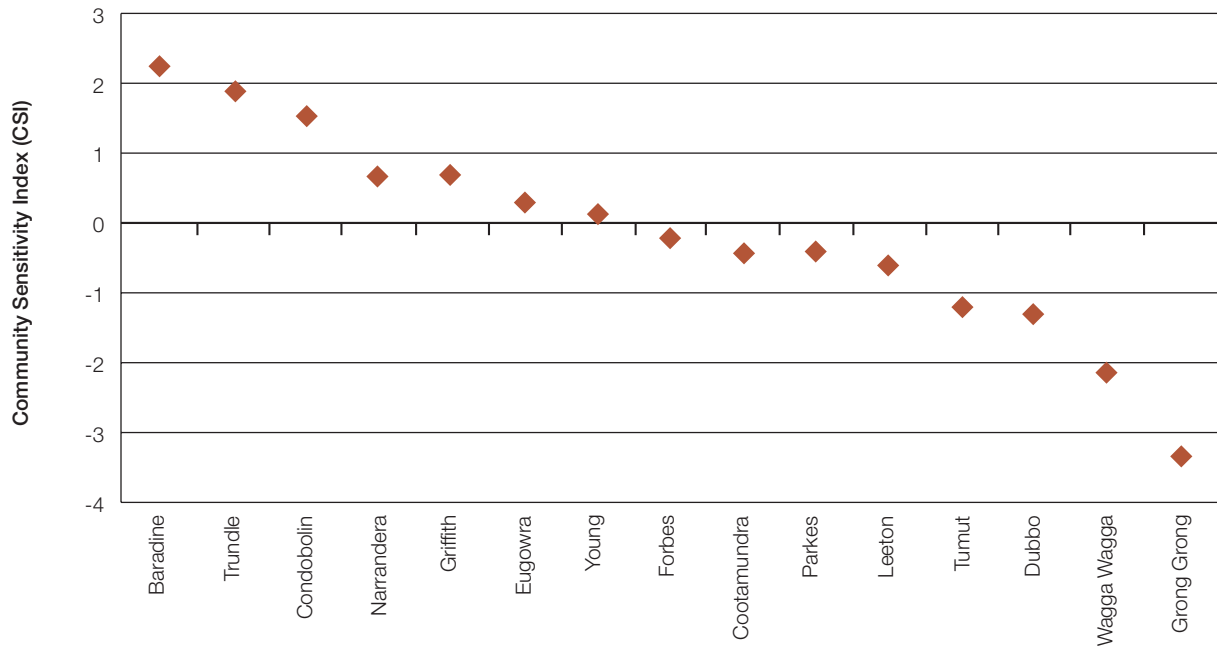


⁶ Given the relatively small size of the town of Baradine, it is likely that some expenditure from this business may occur in other local regional centres such as Coonamble and Coonabarabran; however, this would need to be confirmed by more detailed survey work. Compared with the mills in Narrandera and Condobolin, the Baradine sawmill is not as dependent on the south-western cypress state forests as it primarily sources sawlogs from state forests in northern NSW.

⁷ This analysis does not further assess or quantify these interstate dependencies.

⁸ The CSA excluded indirectly linked coastal NSW and interstate communities.

Figure 4.5: Community Sensitivity Index scores for communities with a linkage to cypress state forests



Source: Coakes Consulting

A high, positive index indicates relatively weaker capital assets, while a low, negative index reflects relatively stronger capital assets.

Generally, larger centres such as Griffith and Wagga Wagga have strong economic, human and physical capital, but weaker social capital. On the other hand, smaller rural towns tend to have strong social capital but weaker economic, human and physical capitals.

The raw data for each of the indices that informed the CSI analysis can be found in the indicator summary table in **Appendix 15**.

4.7.1 Adaptive capacity of communities with linkages to the south-western cypress state forests

The CSA is most useful when considered in the context of each community's linkage to the cypress state forests.

Narrandera and Condobolin have the strongest social and economic linkages to the south-western cypress state forests, as well as relatively low adaptive capacity. Further, although Baradine is less dependent on the cypress state forests than Narrandera and Condobolin, it has the lowest relative adaptive capacity.

This assessment provides a broad indication of community sensitivity; however, more detailed profiling of all communities linked to the south-western cypress state forests would be recommended if there are to be significant changes to timber resource access.

Condobolin

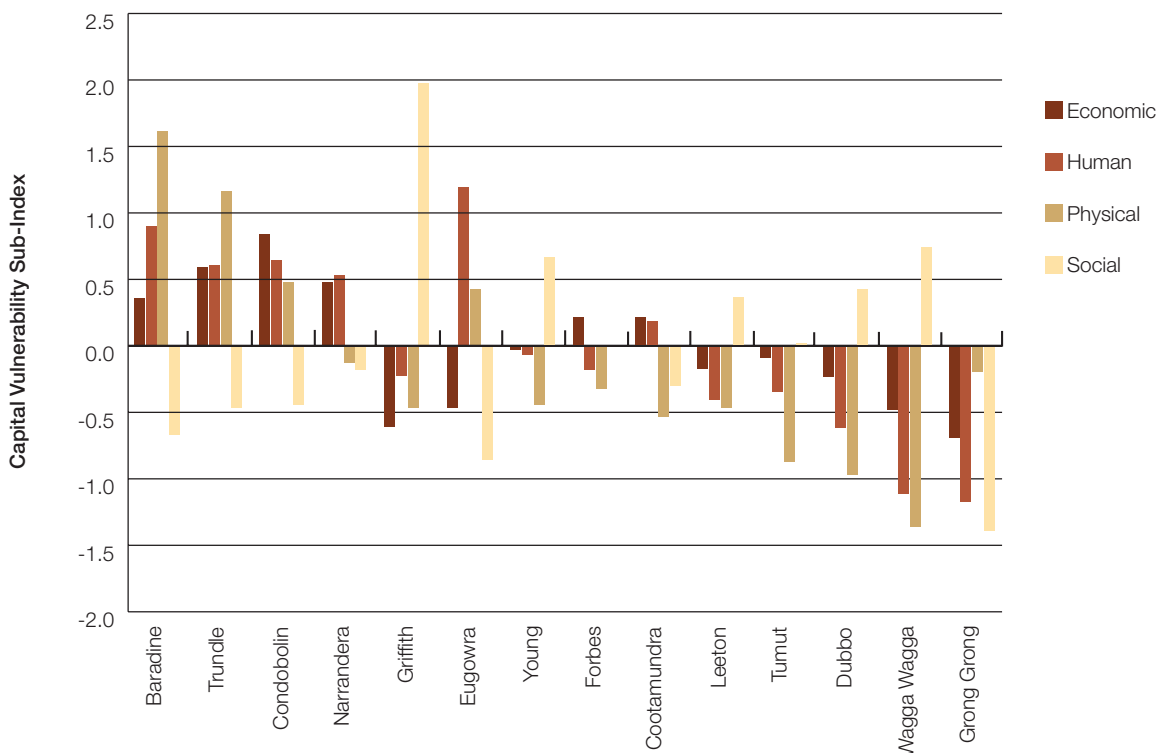
Condobolin's high CSI score was characterised by high levels of economic, human, and physical capital vulnerability, but average social capital vulnerability.

Condobolin's weaker economic capital, relative to the other communities, is related to its particularly high proportion of renters who rent from government or community organisations (38 per cent compared with the average of 23 per cent), as well as its high unemployment rate (10 per cent compared with the average of 7 per cent). Some people within this community are also directly employed in the cypress timber industry, either in the Grants Holdings sawmill or as Forest NSW employees responsible for managing the cypress state forests.

Condobolin was identified as one of the most remote communities, reflected in its high physical capital vulnerability, second only to Baradine. This suggests Condobolin has limited access to some services and facilities. For instance, Condobolin has a lower percentage of people with access to the internet compared with many other communities in the assessment.

Condobolin's human and social capital indicators generally fall within the average range.

Figure 4.6: Capital vulnerability sub-indices for communities with a linkage to the south-western cypress state forests (in order of decreasing overall CSI).



Source: Coakes Consulting

Narrandera

Narrandera’s relatively lower adaptive capacity was related to its having higher levels of vulnerability in the areas of economic and human capital. In general, Narrandera has slightly higher than average figures across the majority of the indicators used to assess these capital areas.

Narrandera’s high economic capital vulnerability is particularly influenced by having the highest proportion of its workforce (2.5 per cent) directly employed in cypress timber industry activities, either through Grants Holdings sawmill or as Forest NSW employees. Narrandera has slightly higher industrial diversity than the average, and a lower proportion of people renting from government or community organisations. However, there is a higher proportion of one-parent families with dependent children compared with other towns.

Narrandera’s high human capital vulnerabilities were associated with it having slightly higher than average figures across the majority of the indicators used to assess these capital areas. This includes the proportion of people who left school by Year 10 and proportion of adults within no post-school qualification.

Narrandera’s strongest capital area was social capital, explained by lower-than-average scores on the cultural diversity and population mobility indicators.

Baradine

Of all of the communities, Baradine had the highest CSI score, indicating low adaptive capacity. Most notably, Baradine had the highest physical capital vulnerability. In particular, it was classified as being the most remote town in terms of road distance from facilities and services.

Furthermore, Baradine had the highest unemployment rate at 11 per cent in addition to low industrial diversity of employment, indicating limited employment opportunities in the community. In relation to human capital, Baradine had a high number of people aged over 65 (24 per cent), as well as the highest proportion of adults who had left school before Year 10 (33 per cent).

However, like most of the smaller communities, Baradine did have stronger social capital. This is explained by lower-than-average scores on the cultural diversity and population mobility indicators.



Aerial view of Narrandera – Photo courtesy of Wikipedia

Cypress timber resources

5.1	Overview	76
5.2	Cypress timber resources of the south-western cypress state forests	76
5.3	Cypress timber resources on other Crown land and private land	81
5.4	Characteristics of the cypress timber industry	82
5.5	Markets for the cypress timber industry	86



5.1 Overview

The south-western cypress state forests have historically been, and continue to be, harvested for timber products, supporting a cypress industry that supplies domestic and export markets. Forests NSW and the NSW Government have entered into 20-year wood supply agreements with mills, to supply timber from the south-western cypress state forests until 2025. This chapter provides an assessment of the timber values of the south-western cypress state forests, including the current timber resource, wood supply commitments, state of the industry and probable future trajectories for the resource and industry.

This chapter supports **Steps 2** and **3** of the analytical framework by describing the:

- cypress timber resource on state forests, other Crown timber lands and private land
- sustainable yield estimates for the south-western cypress state forests and the ability of Forests NSW to meet commitments under current and any future wood supply agreements
- characteristics and economic value of the cypress forestry industry and its market outlook.

The key findings of this chapter are:

- Commitments within the existing 20-year wood supply agreements can be met by the cypress timber resources in the south-western cypress state forests. These commitments will largely be met from the 1890s cohort stock, but longer-term supply will have an increased reliance on the 1950s and post-1950s cohorts.
- Forests NSW's ongoing ability to meet current annual timber supply volumes is less certain in the medium to long term, particularly after 2040. This stems from uncertainty about the current extent of growth locked cypress requiring thinning, and the adequacy of past non-commercial thinning of the 1950 and post 1950s cohorts
- The current industry has benefited from past government investment in thinning programs, which improved commercial timber quality and volume. Ongoing investment in silvicultural thinning is required to support commercial timber and conservation values. Active and

adaptive management is also required to manage external risks.

- Within Forests NSW's current business model there are uncertainties associated with the cost of active management, returns on investment and long-term sustainable yields.
- It is important that Forests NSW continues to implement planned improvements in forest inventory sampling using remote sensing technology. The information generated should increase the certainty of sustainable yield estimates and improve the planning of silvicultural activities.
- While there are significant areas of timber resource on private and leasehold land, Private Native Forestry Property Vegetation Plans (PVPs) do not offer sufficient incentive or long-term investment security to encourage investment in silviculture on private land. Similarly, the Thinning and Invasive Native Scrub PVPs that apply on leasehold land (such as Western Lands Lease) do not promote the silvicultural practices needed to encourage commercial timber stands.
- There is potential for growth in the cypress industry, which has undergone a period of consolidation and modernisation since 2005. The remaining milling companies have invested in equipment upgrades and in developing domestic and export markets.

5.2 Cypress timber resources of the south-western cypress state forests

The south-western cypress state forests contain cypress timber resources. Cypress is a honey coloured aromatic Australian native timber. It is unique among the softwood timber species because of its superior durability and density characteristics and its natural termite resistance (NHT, 2005). The south-western cypress state forests' cypress resources are harvested and milled by the cypress timber industry, contributing to local economies and providing employment in a number of communities.

5.2.1 Cypress cohorts in the south-western state forests

Cypress is a slow-growing tree. Across the landscape, and in south-western cypress state forests, there are five distinct cypress age cohorts. These are described in **Table 5.1**. The two oldest cohorts, old greys and veterans, are now rare in

Table 5.1: Age cohorts found in white cypress forests

Cohort (common name)	Period of origin	Comments
Old greys	Pre-European	Often large trees, with distinctive light grey bark.
Veterans	1800–1840	Grey tinge to the bark.
1890s	1865–1890	Mature trees, dark coloured bark. Primary timber source at present.
1950s	1952–1956	Mass germination and establishment followed the introduction of myxomatosis during wet years in the 1950s.
Post-1950s	Principally 1974 onwards	Recruitment has occurred relatively frequently since the 1970s. Cohort will supply timber from 2024.

most forests. Currently, the 1890s cohort is the primary timber resource; however timber will eventually need to be sourced from the 1950s and post-1950s cohorts.

5.2.2 Cypress sawlog specifications

The south-western cypress state forests' timber resources are valued for cypress sawlogs. Sawlogs are a timber product meeting a number of specifications, including (but not limited to):

- a minimum length of 2.6 metres
- a minimum small end diameter of 12 centimetres (measured under bark)
- a minimum large end diameter of 16 centimetres (measured under bark)
- a low number of knots.

Cypress timber does not normally meet these specifications until it is at least 50 years old. Cypress timber that does not meet sawlog specifications may have other commercial uses.

5.2.3 Silvicultural thinning in the south-western cypress state forests

Silviculture is a set of forest management practices that support the establishment, growth, composition, health and quality of forests (as described in **Chapter 6**). These practices are often used for optimising timber production and maintaining functioning forest ecosystems, as well as managing bushfire risk and controlling invasive species (Curby, 1997; Allen, 1998; Dargavel et al., 2001; Cypress Industry Strategic Plan Group, 2003).

Non-commercial thinning is a silvicultural practice that involves removal of trees from a forest, providing growing space for the remaining trees to develop into a commercial timber resource. Over the longer term, thinning may also help improve environmental values in areas where there are extensive stands of dense cypress (as described in **Chapters 3 and 6**).

To sustain timber yields from cypress state forests at the current levels, Forests NSW needs to continue actively managing the cypress state forests. Thinning programs implemented in the past have made current cypress timber yields possible.

However, historical records are not comprehensive enough to allow a thorough evaluation of the outcomes, costs and benefits from past thinning programs (Forests NSW, written communication, 5 March 2010). To quantify and evaluate the costs and benefits, current and future silvicultural thinning programs need to be supported by an appropriate evaluation framework.

Chapter 2 outlines the chronology of use and management of the south-western cypress state forests. Thinning of cypress has been practised since the 1880s. In the 1920s, public forest resources were assessed and timber resource management plans were prepared. In the 1930s, newly available funding and the use of employment relief schemes led to non-commercial thinning activities in these state forests. Thinning in these state forests has continued up to the present day. For example, since 2005, Forests NSW has conducted thinning using funding from the NSW Government's Brigalow Thinning Program. This funding has enabled Forests NSW to catch up on a backlog of non-commercial thinning programs.

Forests NSW has also focused on improving the efficiency of its thinning operations. In recent years, Forests NSW has been developing and conducting mechanical thinning treatments using funding from the Brigalow Thinning Program. These treatments have created stands in which future manual thinning will be much more efficient, thereby reducing the cost of thinning per unit area. Forests NSW also expects to continue to use opportunities such as government employment programs to boost cypress silviculture (Forests NSW, written communication, 5 March 2010).

5.2.4 Sustainable yields and current commitments

The south-western cypress state forests are mainly located within the former Forests NSW management areas of Narrandera, Griffith, Forbes, Condobolin, Cobar, Walgett and Bathurst, and in parts of the former Dubbo, Gilgandra and Mudgee management areas (DPI, 2009). **Figure 5.1** shows how these former management areas were combined with management areas in the Brigalow Belt South and Nandewar bioregions to create a single Western Region Supply Area for cypress.

Table 5.2 shows the estimated long-term sustainable yields of timber suitable for sawlog from the south-western cypress state forests and the wider Western Region Supply Area.

Table 5.2: Estimated annual sustainable yields from state forests

Estimated sustainable yields	South-western cypress state forests ^a (cubic metres per year)	Western Region Supply Area (cubic metres per year)
Previous estimated annual sustainable yield ^b	22,815 ^c	62,815
Current estimated 150-year average annual sustainable yield from FRAMES model ^d	-	57,500

Source: DPI (2009), Forests NSW, FRAMES presentation.

Notes:

a The south-western cypress state forests are part of the Western Region Supply Area. Figures are therefore a subset of those in the right-hand column.

b Based on previous inventory and yield analysis as reported in DPI (2009).

c This estimate was based on sustainable yields from the previous Narrandera, Griffith, Forbes and Condobolin management areas.

d This figure is the average annual sawlog volume that Forests NSW modelling in 2010 indicates can be sustained over 150 years for the Western Region Supply Area.



Forest area that has undergone silvicultural management

In 2009, the long-term sustainable yield for the total Western Region Supply Area was estimated to be 62,815 cubic metres per year of cypress sawlog. Of this, 22,815 cubic metres per year was estimated to be available from the south-western cypress state forests.¹ This is consistent with commitments to mills in the south west, although in practice the entire Western Region Supply Area is managed as one resource with the possibility of cross supply between areas.

Forests NSW has a Forest Resource and Management Evaluation System (FRAMES) which is a strategic planning tool that it uses to predict future yields. Recent FRAMES modelling in 2010 estimated a long-term average sustainable yield of 57,500 cubic metres per year over the next 150 years across the Western Region Supply Area.

After reviewing Forests NSW's recent FRAMES modelling of sustainable yields, the NRC considers that the current wood supply agreements, committing 59,590 cubic metres per year to 2025, can be met. There appears to be an adequate standing resource of sawlog-quality cypress timber to meet these agreements, with the majority of cypress sawlogs being sourced from the 1890s cohort.

5.2.5 Future management considerations

The NRC considers that there is less certainty surrounding the sustainable cypress timber resource that will be available in the medium to long term, particularly post-2040. Longer-term supply will increasingly rely on the 1950s and post-1950s cohorts. There is uncertainty about the current extent of growth-locked cypress requiring thinning and the adequacy of non-commercial thinning of the 1950 and post 1950s cohorts within past programs. Further, areas requiring different phases of silvicultural treatment (as outlined in **Chapter 6**) are not well identified.

Better inventory of standing timber volumes across the south-western cypress state forests is required to give more certainty to future sustainable yield estimates. More knowledge about the silvicultural requirements of these cypress stands is also necessary to maximise the available resource base. This information will be particularly important when planning future thinning programs that are required to support long-term sustainable yields and negotiating any subsequent wood supply agreements.

New remote sensing technologies, such as Lidar (Light Detection and Ranging), are expected to address this issue by generating more accurate estimates of the area of each cypress cohort.

Forests NSW has commenced trialling and developing Lidar technology to map commercial cypress resources in cypress state forest. Once implemented, this should provide the spatially-explicit information base necessary to support better planning and more efficient management of the resource. Forests NSW is expected to gain detailed information about standing timber volumes across its entire estate, rather than from a sample of inventory plots (as in the current system). This should greatly increase the certainty and transparency of current sustainable yield estimates, particularly the sustainable yields available from cypress cohorts younger than the 1890s cohort. It should also improve the accuracy and efficiency of scheduling areas for silvicultural treatment.

External risks that may impact the long-term sustainable yield estimates for these forests include a reduction in available harvestable area, prolonged drought or large-scale bushfires. Some of these risks, such as potential changes to forest zoning and management prescriptions to protect threatened species, endangered ecological communities or other non-timber values, were either considered by Forests NSW in negotiating current wood supply agreements or are currently being contemplated

¹ In a NSW DPI Environmental Impact Statement (DPI, 2009) these figures were rounded down to 62,800 cubic metres and 22,800 cubic metres, respectively.

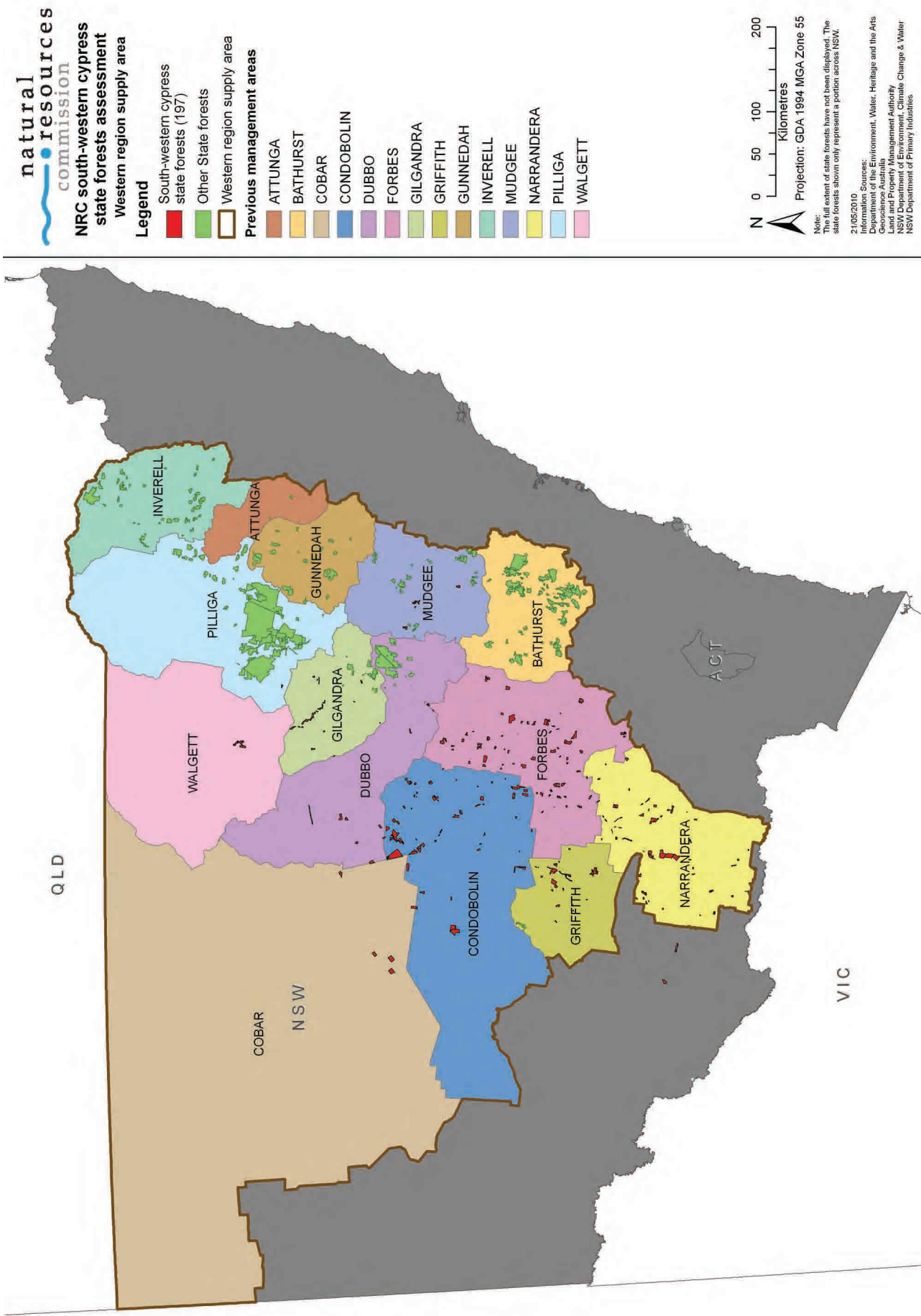


Figure 5.1: Western Region Supply Area

(DPI, 2009). Other risks—such as the frequency and duration of prolonged drought, major bushfires or the impacts of climate variability and change on growth rates and regeneration—have been addressed to a lesser extent (DPI, 2009). Active and adaptive management will be required to manage or mitigate these external risks.

The single Western Region Supply Area provides Forests NSW with some capacity to manage these risks. The large areas over which cypress is distributed, combined with the ability to harvest the current standing volume more intensively for defined periods of time, supports a flexible approach to harvest area scheduling. This should allow short-term supply constraints, such as localised bushfires, to be buffered by volumes from other areas of the supply area.

Table 5.3: Volume of cypress timber harvest recorded in Forests NSW's current sales system

Forest ^a	Cypress volume per financial year ^b (cubic metres)								
	part 2003	2004	2005	2006	2007	2008	2009	part 2010	Total
Albert					1,271	1,638	228	270	3,407
Back Creek	2,080	1,388							3,468
Back Yamma	1,064		564	2,010			6,629		10,267
Bimbi	18			2,165	154				2,337
Binya	105	2,138							2,243
Blow Clear West	197			2,549					2,746
Boona	1,246	3,402							4,648
Buckingbong		2,650	6,107	2,216	6,267	4,695	2,635	3,583	28,153
Bulbodney		3,263	3,241	311					6,815
Carrabear			623						623
Conapaira East		920			1,574		535		3,029
Conapaira South			3,499	1,054	1,550		1,411		7,514
Corringle		5,176	2,276						7,452
Curraburrama			2,918	169			1,761	3,255	8,103
East Cookeys Plains						3,241	534	2,708	6,483
Gillenbah	359	1,585	267	1,506	428			573	4,718
Gunning Gap							1,051		1,051
Gunningbland						1,424			1,424
Lester		656				1,953	464		3,073
Manna	536	2,258			2,748	2,526			8,068
Matong				3,866	105	1,668			5,639
Merrinele							28	2,785	2,813
Mount Tilga				649	627	583			1,859
Narraway		691							691
Pullabooka	66	468	365						899
Ringwood Tank							2,990		2,990
Tabratong								1,377	1,377
Tallegar			1,162			2,291			3,453
Taratta	871	2,508	2,999						6,378
Therabung								721	721
Tottenham				3,085	965				4,050
Warraderry				1,280					1,280
Warrie				470	289			2,209	2,968
Weddin				1,390	3,260	1,102			5,752
Weelah			2,232	4,230					6,462
Yarranjerry	71	266	283	253	105	96	1,226	653	2,953
Yathong	458	1,507	1,365						3,330
Total	7,071	28,876	27,901	27,203	19,343	21,217	19,492	18,134	169,237

Source: Forests NSW, written communication, 5 March 2010.

a Including only the forests under assessment that were harvested during the period.

b For example 2010 refers to the financial year from July 2009 to June 2010.

5.2.6 Harvesting of south-western cypress state forests

Forests NSW specifies which state forests and forest areas (or compartments) are available for harvesting in their Harvest Plans of Operation. These plans cover a 3-year planning cycle and are agreed with the sawmills undertaking the harvesting. The plans take into account the age and quality of the timber stands, and haulage distances. The plans allow for some flexibility in site selection to accommodate localised wet weather events.

Forests NSW also requires operational flexibility when unpredictable events, such as wildfire or severe windthrow, affect their ability to harvest from some forests.

The volumes of cypress that have been harvested between 2003 and 2010 from the south-western cypress state forests are listed in **Table 5.3**.

5.2.7 Additional state forest timber supplies

Forests NSW sometimes supplies additional timber outside of the volumes specified under wood supply agreements. This includes volumes forfeited under wood supply agreements, as well as low-quality logs (for example, salvage material) and small logs that do not meet sawlog size requirements. These additional supplies do not have ongoing allocations at present.

There is growing potential to develop products made from smaller logs, including posts and trellises (see **Section 5.5.1**). Currently Forests NSW sells these small logs opportunistically (Forests NSW, written communication, 18 March 2010). However, as future demand grows these small logs may be supplied under formal allocations.

5.3 Cypress timber resources on other Crown land and private land

In addition to state forests, cypress timber resources exist on other Crown lands including Western Lands Leases (most of which is under perpetual livestock grazing lease), central division Crown land, travelling stock reserves, as well as on private land.

According to Forests NSW, Crown land has provided additional sawlogs of around 2,000 cubic metres per year (for example, 2,580 cubic metres were harvested in 2008-09). Less than 2,000 cubic metres per year of sawlogs comes from private land.

Lessees of Crown land and private landholders do not generally manage their forests for timber production. As discussed in **Chapter 3**, cypress requires active silvicultural management to mature into stands of sawlog quality. This is also discussed further in **Chapter 6**.

Western Lands Leases

The cypress timber resource on Western Lands Leases is generally of a lower quality than that from the central division forests. Lower rainfall and longer growth times results in trees that are typically shorter, knottier and more tapered.

Historically, some mills previously sourced timber from Western Lands Leases which went on to supply timber to the Sydney flooring market (Allen, M, personal communication, 20 April 2010). However, Forests NSW and mills have advised that Western Lands Lease timber is not of the quality required to meet current market requirements. For instance, in its submission, the Baradine Sawmilling Company noted:

We have knowledge of logs sourced from Western Land Leases and confirm that they are of a quality unacceptable for the Sydney/Melbourne flooring market and would certainly not be of export quality.²

Lessees have limited economic incentive to clear invasive native scrub and manage cypress regeneration for timber production. Even when additional livestock grazing returns (through carrying capacity and shelter values) are included, there is little economic incentive to thin cypress stands. Advice from the western region suggests that even if the standing resource were thinned now, a lack of management in the past would mean poorer quality sawlogs. At current royalty rates it is uneconomic for landholders to silviculturally thin cypress (Green, D, Western CMA, written communication, 31 March 2010).

The cypress timber resource on Western Lands Leases is scattered, remote and suffers from poor access. This results in higher harvest and haulage costs. In addition, the royalty rates that Forests NSW receive from Western Lands Leases are far less favourable than in other regions because of reduced timber quality, increased haulage costs and shares of the royalty being paid to the lessee. The royalty rates for Western Lands Lease sawlogs may only be worth 40 per cent of the royalty rates received from the central division (Forests NSW, written communication, 22 March 2010).

Private land cypress resource

In 2003 the private cypress timber resource accounted for 6 per cent of total cypress sawlog supply across NSW (Cypress Industry Strategic Plan, 2003). This volume has been decreasing over time, a trend that is unlikely to change with current economic and policy settings. Forests NSW notes that timber supply from private land in the south-west is “now negligible, intermittent and diminishing” (DPI, 2009, p. 157).

Private landholders have not invested in managing their cypress forests to produce a commercial timber resource because:

- cypress is often seen as a liability to be reduced rather than an asset to be protected and managed – it is classed as an invasive native scrub in six catchment management areas, and stands of growth-locked cypress can adversely affect pasture production and biodiversity values where they occupy extensive areas
- cypress grows relatively slowly and therefore there are long periods before returns on investment can be realised
- the requirement to operate under property vegetation plans is perceived as increasing the complexity and uncertainty of land management (further complicated by the maximum 15-year duration of these plans)

² Baradine Sawmilling Co Pty Ltd submission dated 1 April 2010, available on the NRC website.

- historically there has been an ample supply of competitively priced sawlogs from the cypress state forests
- there is a lack of information on the potential enterprise (NHT, 2005).

Future opportunities

There is potential for different regulatory arrangements and market forces to support more active management of private cypress forests and those on Western Lands Leases.

Williams et al. (2001), Garnaut (2007) and the Wentworth Group of Concerned Scientists (2009), amongst others, have discussed ways in which traditional and emerging markets could be harnessed in support of better management of private forests. Development of cypress-based agroforestry will require policy support and subsidies, additional to current CMA incentives. If this is warranted, it should focus on the higher rainfall areas where tree growth rates and livestock grazing returns are least marginal. Optimal regimes for carbon sequestration in cypress forests would involve non-commercial

thinning, but further research to evaluate the costs and benefits of alternative management regimes is necessary.

There also exist considerable market opportunities for cypress, with demand likely to grow in both the domestic and export sectors (NHT, 2005). With the right incentives and collaboration across relevant parties, including the cypress timber industry, CMAs and landholders, there are opportunities to broaden the cypress timber resource and income stream from both Crown timber lands and private land.

Institutional, market and certification constraints would need to be addressed for these opportunities to be fully realised.

5.4 Characteristics of the cypress timber industry

5.4.1 Overview of the cypress timber industry

The Australian cypress industry is largely reliant on timber from NSW and Queensland. White cypress occurs in South Australia, Western Australia and the Northern Territory; however, the timber quality is lower in these areas and has limited value for commercial products (NHT, 2005).

Table 5.4: Mills currently supplied with cypress sawlog by Forests NSW under 20-year wood supply agreements

Milling company	Operations
Grants Holdings Company Pty Limited	<ul style="list-style-type: none"> Mills in Narrandera and Condobolin Harvests and mills white cypress sawlogs pursuant to a 20-year wood supply agreement Sawlogs are primarily harvested from the south-western cypress state forests.
Baradine Sawmilling Company Pty Limited	<ul style="list-style-type: none"> Mill based in Baradine Harvests and mills white cypress sawlogs pursuant to a 20-year wood supply agreement Harvests majority from forests in the Brigalow and Nandewar bioregions. In the current financial year has harvested about 20 per cent of its total wood supply agreement volume from south-western cypress state forests.
Gunnedah Timbers	<ul style="list-style-type: none"> Mill based in Gunnedah Harvests and mills white cypress sawlogs pursuant to a 20-year wood supply agreement Sawlogs are primarily harvested from the Brigalow and Nandewar bioregions.
R Austin Pty Limited	<ul style="list-style-type: none"> Mill based in Quirindi Harvests and mills a small volume of white cypress sawlogs pursuant to a 20-year wood supply agreement primarily from the Brigalow and Nandewar bioregions.

Table 5.5: Other mills, manufacturers and distributors

Company	Operations
Millabill Timbers	<ul style="list-style-type: none"> Located in Mendooran A private mill that has previously processed sawlogs sourced from state forests including undercuts from the Brigalow mills.
E & RJ Hay & Company	<ul style="list-style-type: none"> Located in Eugowra and Parkes Purchases sawn cypress from Grants Holdings and laminates some of this material.
RJ & JR Stephenson Sawmilling Company	<ul style="list-style-type: none"> Located in Trundle Further processes green-sawn timber from Grants Holdings for value-adding.
J Treseder & Company	<ul style="list-style-type: none"> Located in Narromine Mills a small volume of private property cypress for the local market.
Ramiens Timber Company Pty Limited	<ul style="list-style-type: none"> Located in Dubbo Timber retailer that sells some Grant Holdings products.

Across NSW and Queensland the industry mills around 200,000 cubic metres of white cypress per year (Cypress Industry Strategic Plan, 2003; KPMG, 2006; and AgEconPlus estimate).

The south-western cypress state forests contribute around 11 per cent of this total volume.

In 1972 there were between 45 and 50 cypress mills within what is now the Western Region Supply Area (FCNSW, 1972). Transport infrastructure, demand from distant markets, the Brigalow decision and the benefits of economies of scale have resulted in industry consolidation and modernisation.

The industry in the south-western cypress state forests is dominated by one company, Grants Holdings. Grants Holdings operates two mills: one in Condobolin and one in Narrandera. The two mills have been operating since the start of the last century and the Grant family has been involved in the business since 1965 (Grants Holdings Company Pty Limited, 2010).

Within the Western Region Supply Area, Forests NSW will occasionally allocate timber from the south-western cypress state forests to mills further north. Baradine Sawmilling Company sources its timber primarily from forests in the Brigalow Belt South and Nandewar bioregions; however Baradine Sawmilling Company's submission indicated that during this financial year it will have sourced 4,500 cubic metres from the south-western cypress state forests.

Tables 5.4 and 5.5 list the companies currently operating in the Western Region Supply Area.

Since the NSW Government's 2005 Brigalow decision, the NSW cypress industry has consolidated, undergone structural adjustment and invested in improved technology. This investment in mill equipment, business management, marketing, certification and quality assurance improved sawlog recovery rates.

5.4.2 Cypress timber industry supply chain

The key stages in the supply of timber include land management (for example, Forests NSW silviculture), harvesting, haulage, milling, manufacture and transportation of final product to the market. A wide range of inputs contribute to each of these

stages including specialist labour, utilities, specialist forestry equipment, fuel maintenance and transport.

The activities of timber harvesting, haulage and milling can be viewed as distinct operations in the supply chain. However, several of these functions are often undertaken by one company. For example, mill owners in the south-western cypress state forests conduct their own haulage and harvest activities.

Role of Forests NSW

Forests NSW is responsible for managing the sustainable supply and extraction of timber from Crown timber lands. This includes:

- resource assessment and monitoring to ensure sustainable sawlog supply
- silviculture to ensure sawlog quality
- determining mill allocation
- wood supply agreement management
- mill licensing
- harvest and haulage monitoring
- royalty administration.

Forests NSW employs staff in the region to provide these services. Current Forests NSW employment linked to the south-western cypress state forests is shown in **Table 5.6**.

Forests NSW employment numbers fluctuate over time (Forests NSW, personal communication, 5 March 2010). Government employment programs have sometimes been used to supplement the work done by permanent employees. Historically there has been an overall reduction in Forests NSW employment, with a corresponding increase in efficiency. This has been largely due to technological advances, new methods and mechanisation.

Forests NSW was not able to provide annual expenditures for cypress management in the south-western cypress state forests, as management costs are not separated for sub-

Table 5.6: Forests NSW staff employed to manage south-western cypress state forests

Forests NSW Office	Full-time equivalent staff
Narrandera	4
Forbes	7
Condobolin	1
Peak Hill	1
Dubbo (9 employed in total)	3.5
Deniliquin (4 employed)	0.5
Coffs Harbour and Sydney (corporate support staff)	N/A – exact figures not available
Total	17

Source: Forests NSW, personal communication, 5 March 2010

regions within the Western Region Supply Area. Additionally, there are no comprehensive records for expenditure on non-commercial thinning (Forests NSW, personal communication, 5 March 2010).

Timber harvesting and haulage

Harvest contractors and operators must be licensed by Forests NSW and operate according to Forests NSW's harvesting plans when sourcing timber from Crown timber lands (DPI, 2009). Today, all timber harvesting from state forests is undertaken by specialist logging crews using mechanical harvesting equipment.

Milling and manufacturing

Mills process logs according to the specifications of secondary markets and end markets. Substantial fixed mills depend on a proportion of sawlogs from Crown timber lands to support value-added processing (DPI, 2009).

For example, timber milled at Narrandera by Grants Holdings is also sold to RJ & JR Stephenson, Trundle, where it is further processed. RJ & JR Stephenson manufacture kiln-dried weatherboards, flooring and some decking. E & RJ Hay & Company, at Eugowra and Parkes, purchase sawn cypress from Grants Holdings and laminate some of this material.

Transport of finished products to market

Transporters of finished product may be independent or from within mill businesses, and may work as contractors, employees or subcontractors (DPI, 2009). Typically mills in the south-western area rely on a combination of road freight and rail for product distribution to capital cities and export terminals.

5.4.3 Cypress timber industry assets

Assets of the south-western cypress timber industry include:

- harvest and haulage equipment
- non-forest property (for example, land on which the mill is located)
- mill buildings
- fixed machinery for processing
- mobile plant
- contract service equipment.

While data is not available to quantify the value of these assets, it is known that following the Brigalow decision, mills (including those harvesting from the south-western cypress state forests) invested substantially in upgrading assets, improving product quality and value-adding processing. Part of these costs was met with funding assistance from the NSW Government's Brigalow Assistance Fund (see **Appendix 19**).



Milled timber

Grants Holdings purchased a new log loader-excavator and docking facilities, two new weighbridges and dry timber export production equipment (NSW Parliament, 2007). Baradine Sawmill also invested in capital equipment, including an automatic sawbench to assist in processing smaller logs and saw sharpening equipment (Baradine Sawmilling Company Pty Limited, 2010).

5.4.4 Cypress timber industry economic value and contribution to local and regional economies

Direct economic values

The majority of the direct economic value of the cypress industry in the south-western cypress state forests relates to the operations of the two Grants Holdings mills and Forests NSW. While other mills occasionally draw small volumes from these forests, it is generally a small proportion of their annual timber intake.

For reasons of confidentiality, it was not possible to survey the size of the Grants Holdings business. The NRC has produced a general overview of the economic value of the industry directly dependent on the south-western cypress state forests from published information. These figures are derived from average industry economics across the whole NSW white cypress forestry industry and are not based on the actual financial position of any one company. Therefore, they do not reflect the exact product mix, product prices or cost structure of Grants Holdings' business.

DPI (2009) estimated the gross value of the cypress forestry industry directly dependent on the south-western cypress state forests as \$7.4 million per year. An estimated \$1.1 million of this is paid to Forests NSW as sawlog royalties.³ While a complete breakdown of other expenditures was not possible, previous studies in comparable industries suggest that total mill expenditure may be in the range of 80 to 90 per cent of gross value generated (range of production costs based on DPI, 2009; RACAC, 2000; DIPNR, 2004).

³ Estimate based on average royalty unit value of \$49 per cubic metre (DPI, 2009) multiplied by 2009 estimate of 22,815 cubic metres per year sustainable harvest volume from the south-western cypress state forests (see **Section 5.2.3**).

⁴ The first set of multipliers was prepared for the NRC's NSW River Red Gum assessment which is recent and focuses on large mills close to the study area (Arche Consulting, 2009). The second set of multipliers was prepared in 2008 for the Victorian River Red Gum industry (Gillespie et al., reported in DPI, 2009). It shares many of the same attributes as the Arche Consulting (2009) study. The final set of multipliers is for cypress milling in the Brigalow (RACAC, 2000). This study reports on the cypress industry but for a different regional economy and is now a dated analysis.

Table 5.7: Estimated regional economic contribution of the south-western cypress industry

Economic indicator	Direct value	Multipliers			Estimated regional total
		Arche Consulting (2009) (River Red Gums NSW)	DPI (2009) (River Red Gums Victoria)	RACAC (2000) (Cypress Milling Brigalow)	
Employment (mill)	50 jobs	1.78	1.38	1.51	69 jobs
Gross value (GVP equivalent)	\$7.4 million per year ^a	1.81	1.67	1.14	\$12.4 million/yr

^a This direct value figure is sourced from DPI (2009). As stated above, it does not reflect the actual financial position of the south-western mills.

These estimates of timber industry value and sawlog royalties reflect prices and demand for cypress products as they were reported in 2009 (DPI, 2009). Therefore they are not necessarily an indicator of the value of the industry into the future.

Contribution to local and regional economies

The total contribution of the south-western cypress industry is larger than the direct economic values outlined above, due to the flow-on effects of expenditure by the mills and employment of Forests NSW and mill staff. One way of estimating the total contribution is to apply appropriate multipliers to estimate the stimulus effect of expenditure by a particular industry on the overall economic activity in the region.

Table 5.7 shows that the total contribution of the forestry industry to the regional economy is estimated at 69 jobs and \$12.4 million per year in gross value. For this assessment, the NRC has assumed the structure of the regional economy is reasonably similar to that of other agriculturally dominated areas of NSW and Victoria. There are no available multipliers specifically developed for the south-western cypress forest industry; however, relevant multipliers have been sourced from studies in three other areas.⁴ All three sets are shown in **Table 7**. The middle set is used in this analysis, to allow comparison with estimates used by DPI (2009).

As **Chapter 4** outlined, Narrandera and Condobolin are the two towns that benefit most from the economic contribution of the cypress industry (and conversely, are most vulnerable to any changes in the industry). The majority of mill expenditure on goods and services occurs in these two towns⁵, and most mill employees also reside there.⁶ While employment directly supported by the south-western cypress state forests amounts to 2.5 per cent of Narrandera's total workforce and 1.3 per cent of Condobolin's workforce⁷, this may not adequately reflect the contribution of the industry to the economies of these two towns once flow-on effects are considered.

Timber from the south-western cypress state forests made up around 20 per cent of the total sawlog volume supplied to the Baradine Sawmilling Company in the last financial year. Therefore, a proportion of the 17 employees and eight

contractors employed by the Baradine Sawmilling Company (Baradine Sawmilling Company Pty Limited, 2010) are associated with the south-western cypress industry. There will also be additional flow-on effects, with some employment and household income within Baradine being supported by the use of the south-western cypress state forests timber resource.

As shown in **Table 5.6**, Forests NSW also employs 17 staff located in a number of regional centres to manage the south-western cypress state forests.

The industry also makes a contribution to the regional economy. In the Lachlan and Narrandera local government areas, within which the mills are located, the value of agriculture is approximately \$278 million per year (ABS, 2007). On this basis, the direct and indirect contribution of the industry is around 4 per cent of the value of agriculture in a typical year. In some years, this contribution may be greater due to the highly variable nature of the dominant livestock grazing industry. The cypress industry may provide an important economic buffer for the regional economy against drought-induced downturns in agriculture, as it does across NSW and Queensland (NHT, 2005).

5.4.5 Cypress timber industry outlook

Over the long term, the cypress industry is likely to face pressure on profit margins from the impacts of rising input costs (for example, labour and energy) coupled with stable commodity prices. This is a characteristic feature of primary industries. At current mill throughputs, the industry will need to continue to invest in capital that enhances log recovery rates and adds value to lower-value products. For this reason, receiving less timber supply than the volume received under current agreements could adversely affect the viability of milling operations.

Economies of scale and productivity enhancement opportunities are minimal, as there are limited opportunities to buy out competitors to secure additional cypress wood supply in this industry. If the mills are to remain profitable in the long term, more output and value needs to be garnered from existing or alternative timber supplies.

⁵ Grants Holdings indicated that most of their expenditure on goods and services occurs in Narrandera (43 per cent) and Condobolin (30 per cent). This is generally consistent with the 13 submissions from businesses supplying goods and services to Grants Holdings.

⁶ The mills in Narrandera and Condobolin currently employ 30 people residing in Narrandera (not including four unfilled positions and three staff living in nearby Grong Grong) and 13 people residing in Condobolin. Additionally, Forests NSW employs four staff in Narrandera and one staff member in Condobolin for managing the south-western cypress state forests.

⁷ The calculations are based on Coakes Consulting surveys and ABS (2006) and include both mill employees and Forests NSW employees responsible for managing the forest.

There is potential for enhanced product prices and margins if cypress timber is recognised for its unique product characteristics. As described in the following section, the cypress industry has strategic plans to market the termite-resistant characteristics of cypress timber and expand exports to overseas markets.

5.5 Markets for the cypress timber industry

The cypress timber industry enjoys a favourable market outlook that includes local domestic, capital city and export green-sawn and value-added sales.

Cypress is traditionally used in the construction sector for structural timber, external cladding, internal linings and flooring. The versatility of cypress also makes it suitable for application as weatherboards, interior lining, flooring, decking, mouldings, posts, bearers and joists, as well as for general framing purposes.

5.5.1 Cypress timber industry domestic markets

Prior to the mid-1990s, cypress timber was sold into the domestic market as a low-quality product for green structural framing.

Since the mid-1990s the cypress industry has undergone a transformation. Increasing competition from other sectors in the timber industry, such as exotic softwoods from plantations, displaced domestic markets for cypress. The cypress industry subsequently shifted focus towards maximising and promoting its unique timber qualities (NHT, 2005).

Cypress has now been repositioned as a durable, naturally termite-resistant native timber. As a result, cypress currently enjoys a niche market position with increased use as a high-value feature timber.

Domestic markets serviced with NSW cypress include the major capital cities and western NSW. The capital cities demand products such as flooring, decking, structural timbers, pickets and posts. Western NSW purchases structural timbers.

Mill waste can be processed into a range of valuable garden products, but also has potential for other uses. Short pieces are already being used to manufacture laminated beams and small logs are used for durable vineyard posts and trellis. Investments have also been made in research and development to distill mill waste and produce a natural termite-proofing agent.

Substitutes for cypress include steel framing, chemically-treated plantation *Radiata* pine, and Australian and imported natural and plantation hardwoods. However, none of these alternatives offer the cypress' natural termite resistance and durability. Cypress therefore enjoys a market niche. Favourable product and market development trends (value adding, quality and manufactured product) documented in the last Cypress Industry Strategic Plan (Cypress Industry Strategic Plan Group, 2003) have become more important to the industry in 2010.

5.5.2 Cypress timber industry export markets

Between 10 and 20 per cent of NSW cypress is exported. The Cypress Industry Strategic Plan Group (2003) quotes exports of 11 per cent of NSW cypress sales in 2002, with a target of 25 per cent by 2010. Baradine Sawmilling Company indicates up to 40 per cent of its sales are export (Baradine Sawmilling Company Pty Limited, 2010).

Cypress is exported to countries such as Japan, China, the US and Europe. The export product mix includes dodai (traditional Japanese construction timber), kiln-dried flooring, weatherboards, decking, pickets and other dressed timbers. Japan demands high-quality structural timbers. Basic milled product is currently sent to China where it is manufactured into engineered floors for re-export. A domestic market in China for NSW cypress timber is also under development.

While it would be expected that the impacts from the global financial crisis and a strong Australian dollar would have limited cypress export growth in the short term, the industry reports minimum impacts since 2007.

5.5.3 Certification

Forest certification is increasingly important in maintaining access to export markets. There are two forest management certification schemes in Australia: the Australian Forest Certification Scheme (Australian Forestry Standards Limited, 2010) which is recognised by the international Programme for Endorsement of Forest Certification (PEFC); and the Forest Stewardship Council (FSC).

The NSW cypress industry has expanded its international markets on the basis of PEFC certification, and obtained additional accreditations specifically for the Japanese market.

State forests managed by Forests NSW are certified under the Australian Forest Certification Scheme. Currently 87 per cent of Australia's native timber harvesting forests and plantations are certified under this scheme.

Certification would assist private forest owners to gain market access. However, no private forest owners currently harvesting cypress have sought certification under these schemes. While there are no barriers in principle to certification of small-scale growers, there are various constraints in practice. Overcoming these constraints is the subject of active debate internationally (Forest Stewardship Council, 2008; Street & Price, 2009). In addition, land management actions on Western Lands Leases may compromise successful forest regeneration and lessees may need to change management practices to gain certification.



Timber drying kiln

Managing cypress forests and associated woodlands

6.1	Overview	88
6.2	Managing cypress in the south-western cypress state forests	88
6.3	Managing cypress on private and leasehold land	92
6.4	Managing cypress in the reserve system	95
6.5	Goals, objectives and principles for management	95
6.6	Conservation and tenure arrangements	104
6.7	Performance review and improving information	109



6.1 Overview

The ecological characteristics of cypress influence the environmental and social values of the cypress state forests. Given the structure and condition of most white cypress forests and woodlands, they now require ongoing active management across all tenures.

Clear management goals and feasible strategies to achieve those goals are necessary to ensure the cypress state forests continue to support the values we seek from them. In developing these goals and strategies it is important to view the cypress state forests from a landscape perspective. We need to understand how and why the south-western cypress state forests have changed, and the trajectories that past, current and future forest management have or will set for these forests.

This chapter supports **Steps 2, 3 and 4** of the analytical framework by:

- describing the management of cypress on the south-western cypress state forests, private and leasehold land and reserves
- outlining management objectives and principles for the south-western cypress state forests, which are equally applicable to the cypress forests on other tenures in the broader landscape
- identifying potential management approaches and associated tenure arrangements that should continue to support community values and promote resilient landscapes.

The key findings of this chapter are:

- There is already a diversity of management arrangements for managing white cypress forests and associated woodlands; for instance:
 - Forests NSW is managing 197 south-western cypress state forests, covering approximately 195,750 hectares, using a system of management zoning and silvicultural practices to support environmental values and timber production
 - over 2 million hectares of invasive native scrub, including cypress, is currently managed on private and leasehold land across the six catchment management areas surrounding the south-western cypress state forests to improve or maintain environmental outcomes and support agricultural production values
 - approximately 372,000 hectares is managed for conservation in the reserve system surrounding the south-western cypress state forests, containing at least 40,000 hectares of mixed cypress woodlands
 - approximately 12,550 hectares of white cypress and western hardwoods are managed for private native forestry in NSW, mostly in the Brigalow Belt South and Nandewar areas of NSW.

- CMAs are working with landholders to transition dense cypress regrowth behaving as invasive native scrub into vegetation mosaics to maintain or improve environmental outcomes and support productive values. They are also working with other agencies to manage cypress on other Crown lands, such as travelling stock reserves, to support environmental and agricultural productive values.
- In the central division, south-western cypress state forests should be managed to maintain and enhance structural complexity. Ways of achieving greater connectivity between these state forests should be pursued.
- In the western division, management should focus on transitioning the landscape into a mosaic of vegetation types to increase landscape function.
- Based on available scientific information on the 197 cypress state forests, the NRC found that 168 cypress state forests are particularly valued for their timber resources, environmental values and contribution to landscape function. These 168 forests should remain as state forests and be specifically managed to maintain these suites of values. Forests NSW should revise its forest management protocols to ensure they are consistent with the forest management principles in **Section 6.5.2**.
- Of these 168 cypress state forests, available evidence suggests that a subset of forests may have particularly high value for landscape function and/or are vulnerable to particular threatening processes. In 25 forests with high values for landscape function, the impacts of grazing on ecological values should be monitored closely and management regimes should be refined where required. In a further 11 cypress state forests that are small and isolated, timber harvesting should be carefully managed to ensure that spatial variability and habitat refuges are maintained.
- The remaining 29 cypress state forests are valued more highly for environmental and other uses than for their timber resources, and it will be more practical to manage these forests primarily for conservation. Alternative management and tenure arrangements are identified for these forests.

6.2 Managing cypress in the south-western cypress state forests

Forests NSW is responsible for managing the 197 south-western cypress state forests, covering a total area of approximately 195,750 hectares.

In managing these forests, Forests NSW is guided by five-year strategic plans that identify policies, objectives and targets for the south-western cypress state forests.¹ The plans describe the cypress state forests' values, how they will be managed, how compliance with regulatory regimes will be ensured and how ecological sustainability in forest-based activities, including timber production, will be achieved (Forests NSW, 2008c). Forest management practices are certified by Forests NSW's Environmental Management System (certified to ISO14001) and the Australian Forestry Standard AS4708.

¹ For example – *Ecologically sustainable forest management plan, western region NSW* (Forests NSW 2008c).



Marked trees retained after thinning in Yarranjerry State Forest

The silvicultural systems and management practices applied in the south-western cypress state forests have evolved as a result of experience and research since formal forest management began in the region in the early 1900s. Forests NSW has developed a silvicultural system and management prescriptions for cypress. Their aim is to sustainably manage the cypress timber resource, promote growth and regeneration of cypress stands after harvesting and reduce impacts on environmental values (Forests NSW, 2008b, 2008c).

6.2.1 Silvicultural system and prescriptions

A silvicultural system has been developed to address the unique ecological characteristics of cypress, particularly its tendency to form dense stands of regrowth. The system aims to optimise cypress timber production and maintain ecosystem function and incorporates three phases:

1. **Non-commercial thinning** – where dense stands of small cypress regeneration are thinned to reduce competition, eliminate growth-locked stands and promote tree growth. In the long term this helps to ensure the provision of merchantable timber in the remaining cypress timber resource.
2. **Commercial thinning** – where cypress timber is thinned to extract merchantable timber, while simultaneously creating a more open canopy that can promote further growth of remaining trees and regeneration of a new cohort.
3. **Commercial harvest** – where large, merchantable cypress timber is harvested on a large scale, after a new

cohort of young trees is well established. The harvest reduces competition and promotes further growth in the new cypress cohort (Cypress Industry Strategic Plan Group, 2003).

Figure 6.1 illustrates this silvicultural system. In today's south-western white cypress state forests:

- non-commercial thinning is generally applied to 1950s and post-1950s cohorts
- commercial thinning is generally applied to the 1890s cohort, and in some cases advanced 1950s cohorts
- commercial harvesting is generally applied to the 1890s cohort, where non-commercial thinning was applied in the late 1800s and early 1900s.²

In general, the 1890s cohort supplies the current 20-year wood supply agreements. Subsequently, longer-term sustainable yields and extraction will rely on the 1950s and post-1950s cohorts.

Appendix 17 provides some more detail on the silvicultural systems applied, including other management prescriptions. It also compares these against forestry practices that can be undertaken by landholders on private and leasehold land.³

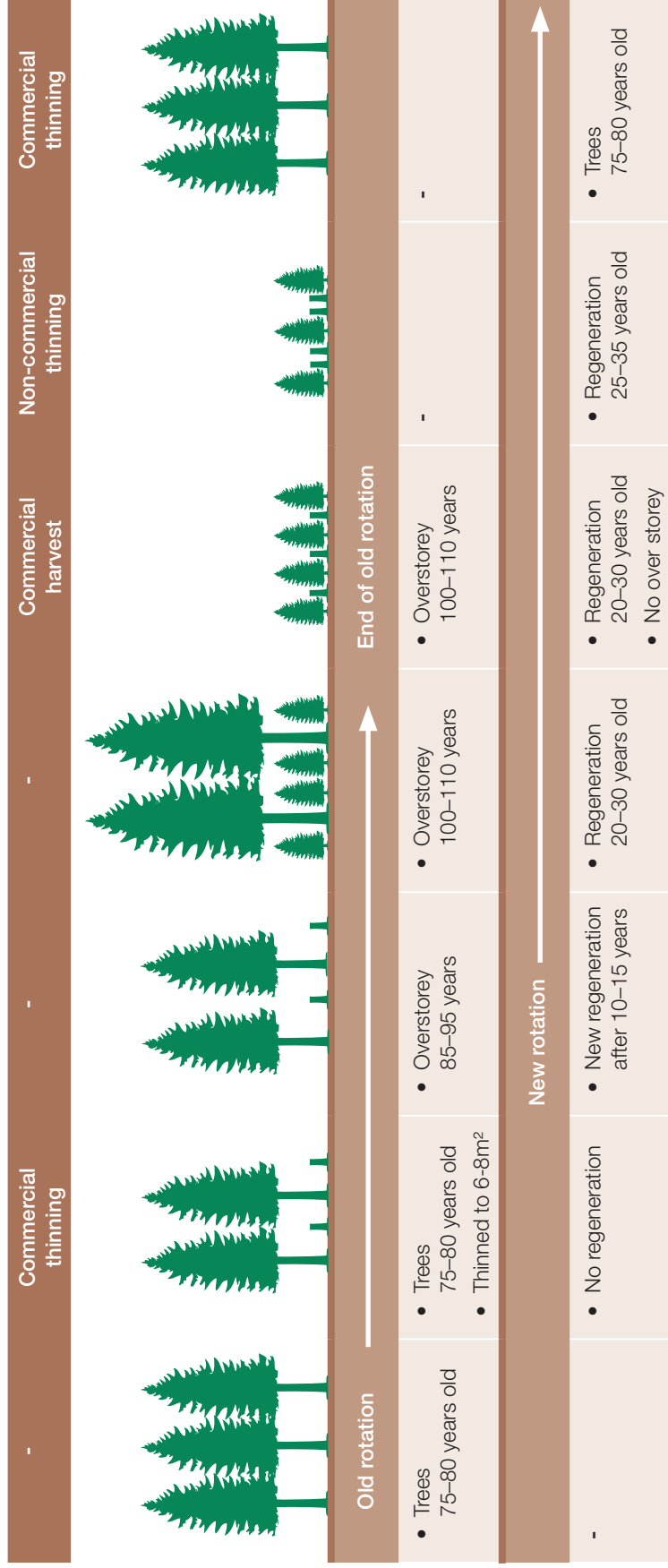
6.2.2 Forest management zoning

Forests NSW uses a system of forest management zoning to help achieve specific management objectives in each of the

² See **Chapter 5** for a definition of cohorts.

³ Under the *Native Vegetation Act 2003*.

Figure 6.1: Nominal silviculture for white cypress stands



Notes:

- Although this figure shows cypress-dominated stands, most stands contain a mixture of cypress and other species, particularly Eucalyptus species. Eucalyptus species are not removed, thinned or harvested at any point during this sequence of silvicultural activities.
- A prescribed minimum stocking of mature trees is retained in all stands following commercial harvesting to provide seed trees in case regenerating stands are damaged by fire or other disturbances.

Table 6.1: Forest management zoning – objectives and activities

Forest management zone ^a	Objectives	Activities permitted (examples)	Activities not permitted (examples)	Activities requiring special permission (examples)
Zone 1 – Special protection	Management to maximise protection of very high natural and cultural conservation values	<ul style="list-style-type: none"> Scientific studies approved by Forests NSW Maintenance of existing roads and fire trails Feral animal and noxious weeds control 	<ul style="list-style-type: none"> Timber harvesting Removal of forest products and materials Grazing by domestic stock 	<ul style="list-style-type: none"> Construction of new roads and fire trails (only permitted when no practical alternative is available)
Zone 2 – Special management	Specific management and protection of natural and cultural conservation values where it is not possible or practicable to include them in Zone 1	<ul style="list-style-type: none"> Scientific studies approved by Forests NSW Maintenance of existing roads and fire trails Feral animal and noxious weeds control 	<ul style="list-style-type: none"> Timber harvesting Removal of forest products and materials Grazing by domestic stock 	<ul style="list-style-type: none"> Construction of new roads and fire trails (only permitted when no practical alternative is available)
Zone 3 – Harvesting exclusions and special prescriptions	Management for conservation of identified values and/or forest ecosystems and their natural processes, in either Zone 3A or Zone 3B	<ul style="list-style-type: none"> Scientific studies approved by Forests NSW Maintenance of existing roads and fire trails Grazing by domestic stock 	<ul style="list-style-type: none"> Examples for Zone 3A: <ul style="list-style-type: none"> Timber harvesting Removal of forest products and materials Gravel/hard rock quarrying 	<ul style="list-style-type: none"> Zone 3B – Timber and other forest product extraction Road and fire trails construction Infrastructure development
Zone 4 – General management	Management of native forests for timber production utilising the full range of silvicultural options as appropriate; and conservation of broad area habitat and environmental values that are not dependent on the structure of the forest	<ul style="list-style-type: none"> Production of timber and other forest products Road construction and maintenance Gravel/hard rock quarrying Grazing by domestic stock 	-	-

^a Other zones, not applied to the south-western cypress state forests, are Zone 5 – Hardwood plantations; Zone 6 – Softwood plantations; Zone 7 – Non-forestry use; and Zone 8 – Area for further assessment
Zone 7 – Non-forestry use is applicable to 2 state forests (Condobolin and Dubbo) in which depots and offices are located.

south-western cypress state forests. There are eight zoning classifications, ranging from zones with special protection to zones that require further assessment.

Table 6.1 describes the four main zones applicable across the south-western cypress state forests. **Appendix 16** lists the zones applicable to each state forest under this assessment.

6.3 Managing cypress on private and leasehold land

The *Native Vegetation Act 2003* (NSW) regulates the management of native vegetation on private land and leasehold properties in NSW. This Act provides for the preparation of Property Vegetation Plans (PVPs) which set the specific management actions that can be undertaken on a property for up to 15 years. For any PVP to be approved, it must meet the 'improve or maintain' test which means any activity must improve or maintain environmental outcomes.

There are three types of PVP for the management of white cypress on private and leasehold land: Invasive Native Scrub PVP; Thinning PVP; and Private Native Forestry PVP.

CMAAs are responsible for approving Invasive Native Scrub and Thinning PVPs.⁴ Private Native Forestry PVPs are approved by DECCW.

6.3.1 Managing cypress as invasive native scrub

Cypress is classified as invasive native scrub under the NSW *Native Vegetation Act 2010* in six catchment regions of NSW (DECCW, 2010 and **Figure 6.2**).⁵ Invasive native scrub is:

- a plant species that invades vegetation communities where it has not been known to occur previously, or a species that regenerates densely following natural or artificial disturbance,
- where the invasion and/or dense regeneration of the species results in change of structure and/or composition of the vegetation community,
- where the species is within its natural geographic range or distribution (NSW Government, 2006).

Extensive dense stands of invasive native scrub can affect production values by reducing pasture growth, creating difficulties in livestock management and providing habitat for feral animals. They can also affect biodiversity by reducing habitat variability and may promote soil erosion by reducing groundcover. However, stands of invasive native scrub still provide habitat for many native flora and fauna and can act to connect remnant patches of vegetation, providing for movement of animals across the landscape (NSW Government, 2006).

Much of the science underpinning the approach to invasive native scrub in NSW is interpreted through well-established state-and-transition models, self-thinning and landscape heterogeneity theories (Hassall & Associates, 2006). There are over 40 native plant species listed as invasive native scrub in NSW, including white cypress. Landholders can elect to follow either an Invasive Native Scrub PVP (INS PVP) or Thinning PVP to treat cypress behaving as an invasive species.

Invasive Native Scrub Property Vegetation Plans

INS PVPs aim to re-introduce vegetation mosaics into the landscape, to promote biodiversity and healthy soils. Once an INS PVP has been approved by a CMA a number of management treatments can be applied (**Table 6.2**). Landholders can strategically retain areas of invasive native scrub in a pattern to match their landscape conditions. However, it is preferred that invasive native scrub be retained in patches and clumps across the property. Invasive native scrub can also be retained as separate buffers between treated areas of invasive native scrub, rather than as a single large block.

Over 200 INS PVPs have been approved in NSW (**Table 6.3**). In practice, many properties have been treated for a number of different invasive native scrub species. However, in the past the information management systems for capturing data in INS PVPs have not spatially distinguished between white cypress and other invasive native scrub species under treatment.

Thinning Property Vegetation Plans

Thinning is applied to dense stands of white cypress to improve or maintain environmental outcomes. A Thinning PVP can be approved if the activity:

Table 6.2: Management treatments for white cypress acting as invasive native scrub

Treatment	Treatment limit	
	Initial (%)	Maximum (%)
Burning	80	80
Clearing of individual plants with no disturbance to groundcover	80	80
Clearing of individual plants with limited disturbance to groundcover	60	80
Clearing of plants at paddock scale with limited disturbance to groundcover	60	80
Clearing of plants at paddock scale with temporary disturbance to groundcover	40	80
Clearing of plants at paddock scale with longer term disturbance to groundcover	20	80

⁴ On behalf of the Minister for Climate Change and the Environment.

⁵ Border Rivers Gwydir, Central, Lachlan, Namoi, Murrumbidgee and Western CMA areas.

- thins stem densities at or above a predefined benchmark for the vegetation type
- minimises disturbance to remaining vegetation
- does not occur over more than 80 per cent of the proposal area.

Native vegetation regulations do not require offsets⁶ for this activity if these conditions are met.

A 'benchmark' defines the range of abundance of different species that occurs naturally in a vegetation stratum of a particular vegetation type. For example, in the Western CMA region, landholders can thin cypress⁷ to a minimum of eight stems per hectare on up to 80 per cent of a proposed area. This is because cypress occurs naturally as an overstorey species with 8–30 stems per hectare.

Currently, 21 Thinning PVPs have been approved in NSW, covering 2,421 hectares (Table 6.3). In practice, many properties apply thinning back to benchmark for a number of different invasive native scrub species. However, the information management systems for capturing data on Thinning PVPs do not spatially distinguish between white cypress and other invasive native scrub species under treatment.

6.3.2 Managing cypress under private native forestry

Private native forestry in NSW is regulated under the *Native Vegetation Act 2003*. A landholder must have an approved Private Native Forestry PVP (PNF PVP) to commence forestry operations on private land.

The *Private Native Forestry Code of Practice for Cypress and Western Hardwood Forests* (PNF Code) sets the minimum operating standards for harvesting in private native forests, where the management intent is to derive commercial returns from forest management. The PNF Code also provides minimum standards with respect to soil erosion and protection of waterways. The application of these standards is considered to 'improve or maintain' environmental outcomes.

The PNF Code also sets out provisions for the protection of other environmental values, including old growth forests, rainforests, wetlands, heathlands and threatened ecological communities, populations and species.

On Western Lands Leases and other Crown timber lands, PNF PVPs are not applicable. Instead, the leaseholder needs to operate under an Invasive Native Scrub or Thinning PVP approved by the relevant CMA. Royalty aspects are discussed and agreed with Forests NSW prior to any clearing.

There are currently 27 approved PNF PVPs for cypress and western hardwoods in NSW, covering 12,550 hectares⁸ (DECCW, 2010). Figure 6.2 shows the majority of these are located in the north-eastern part of NSW, with only a few located on private land around the south-western cypress state forests. Only one PNF PVP occurs south of Dubbo. It is not possible to distinguish how much of this area is for harvesting white cypress, as the PNF Code also allows for harvesting black cypress and many species of eucalypt.

PNF PVPs can be prepared for landholders looking to harvest timber on their land for commercial gain. There is no specified lower limit on the duration of a PNF PVP, though it is not common or desirable for a PNF PVP to be less than two years. The upper limit is 15 years, which is significantly shorter than the silvicultural cycle of slow-growing cypress species. The PNF Code outlines the silvicultural practices permitted under a PNF PVP, including the minimum vegetation restocking rates that must be met after harvesting or regeneration events. These include:

- **Non-commercial thinning** – cypress can be thinned in the 4–6 metre height class to 280 stems per hectare (around 6 x 6 metre spacing).
- **Commercial thinning** – commercial grade cypress can be thinned to a basal area of 6 square metres per hectare.
- **Commercial harvest** – the oldest age class can be harvested when regenerating white cypress in the understorey reaches the 4–6 metre height class.

Table 6.3: Area of approved Invasive Native Scrub PVPs and Thinning PVPs

CMA	Invasive Native Scrub PVPs		Thinning PVPs	
	Number	Area (ha)	Number	Area (ha)
Border Rivers/Gwydir	19	6,798	2	164
Central West	29	47,595	1	111
Lachlan	29	50,353	7	518
Murrumbidgee	4	80	1	56
Western	132	2,019,390	8	988
Namoi	37	3,576	-	-
Total	250	2,127,792	21	2,421

Source: DECCW (2010) Public register of approved clearing PVPs and development applications.

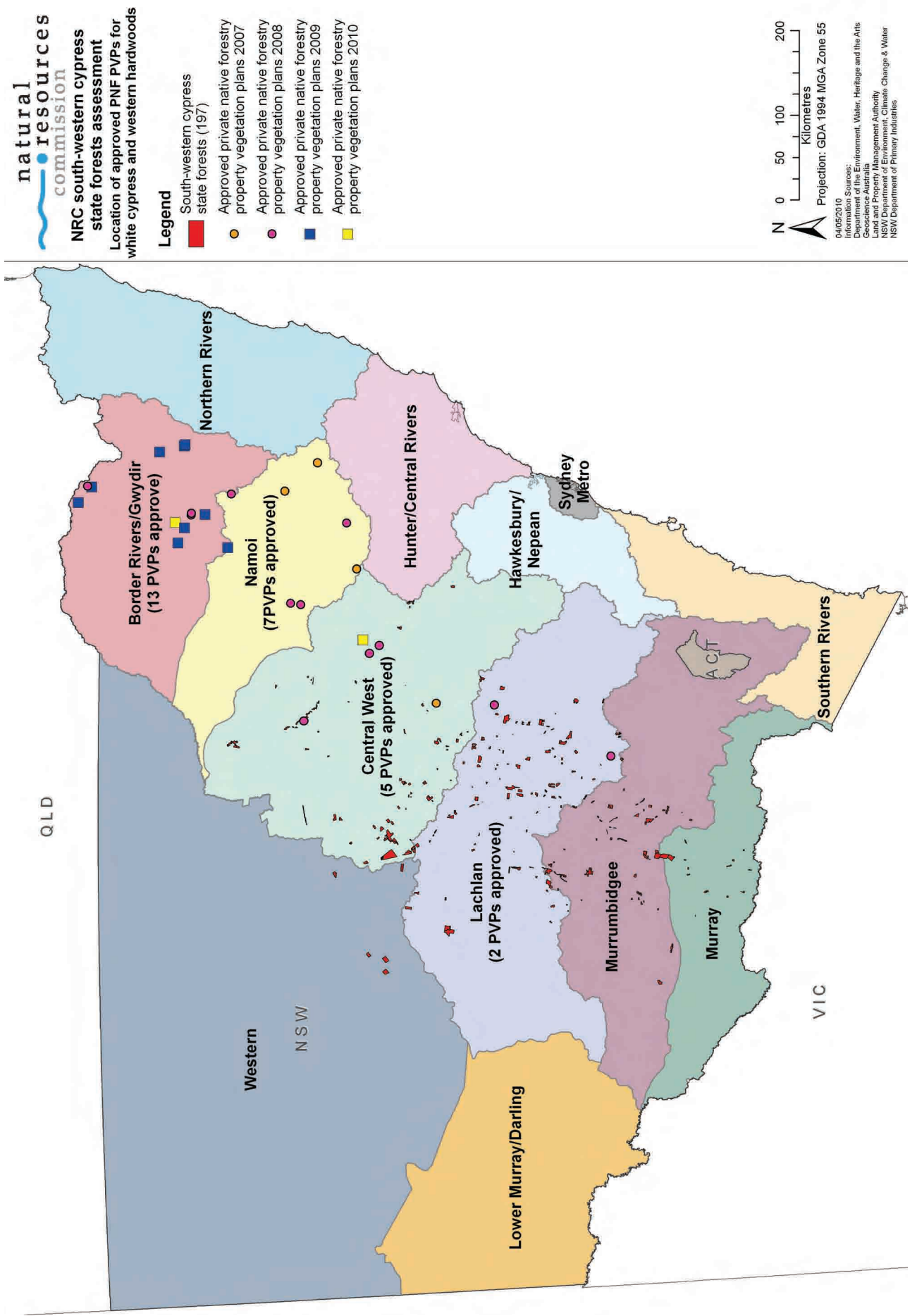
⁶ Offsets are management actions to balance any negative impacts of clearing and are required under the *Native Vegetation Act 2003* to meet the 'improve or maintain' test.

⁷ White cypress pine woodland on sandy loam soils is the vegetation community in this example.

⁸ As at 1 April 2010.

Figure 6.2: Location of approved PNF PVPs for white cypress and western hardwoods

Source: DECCW (2010) Public register of approved clearing PVPs and development applications :



- **Regeneration and stocking** – 80 per cent of plots must be stocked with regenerating seedlings within 36 months of a regeneration event (that is, two consecutive wet summers following a harvesting or thinning operation).

6.4 Managing cypress in the reserve system

DECCW manages more than 6 million hectares of national parks and reserves under the *National Parks and Wildlife Act 1974*. The reserve system aims to:

*identify, protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor use and enjoyment.*¹⁰

In the landscape surrounding the south-western cypress state forests, there are 36 conservation reserves¹¹, totalling approximately 371,838 hectares.¹² These reserves contain a range of vegetation types, including white cypress forest and associated woodlands.

Some of the major reserves are:

- Yathong Nature Reserve – 109,024 hectares of which around 20,000 hectares is associated woodland
- Nombinnie Nature Reserve – 72,289 hectares of which around 20,000 hectares is associated woodland
- Nombinnie State Conservation Area – 46,324 hectares
- Goobang National Park – 42,439 hectares.

6.4.1 Management plans

Under the *National Parks and Wildlife Act 1974* a plan of management is required for all reserves in NSW. Plans are legal documents that explain how a reserve will be managed, including fire management.

Yathong and Nombinnie Nature Reserves contain around 40,000 hectares of associated woodlands amongst other vegetation types. **Table 6.4** describes these vegetation types and how the reserves are managed to achieve a range of objectives.

As in the *Native Vegetation Act 2003*, the management plans of these two nature reserves identify fire regimes as a way to achieve more diverse vegetation structures and floristics. There are other thinning and clearing treatments listed in the *Native Vegetation Act* as methods for maintaining and improving environmental outcomes. However, these treatments are not identified in the nature reserve management plans as being appropriate for use in treating cypress behaving as invasive native scrub.

6.5 Goals, objectives and principles for management

The NSW Government has adopted a long-term, aspirational goal to achieve:

resilient, ecologically sustainable landscapes functioning effectively at all scales and supporting the environmental, economic, social and cultural values of communities (NRC, 2005).

The NRC considers that this is a suitable long-term goal for the future management of the south-western cypress state forests and the broader landscape.

Natural resource management actions are often focused on one component of the system in isolation of others (NRC, 2007; NRC, 2008). While this can deliver measurable benefits for that component, it can fail to recognise both positive and negative changes in the larger system.

The NRC considers that all natural resources, including vegetation, need to be managed at the appropriate temporal, spatial and institutional scale to ensure that underlying landscape processes can support the environmental, economic and social values that society identifies for that landscape over time. Understanding and managing landscape processes requires analysis of different natural resources and their interaction at various scales to form an integrated understanding of the landscape (NRC, 2005; NRC, 2007).

The NRC has developed a guiding set of management objectives and principles for white cypress and associated woodlands across all tenures in the landscape. These are not intended to replace the management approaches already undertaken by Forests NSW in state forests. Rather, they provide an overarching framework for continual improvement of management both within the cypress state forests and across the landscape.

For this assessment, the NRC identified the central and western divisions as important landscape units in which to examine the function of white cypress and associated woodland communities in the landscape.

6.5.1 Future management objectives to promote function and resilience at the landscape scale

The NRC considered a range of criteria to develop a set of management objectives for white cypress and associated woodlands across the central and western divisions of NSW. These include the:

- **current condition** (or states) of cypress vegetation types as indicated by the generalised models describing vegetation change across the landscape and over time (developed by the NRC and outlined in **Chapter 3**)

¹⁰ Section 36, *National Parks and Wildlife Act 1974*.

¹¹ For example, national parks, nature reserves and state conservation areas.

¹² Within the NRC's composite mapping area, approximately 230,400 hectares of white cypress forests and associated woodlands are managed in the reserve system – see **Appendix 11** for more detail.

Table 6.4: Management strategies for reserves in the assessment area

Management plan	Key vegetation types	Specific management objectives	Strategies and approach
<p>Plan of Management for Yathong Nature Reserve, Nombinnie Nature Reserve and Round Hill Reserve (1996)</p>	<p>White cypress woodland occurs widely on the lowlands and ridges – around 40,000 hectares</p> <p>Red box – white cypress woodland is widespread on the rolling lowlands and also occurs on the old playa lakes</p> <p>Bimble box occurs in often quite dense stands along drainage channels and run-on areas</p> <p>Belah woodland occurs on level to undulating country on calcareous soils</p> <p>Other woodland communities include ironwood (<i>Acacia excelsa</i>), on the lowlands, mulga (<i>Acacia aneura</i>), on the ranges and black box (<i>E. largiflorens</i>), in a depression near the south-western boundary of Nombinnie</p> <p>Mallee (<i>E. socialis</i>, <i>E. Dumosa</i>, <i>E. gracilis</i>) covers most of the sandplain and dune areas</p> <p>Mallee (<i>E. morrissii</i> and <i>E. viridis</i>) occurs in small areas on the ranges and hills</p>	<ul style="list-style-type: none"> • Protection and encouragement of habitat diversity, including a range of age classes since fire • Encouragement of the regeneration and growth of native vegetation communities • Protection of the habitat of rare plant and animal species • Protection of native animal communities from predation and competition by feral animals • Improvement of knowledge of the natural heritage and ecology of the area • Promotion of awareness of changes to the natural systems of the region arising from livestock grazing and agricultural practices 	<ul style="list-style-type: none"> • Control of rabbits and goats in order to permit regeneration of previously cleared plant communities • Fire management to achieve a wider range of vegetation age classes and in particular to permit development of Mallee communities • Research and education



- **trajectories** of the white cypress and associated woodlands across the wider landscape considering: the feasibility of transitions into previous conditions; environmental, social and economic values; and the range of management regimes available to support future options for our communities.

From this, the NRC has developed a set of 10 landscape-specific management objectives that should promote the achievement of the NSW's Government's long-term NRM goal in the south-western cypress state forests and the broader landscape. **Tables 6.5** and **6.6** detail the proposed management objectives for different tenure types across the central and western divisions.

In summary:

- **The south-western cypress state forests** of the **central division**, along with travelling stock reserves, provide many of the largest patches of high quality native vegetation in an otherwise cleared landscape. They also provide important refuge for flora and fauna in a cleared landscape and should make a crucial contribution to regional biodiversity conservation as the climate changes (Dunlop & Brown, 2008).

Cypress across the central division landscape should be managed to create or maintain ecological connectivity and networks of habitat across public and private land. The cypress state forests, and other public lands such as travelling stock reserves, should act as connective nodes within these habitat networks.

CMAAs should lead strategic planning that identifies, protects and manages north-south and east-west corridors. Such corridors will be essential to aid faunal movement between remnants, and to allow flora and fauna species to migrate and adapt to climate change.

Figure 6.3 shows the distribution of major areas of refuge in the landscape. These are interconnected by a network of functional corridors that have been delineated based on 'contiguity' of native vegetation patches. Many of these functional corridors include cypress state forests, travelling stock reserves and existing nature reserves.

It is practical to continue to manage these forests for both timber resources and environmental values, as well as other economic, social and cultural uses. Forest management zoning should continue to promote the conservation and protection of environmental values. In areas zoned for timber production, silvicultural practices (particularly non-commercial thinning) have a critical role to play in ensuring long-term sustainable timber yields, while also maintaining and enhancing structural diversity within forest patches and supporting biodiversity conservation.

The viability and feasibility of a higher level of sustainable agro- and farm-forestry on privately managed land in these landscapes should be explored, to improve resilience of the ecological and social systems across the landscape.

- **The south-western cypress state forests** of the **western division** are found in landscapes where the surrounding vegetation is largely intact, contiguous and, in many cases, contains species behaving as invasive native scrub (including cypress).

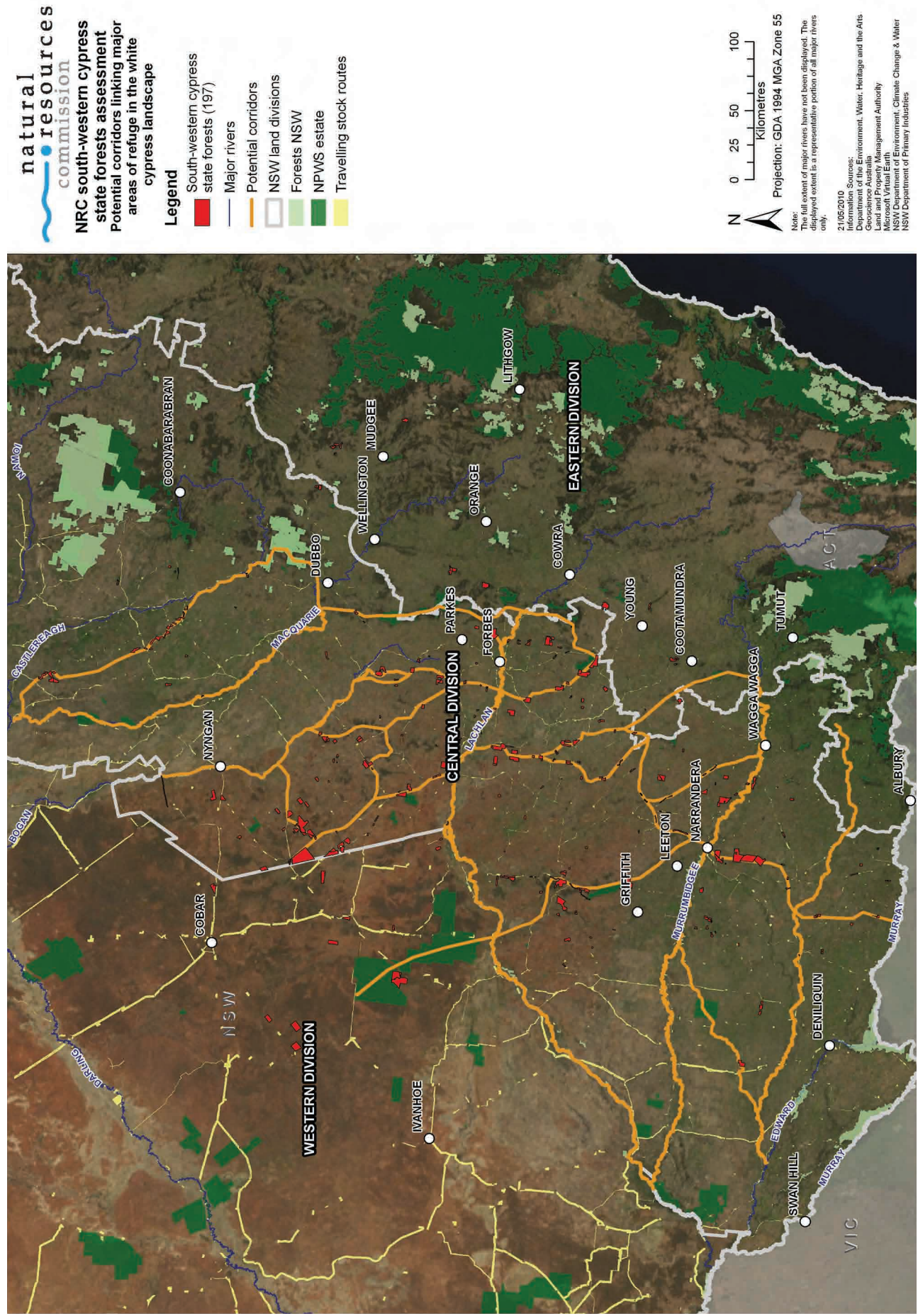
Table 6.5: Proposed management objectives for landscape management of cypress in the central division

Tenure	General biophysical condition	Trajectory	Management objectives
Private and leasehold	<ul style="list-style-type: none"> Fertilised pastures, crops and sown pastures Scattered trees and little recruitment, eucalypt and cypress sparse or absent 	<ul style="list-style-type: none"> Highly likely to remain in current condition Continued agricultural landscapes to support economic and social values Improved landscape function and resilience over long-term through NRM investment and CMA engagement 	<ol style="list-style-type: none"> Increase landscape connectivity (predominantly north-south) between nodes such as south-western cypress state forests Strategic NRM investment and whole-of-government action under catchment action plans
South-western cypress state forests	<ul style="list-style-type: none"> Cypress-dominated stands of different age classes and structure depending on silvicultural history Mix of exotic and native groundcover 	<ul style="list-style-type: none"> Highly likely to remain in current condition In absence of non-commercial thinning or other interventions, many stands will increasingly become dominated by dense cypress Continued forestry to support economic values Continue to play important role in supporting environmental values 	<ol style="list-style-type: none"> Increase non-commercial thinning silviculture in wood supply forests to support longer term production and environmental values Retain state forests in landscape as refugia for fauna and flora Maintain and improve vegetation structure and floristic composition and faunal habitat values
Conservation reserves	Not assessed	<ul style="list-style-type: none"> Variable depending on current vegetation structure and prevailing disturbance regimes, including grazing by feral animals and burning 	<ol style="list-style-type: none"> Retain in landscape as refugia for fauna and flora Maintain and improve vegetation structure, floristic composition and faunal habitat values

Table 6.6: Proposed management objectives for landscape management of cypress in the western division

Tenure	General biophysical condition	Trajectory	Management objectives
Private and leasehold	<ul style="list-style-type: none"> • Areas of dense regrowth thickets of invasive native scrub species including cypress • Low to moderate floristic diversity • Mix of native and exotic groundcover 	<ul style="list-style-type: none"> • Continued transition into vegetation mosaics if increase in Invasive Native Scrub PVP • Improved landscape function and resilience over long-term through NRM investment and CMA engagement • Improved community resilience 	<p>8. Promote Invasive Native Scrub PVPs to increase vegetation mosaics in the landscape</p> <p>9. Transition landholders into 'landscape managers' to support environmental and economic outcomes</p> <p>10. Explore feasibility of private native forestry through innovations such as combined PNF and Invasive Native Scrub PVPs</p> <p>11. See Objective 2.</p>
South-western cypress state forests	<ul style="list-style-type: none"> • Cypress-dominated stands of different age classes and structure depending on silvicultural history • Mix of exotic and native groundcover 	<ul style="list-style-type: none"> • Highly likely to remain in current condition • Continued forestry to support economic values • Continue to play important role in supporting environmental values 	<p>12. Increase non-commercial thinning silviculture in wood supply forests to support longer-term production values</p> <p>13. Maintain and improve vegetation structure and floristic composition and faunal habitat values</p>
Conservation reserves	Not assessed	<ul style="list-style-type: none"> • Variable depending on current vegetation structure and prevailing disturbance regimes, including grazing by feral animals and burning 	<p>14. Maintain and improve vegetation structure, floristic composition and faunal habitat values</p>

Figure 6.3: Potential corridors linking major areas of refuge in the white cypress landscape. Methodology is explained in Appendix 11.



In the western division, management should aim to improve the structural diversity and floristic composition of the cypress state forests and the cypress forests in reserves, while also improving the diversity of existing vegetation on private and leasehold land. CMAs should lead the transition of the western division landscapes into a mosaic of vegetation communities.

As with the central division, the viability and feasibility of an agro- and farm-forestry industry in the western division should be explored.

6.5.2 Management principles for white cypress and associated woodlands.

The NRC considers that the most threatening processes for environmental values in many south-western cypress state forests are likely to be activities which reduce spatial variability in vegetation structure of small forests, ecologically-inappropriate livestock grazing and fire regimes.

However, the NRC considers current silvicultural management of cypress stands in the south-western cypress state forests is appropriate to maintain timber and environmental values and also has the potential to mitigate against some threats (for example, by creating structural variability in vegetation). The current management of the cypress state forests (for example, non-commercial thinning) contributes to variations in vegetation structure, promoting environmental outcomes at both the individual forest and landscape scale. The management of white cypress on other tenures also contributes to these outcomes.

However, there is opportunity for the management of the cypress state forests to provide even greater environmental outcomes at all scales if it is conducted according to the ecological principles outlined below. These principles have been developed specifically for white cypress forests and associated woodlands and build on general principles for managing ecosystems (**Box 6.1**). These principles are intended to underpin the management of white cypress forests and associated woodlands across all tenures in the landscape. Current management protocols should be refined to incorporate the new management principles outlined in this section and these should be codified into an IFOA.

Principle 1: Non-commercial thinning in white cypress forests should be seen and implemented as good natural resource management supporting both long-term private and public benefit.

Dense cypress regeneration is a common feature of cypress ecology and silviculture and can provide important biodiversity values at a stand scale, such as screening for fauna against predation. However, where regrowth occupies large areas for lengthy periods, both production and conservation values are expected to decline. Non-commercial thinning of dense regrowth can maintain production and biodiversity values at forest and landscape scales by creating and maintaining structurally variable vegetation mosaics. It should be implemented as part of good natural resource management, supporting both long-term private and public benefits.

In conservation reserves, ecological burning regimes may provide a practical and appropriate tool to maintain and enhance vegetation variability rather than using thinning as is practised in state forests, although opportunities to use

the latter should be undertaken where required for ecological purposes.

Principle 2: Silvicultural management should maintain the spatial diversity of vegetation structures and the presence of different phases of the cypress silvicultural cycle within each state forest, and – where necessary – enhance these characteristics.

Chapter 3 describes the importance of spatial variability in vegetation structure within individual cypress state forests, as it can make a major positive contribution to biodiversity.

Historical and current harvesting practices by Forests NSW have maintained a diversity of stand structures within many forests by dispersing harvesting areas across different forests each year. This practice also minimises between-year variations in haulage distances and maintains annual flexibility in timber provision under unpredictable weather conditions. As a result, a mosaic of patches at different stages in the silvicultural cycle is dispersed across the entire cypress state forest estate. This mosaic is required to maintain consistent wood supplies over time.

To ensure that the ecological values of cypress forests are protected, it is necessary to develop an operational protocol to ensure that future cypress silviculture and harvesting maintains spatial variability in vegetation structure within each cypress state forest. The following paragraph describes a working principle that should be refined to the extent necessary, and incorporated in forest management plans.

Future management of cypress forests should ensure that silvicultural practices do not unduly reduce spatial variability in vegetation structure within each cypress state forest. This could be achieved by establishing a protocol that ensures that the constraints to silvicultural management within state forests are broadly consistent with the requirement to maintain spatially variable vegetation structures under invasive native scrub regulations on private and leasehold land. This would mean that, in individual state forests where cypress stands managed for production occupy more than 70 per cent of the forest area, harvesting schedules should ensure that no greater than 80 per cent of the forest area is dominated by young cypress regeneration (regeneration cohorts between 20–30 years old) at any point in time. The remaining 20 per cent of the forest area should support mature cypress from the previous rotation cycle; in time, these areas will eventually become available for subsequent harvesting.

Principle 3: Existing eucalypts, large hollow-bearing trees and grazing-sensitive ground plants should be retained. Where possible, their occurrence across the landscape should be enhanced over time.

At the time of colonial settlement, most cypress state forests in central NSW were dominated in terms of basal area by large eucalypts, with cypress being sub-dominant (Lunt et al., 2006). Representation of mature eucalypts has declined in many cypress state forests, as disturbance regimes and management practices imposed before and after declaration of cypress state forests selectively depleted eucalypts and favoured cypress dominance. Mature eucalypt trees provide valuable ecological functions, including provision of nectar-bearing flowers and hollows for hollow-dwelling birds and mammals (Gibbons & Lindenmayer, 2002). Cypress trees do not support these ecological functions to the same extent.

To enhance ecological functioning of state forests for fauna conservation, future management should ensure that representation of mature eucalyptus trees is increased in areas where it is currently low. Current practices implemented by Forests NSW are consistent with this goal, and eucalypts of all ages are not damaged, harvested or killed as part of silvicultural practices. Continuation of this practice will further enhance conservation values of cypress state forests for fauna conservation. This principle should also be followed on other tenures.

Principle 4: Coarse woody debris should be retained, and potentially enhanced where practicable and consistent with other managed objectives such as fire management goals.

Coarse woody debris provides many valuable ecological functions, including habitat provision for ground fauna and ground-feeding birds (see **Chapter 3** for further details). Retention and enhancement of coarse woody debris is a widely accepted principle for ensuring biodiversity conservation in managed production forests (Lindenmayer et al., 2006).

It appears that no formal studies have examined coarse woody debris use in cypress forests. However, fauna species that are widespread in cypress forests in central NSW, such as the small mammal *Antechinus flavipes* and the brown tree creeper bird *Climacteris picumnus*, have been shown to benefit from enhanced levels of coarse woody debris in other forest types (Mac Nally 2006 ; Mac Nally & Horrocks, 2008). Similar outcomes are likely in Callitris forests and eucalypt woodlands. Mac Nally & Horrocks (2008) found that *Antechinus flavipes* preferred coarse woody debris comprised of large logs rather than small boughs.

Enhancement of coarse woody debris, particularly debris dominated by large boughs and logs, is likely to be a slow process in many state forests. This is especially likely in forests where cypress dominates the tree canopy, as large coarse woody debris is largely provided by mature eucalypts. Coarse woody debris levels are likely to be enhanced most rapidly in areas of state forests characterised by non-cypress dominated vegetation types. Management practices that deplete coarse woody debris should be avoided, where this is consistent with other management goals such as fire protection.

Principle 5: Livestock grazing can reduce fire hazards but also threaten ecological values in many forest areas. In areas managed for conservation and integrated production and conservation, livestock grazing should only be undertaken where its effects on fuel levels and ecological attributes are rigorously monitored and assessed in a formalised monitoring scheme, which includes comparisons against ungrazed areas. This approach will allow continual refinement and adaptive management of fuel management and livestock grazing approaches.

Livestock grazing is carried out in many cypress state forests, subject to weather and vegetation conditions, and following Forests NSW's *Grazing Management Plan* (Forests NSW, 2006b).¹³ Little grazing has been conducted in recent years because of drought conditions. Livestock are grazed in cypress

state forests primarily to reduce fuel loads for fire management purposes. While fuel loads vary greatly across space and time in cypress forests, fire control is particularly important in production forests as cypress trees are fire sensitive and easily killed by fire (refer to **Chapter 3**).

While livestock grazing can provide a practical tool to reduce fuel loads, it carries risks of degrading ecological values of cypress state forests, especially those associated with ground vegetation. This risk is especially significant in areas of cypress state forests that contain endangered woodland communities.

The *Grazing Management Plan* includes a number of measures to reduce the threats of livestock grazing to conservation values, and represents a major attempt to ensure that livestock grazing is conducted in an ecologically sustainable manner (Forests NSW, 2006b). However, a lack of monitoring of grazing impacts in cypress state forests has meant that it is not possible to assess how livestock grazing carried out under this plan affects conservation values, or fire risk, in following seasons. Additionally, there is a need to build on the *Grazing Management Plan* to specify spatial arrangements of areas in which grazing is to be permitted and not permitted in each forest and to design and implement a formalised monitoring scheme, which includes comparisons of outcomes in grazed versus ungrazed areas.

The NRC commends NSW Forests' initiative in developing its *Grazing Management Plan*. However, in the absence of a formalised monitoring scheme, the NRC believes that grazing carried out under this plan cannot be assumed to be having negligible impacts on conservation values. Additionally, the NRC believes that there remains a need to identify areas of differential fire risk within forests, and to implement strategic grazing for fire control within this spatial framework, rather than relying on forest-wide grazing to manage the important issue of fire risk.

Principle 6: In areas managed for conservation rather than production values, prescribed fire can provide a useful tool to achieve management goals.

Fire is actively suppressed in the south-western cypress state forests as it kills white cypress (refer to **Section 3.5.3**). In contrast, managers of conservation areas may have more flexibility to use prescribed burning to achieve management goals, as damage to timber values is less relevant to the desired outcomes in these areas. Prescribed burning can potentially be used to achieve many management goals in conservation areas, such as manipulating vegetation structure and composition, thinning dense stands, reducing fuel loads and promoting tree and shrub regeneration. However, prescribed burning can often be difficult to implement in cypress forests owing to low levels of ground fuels.

All prescribed burning should be implemented using an experimental, adaptive management framework to maximise learning outcomes, consistent with approaches recommended by the Biodiversity and Climate Change Expert Advisory Group (2009).

¹³ Grazing Management Plan 2006 – Western Region (Forests NSW, 2006) – referred to as the *Western Region Grazing Management Supplementary Plan* in the *Western Region ESM Plan*.

Principle 7: Ecological thinning can provide a valuable tool to achieve specified conservation outcomes in some white cypress forests and should be applied to areas where clearly defined outcomes can be reasonably expected.

Ecological thinning involves the selective removal of trees (usually regrowth or suppressed trees) to achieve specified ecological outcomes. Thinning is a well established method for enhancing production values. In NSW, thinning is allowed in some circumstance to maintain and improve environmental outcomes (NSW Government, 2007). There is some evidence that thinning also may enhance carbon storage and wildlife habitat (Dwyer et al., 2010; Horner et al., 2010; NSW Government, 2006).

Ecological thinning can be undertaken in many different ways including:

- reducing stocking levels to a uniform, predetermined level across moderately large areas
- creating small open gaps within larger areas of dense regrowth
- reducing stocking levels (and/or creating gaps) around specified features (for example, large trees).

Each of these approaches will have different impacts on forest structures, processes and biodiversity. Approaches that may have the greatest utility from a silvicultural perspective are not necessarily the most appropriate to achieve conservation objectives. Wherever thinning is undertaken to achieve ecological goals, these goals must be clearly specified and the most appropriate technique must be used to ensure that goals can be met.

Ecological thinning should be undertaken in an experimental, adaptive management framework to ensure desired outcomes are achieved, maximise learning outcomes and reduce uncertainty. No single thinning regime is likely be appropriate for all forest types given the range of environmental conditions

across a landscape and uncertainties associated with future climate (Horner et al., 2010). In conservation reserves, ecological burning may be a useful strategy to achieve many of the goals that are described above for ecological thinning.

Principle 8: The environmental impacts of all management activities, including silviculture, ecological thinning, livestock grazing, fire regimes and ‘no management’, should be monitored and assessed in all land tenures using scientifically rigorous, large-scale active adaptive management frameworks.

Compared to many other ecosystems, the scientific understanding of the environmental impacts of many management interventions (or absence thereof) in cypress forests and associated woodlands is relatively limited. Active adaptive management frameworks are those in which the effects of contrasting management approaches are directly compared. These frameworks have great promise for comparing the effects of management interventions on environmental and production values, and for improving future interventions to help develop and refine future management approaches. Consequently, the environmental impacts of all management activities, including silviculture, ecological thinning, livestock grazing, burning and ‘no management’, should be monitored and assessed in all land tenures using scientifically rigorous, active adaptive management frameworks. The NRC proposes some specific research areas in **Section 6.7.1**.



Table 6.7: JANIS targets for white cypress and other native vegetation types in the assessment area

Vegetation type	Pre-1750 (hectare)	Current (hectare)	JANIS 15% pre-1750 (hectare)	Currently reserved (hectare)	New reserves required to meet target (hectare)	Amount in cypress state forests (hectare)
White cypress forests	1,491,000	822,800	223,650	34,050	189,600	80,970
Associated woodlands	6,273,000	3,183,400	940,950	112,760	828,190	53,780
Total cypress types	7,764,000	4,006,200	1,164,600	146,810	1,017,790	134,750
Other native vegetation types	3,584,400	16,152,300	5,376,600	1,104,910	4,271,690	36,280
Total	11,348,400	20,158,500	6,541,200	1,251,720	5,289,480	171,030

Box 6.1: General principles for managing ecosystems

The NRC has identified and drawn on a range of general principles for managing ecosystems to develop its principles for white cypress forests and associated woodlands after Commonwealth of Australia (2009), Lindenmayer et al. (2000, 2006, 2008), Montreal Process Implementation Group (2008a) and NRC (2005). Many of these principles are currently implemented, to varying degrees, by land management agencies.

They are:

- maintain connectivity between communities, habitats and ecological processes across the landscape
- implement active management regimes to maintain production and/or conservation values within both protected and production areas
- implement a range of management strategies across different spatial, temporal and institutional scales to spread risk
- where consistent with other land-use objectives, maintain forest complexity including stand complexity, species diversity, large trees and threshold levels of coarse woody debris, and variability in stand structures across space and time
- involve local communities in strategy development and implementation to ensure greater success in achieving identified goals
- implement adaptive management in reserves and production forests to allow lessons to be learnt from management actions and to facilitate their refinement
- where compatible with other land-use objectives, avoid disturbances and management activities that are known to reduce biodiversity values, such as water and nutrient enrichment and heavy grazing by livestock and feral animals.

6.6 Conservation and tenure arrangements

6.6.1 JANIS reservation targets

The Nationally Agreed Criteria for the Establishment of a Comprehensive Adequate and Representative Reserve System for Forests in Australia are widely known as the JANIS guidelines. The JANIS guidelines form part of Australian and NSW Government policies for sustainable landscape management. They focus on retaining functioning areas of ecosystems and using responsive management to reduce and minimise threats. The application of the JANIS guidelines takes into account a range of regional priorities, including social and economic considerations. The guidelines are designed to deliver good conservation as well as acceptable social and economic outcomes.

The JANIS guidelines have a target of reserving at least 60 per cent of the remaining extent of vulnerable ecosystems. A vulnerable ecosystem is one which:

- has been reduced by about 70 per cent in area within a bioregional context and which remains subject to threatening processes
- is not depleted but is subject to continuing and significant threatening processes (Commonwealth of Australia, 1997).

Table 6.7 shows the application of the 60 per cent target to all white cypress and other vegetation types in the assessment area. More than 1 million hectares of new reserves of cypress vegetation types would be required to achieve a target of 60 per cent. Currently only around 134,000 hectares of white cypress vegetation types are found in the south-western cypress state forests (or 13 per cent of the target).

Clearly, building a comprehensive adequate and representative reserve system will take time in the central west of NSW and will require an innovative and coordinated strategy involving both public and private lands. In this context, the NRC believes that biodiversity conservation of white cypress vegetation types will be best advanced by promoting conservation on public and private land.

6.6.2 Protecting environmental values in a landscape with low levels of reservation

The white cypress forests and associated woodlands are dynamic vegetation types. The remnants, particularly those in the highly cleared landscape of the central division, are substantially modified in comparison to their pre-European condition. This is discussed in **Chapter 3**.

The NRC believes the most practical approach to conserve white cypress forests and associated woodlands, and to recognise priority ecosystems identified by the JANIS guidelines and the NSW *National Park Estate Plan* (DECC, 2008), is to actively and adaptively manage forests on both public and private land to deliver environmental benefits.

This approach is supported by recent work (CSIRO, 2008; Commonwealth of Australia, 2009; Pressey et al., 2007) on designing reserves which advocates:

- a shift in objective from preventing ecological change to managing change in ways that minimise biodiversity loss
- greater emphasis on identifying and protecting significant functional connectivity and linkages to improve species and habitat migration
- coordination of a wide variety of conservation programs across the whole landscape, including those on private land.

The existing regulatory arrangements have the capacity to ensure the cypress state forests continue to provide significant conservation benefits. In practice, the most pressing conservation planning priority is to increase connectivity across these landscapes by ensuring other Crown and private lands between the cypress state forests are managed for conservation.

Improving connectivity between south-western cypress state forests will be a key strategy to conserve and improve environmental values in the central division, particularly under predicted changes in climate (amongst others described in **Table 6.5**). Taking this into consideration, the most practical strategy to achieve conservation goals over the long run in the central and western divisions is to:

- identify those state forests with high value for landscape function and potentially at risk from threatening processes (as described in **Chapter 3**) for immediate management action
- use a landscape perspective to identify and pursue key north–south and east–west corridors and assess the extent to which these can be connected, in both the short and the longer terms, across public and private land in the central division
- implement active adaptive management (consistent with the principles described in this chapter) on public and private land and monitor outcomes to progressively refine management regimes over the longer term.

6.6.3 Management and associated potential tenure changes

It is practical to continue to manage the south-western cypress state forests for timber and environmental values, as well as other social and cultural uses.

The NRC has used its analysis of landscape function and threatening processes in the south-western cypress state forests (**Chapter 3**), along with the commercial timber value of the forests¹⁴, to identify practical management approaches and associated tenure arrangements that are most likely to continue to support community values and promote resilient landscapes.

As described in **Chapters 3 to 5** of this report, the south-western cypress state forests support many different values. Each forest represents a balance of these environmental, cultural, social and economic values. For example, some forests are highly valued for their potential economic contribution through the cypress timber industry, while also having high value for landscape function as they are some of the last remaining remnants of this forest type in an over-cleared landscape.

The available scientific information allowed the NRC to group the 197 assessed forests into broad categories based on the balance of values they support, which the NRC has then used to propose future management and associated tenure arrangements.

The NRC's conclusions on future management and associated tenure are described below.

1. Continue to manage most of the cypress state forests for both production and environmental values

A total of 168 state forests, covering 169,486 hectares, are valued for their cypress timber resource¹⁵, their environmental values and their contribution to maintaining landscape function (see **Table 6.8** for a list of the forests). These forests should continue to be managed by Forests NSW as state forests and should be specifically managed to ensure that these suites of values can be maintained.

Management should include timber harvesting that is subject to existing management protocols, as well as the codification of specific management principles for white cypress forests and associated woodlands¹⁶ into an IFOA.

Over time, cross-agency research and activities should be implemented to identify complementary management arrangements across tenures to deliver desired habitat diversity and connectivity through time.

Within these 168 cypress state forests, the NRC has identified a subset of forests that the available evidence suggests may have particularly high value for landscape function and/or are potentially vulnerable to threatening processes (**Chapter 3**). The NRC believes they warrant immediate management attention.

¹⁴ See **Chapter 2**.

¹⁵ As identified by Forests NSW.

¹⁶ As described in **Section 6.5.2**.

Table 6.8: Cypress state forests that should be managed for production and environmental values under state forest tenure

State forests				
• Albert	• Ardlethan	• Back Creek	• Back Yamma	• Bald Hill
• Balgay	• Banandra	• Barbingal	• Barrow	• Beckom
• Berewombenia	• Berida	• Berrigan	• Bimbi	• Binya
• Blow Clear	• Blow Clear West	• Bobadah	• Bogalong	• Booberoi
• Boona	• Bourbah	• Boxalls	• Bretts	• Broken Range
• Brookong	• Buckingbong	• Buddigower	• Bulbodney	• Bunganbil
• Bygalore	• Calleen	• Canbelego	• Caragabal	• Carawandool
• Cargelligo	• Carolina	• Carrabear	• Carroboblin	• Clear Ridge
• Conapaira East	• Conapaira South	• Condobolin	• Cope	• Coradgery
• Coreen	• Corringale	• Cowal	• Cullivel	• Cumbine
• Curra	• Curraburrama	• Currajong	• Currawananna	• Denny
• Derriwong	• Dubbo	• Dungeree	• East Cookeys Plains	• Edols
• Eringanerin	• Euchabil	• Euglo South	• Eurabba	• Fifield
• Forbes	• Ganmain	• Gap Dam	• Gilgandra	• Gilgunnia
• Gillenbah	• Gilwarry	• Girilambone	• Goolgowi	• Grahway
• Grayrigg	• Gunning Gap	• Gunningbland	• Jimberoo	• Jingerangle
• Kentucky	• Kindra	• Kockibitoo	• Kolkilbertoo	• Kulki
• Lachlan Range	• Lake Urana	• Lake View	• Lester	• Limestone
• Little Blow Clear	• Little Caragabal	• Lonesome Pine	• Mairjimmy	• Mandamah
• Manna	• Matong	• Maudry	• Mejum	• Melbergen
• Mellerstain	• Melougel	• Meriwagga	• Merri Merri	• Merrinele
• Meryula	• Miandetta	• Milbrulong	• Minter	• Momo
• Monumea Gap	• Moombooldool	• Mount Nobby	• Mount Tilga	• Mulyandry
• Murda	• Nangerybone	• Naradhan	• Narraburra	• Narraway
• Nebea	• Nerang Cowal	• Palmer	• Pangee	• Peisley
• Priddle	• Pullabooka	• Ringwood Tank	• Sandgate	• Strahorn
• Tabbita	• Tabratong	• Tailby	• Talgong	• Tallegar
• Taratta	• Tenandra	• Therabung	• Thorndale	• Tomanbil
• Tottenham	• Trundle	• Tuckland	• Tullamore	• Ugobit
• Ungarie	• Vermont Hill	• Wahgunyah	• Walleroobie	• Warraderry
• Warregal	• Warrie	• Weddin	• Weelah	• West Cookeys Plains
• Wharfdale	• Widgiewa	• Wilbertroy	• Wilga	• Willows
• Wingadee	• Wombin	• Wyrra	• Yambira	• Yarragong
• Yarranjerry	• Yathong	• Yelkin		

Table 6.9: Cypress state forests with high value for landscape function which may be threatened by grazing

State forests		
<ul style="list-style-type: none"> • Back Creek • Bimbi • Buckingbong • Carrabear • Conapaira South • Cumbine • East Cookeys Plains • Gap Dam 	<ul style="list-style-type: none"> • Gillenbah • Gunning Gap • Jimberoo • Manna • Melbergen • Melougel • Monumea Gap • Mount Nobby 	<ul style="list-style-type: none"> • Narraway • Sandgate • Strahorn • Tailby • Tallegar • Warrie • Weddin • Wilbertroy • Yathong

Table 6.10: Cypress state forests which may be particularly vulnerable to harvesting impacts

State forests	
<ul style="list-style-type: none"> • Beckom • Coreen • Cullivel • Kentucky • Kulki • Limestone 	<ul style="list-style-type: none"> • Little Blow Clear • Moombooldool • Narraburra • Ringwood Tank • Widgiewa

The NRC has identified 25 forests (covering 61,457 hectares) with commercial timber value that also have particularly high value for landscape function that may potentially be threatened by livestock grazing. These forests are generally large, close to potential ecological corridors, contain endangered ecological communities and/or threatened species and are subject to grazing licences. These forests are listed in **Table 6.9**.

While livestock grazing can provide a practical tool to reduce fine fuel loads, it carries risks of degrading ecological values of cypress forests, especially those associated with ground vegetation. This risk is especially significant in areas of cypress forests that contain endangered woodland communities. Limited monitoring of grazing impacts in cypress state forests has meant that it is not possible to assess how livestock grazing affects ecological values, or fire risk.

The planned monitoring program as part of Forest NSW's *Grazing Management Plan* should be improved and prioritised to these 25 forests. This monitoring program must be robust and assess the actual impacts of grazing on fine fuel levels and ecological values, so that the effects of livestock grazing can be better understood and management regimes can be refined over time where required.

The monitoring program should facilitate comparison between grazed and ungrazed areas on similar soils and in comparable parts of the landscape. An example of how this could be achieved is that, in forests containing internal compartmental fencing, at least 10 per cent of each forest type could be excluded from grazing to provide large-scale adaptive management comparisons of impacts on ecological values and fire risk. These grazing exclusion areas should be located in areas removed from adjacent properties to ensure protection of adjacent landholders from fire hazards.

The NRC has identified a further 11 forests (covering 1,717 hectares) with commercial timber value and which may be more vulnerable to harvesting impacts. These forests are generally small, isolated, surrounded by agricultural land uses and have varying value for landscape function. Ongoing harvesting, thinning and related activities that reduces structural variability and faunal dispersal would have adverse impacts on biodiversity. These 11 forests are listed in **Table 6.10**.

Timber harvesting should not commence in these forests until the reviews of the Western and Riverina ESFM Plans and subsidiary operational plans are completed to ensure that any harvesting and silvicultural activities follow the principles outlined in **Section 6.5.2** and do not reduce spatial variability below acceptable thresholds.

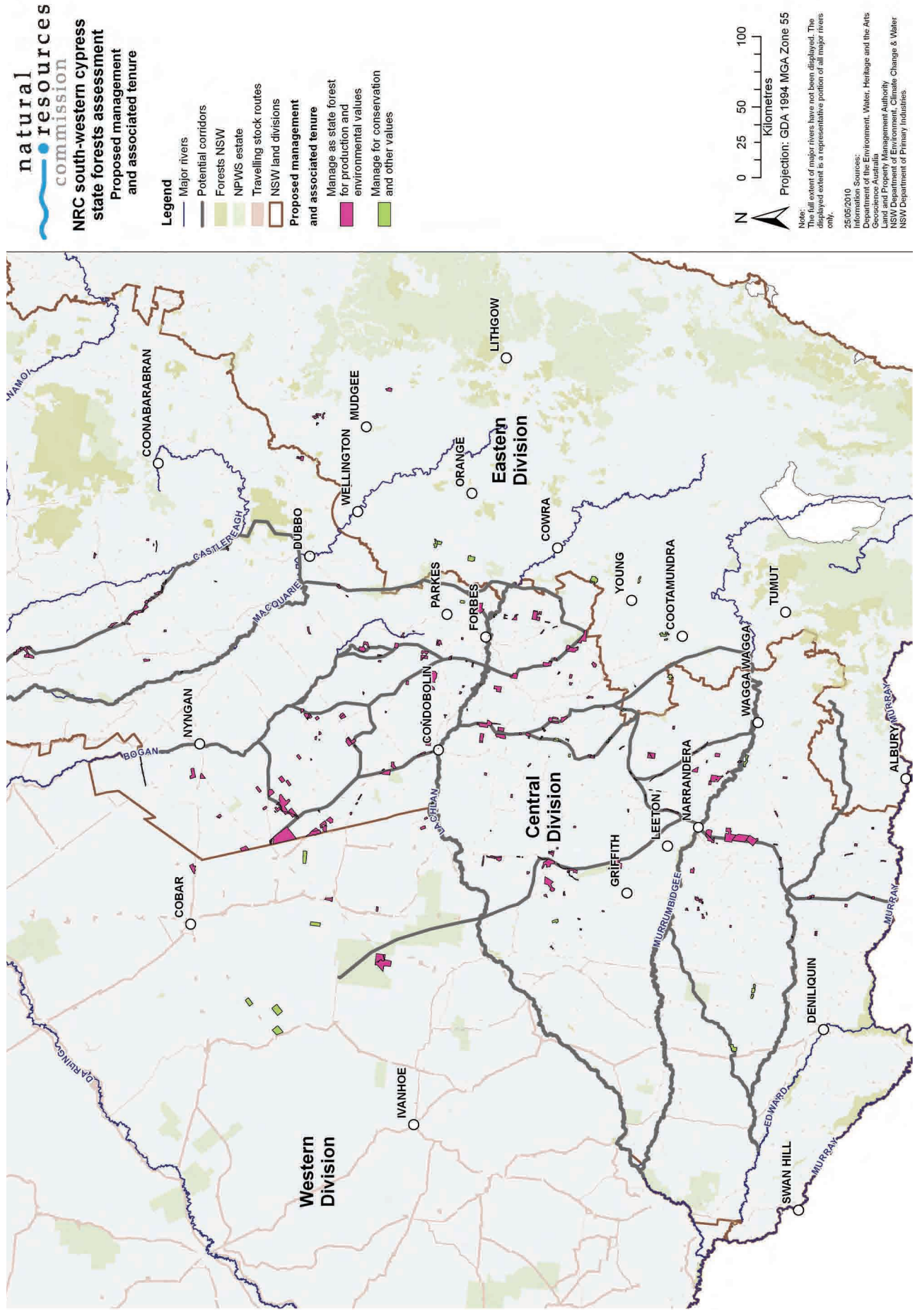
2. Manage a small number of cypress state forests primarily for conservation and other social values

Of the 197 assessed forests, 29 forests covering 26,256 hectares are significantly more valuable for their environmental and other values than for their timber resources (**Table 6.11**).

It would be more practical and efficient for these forests to be managed primarily for conservation, while still in accordance with the management objectives and principles outlined in **Section 6.5.2**. The specific environmental, cultural, social, and economic values of these forests will determine the tenure arrangement that will best support their management:

- a number could be added to the National Reserve System by establishing reserves under the *National Parks and Wildlife Act 1974*, subject to further consideration by DECCW.

Figure 6.4: Map of proposed management and associated tenure arrangements for south-western cypress state forests. (See Appendix 18 for more detailed maps)



- others might be considered for conversion to other land tenures which will best support long-term management for environmental and social values. For example, in some cases, it may be most practical for these lands to be sold or gifted to private landholders or conservation organisations, subject to in-perpetuity conservation covenants.

All of these forests should be subject to further consideration of local recreational or Indigenous cultural values or other economic uses (for example, apiary) that may be affected by any changes in tenure or conditions of access to the forests.

Figure 6.4 illustrates the proposed management and associated tenure arrangements for the 197 south-western cypress state forests.

As Forests NSW and DECCW prepare a forest agreement and an IFOA in coming months, they are likely to gain more information about individual cypress state forests. Using the NRC's methodology (described in **Appendix 22**), this improved information may suggest that some forests should be moved between **Tables 6.8** and **6.11**.

6.7 Performance review and improving information

Adaptive management and regular performance reviews are essential to achieve our goals for future landscapes (Commonwealth of Australia, 2009; NRC, 2005). As such, the implementation of the objectives and principles outlined in this report will rely on the application of new knowledge, effective adaptive management and reporting frameworks. These principles should be subject to ongoing monitoring, review and improvement through the implementation of management plans and agreements.

6.7.1 Improving information on cypress ecosystems

In preparing this assessment report, the NRC found there was a paucity of system-specific data on many important elements of the ecology and management of cypress forests and associated woodlands forests, particularly when compared against other natural ecosystems and forest types in Australia.



While substantial information is available on the silviculture of white cypress (due to long standing investments by Forests NSW and predecessor agencies), little specific information is available on how silvicultural and associated management (for example, proposed grazing strategies) and other relevant activities affect forest biodiversity and ecosystem processes.

In particular, the NRC has identified a number of areas where particular knowledge gaps should be addressed. These include:

- finer resolution vegetation mapping for each cypress state forest, in mapping for endangered ecological communities¹⁷

Table 6.11: Cypress state forests that should be primarily managed for conservation

State forests		
<ul style="list-style-type: none"> • Balowra • Bedooba • Bendick Murrell • Berry Jerry • Blue Mallee • Booororban • Buggajool • Cadow • Combaning • Cookamidgera 	<ul style="list-style-type: none"> • Cumbijowa • Edgar • Gin Gin • Hiawatha • Holybon • Jerilderie • Jindalee • Kiacatoo • Killonbutta • Mandagery 	<ul style="list-style-type: none"> • Paddington • Puckawidgee • Reefton • Stackpoole • Steam Plains • Towyal • Yeo Yeo • Wyalong • Young

¹⁷ The NRC considers the state profile mapping developed for this assessment provides a useful and practical starting point.

- forest-scale assessments of the effects of differing combinations and spatial arrangements of contrasting stand classes (for example, proportions of dense regrowth and mature white cypress stands) on biodiversity patterns, in both reserves and production forests
- impacts of grazing strategies on vegetation composition, particularly grazing sensitive forbs
- optimal levels of coarse woody debris and densities of hollow-bearing trees (especially Eucalyptus) to optimise fauna abundance and diversity within the white cypress production silvicultural system.

Ideally, opportunities for collaboration between agencies should be identified when planning and undertaking research and associated activities on public lands. In particular, Forests NSW should work closely with DECCW in conducting pre-harvest inspections and reviewing the ESFM Plans to gain their assistance in identifying and protecting ecological values, prior to finalisation of the IFOA.

CMA's should lead a whole-of-government and community approach to identify management priorities on private land, for example, by developing Catchment Action Plans that include spatially explicit maps identifying corridors between the south-western state forests.



Appendices

1	Terms of reference	112	14	Listed endangered ecological communities and threatened species in south-western cypress state forests	183
2	Relevant legislation	113	15	Supporting information for the social and economic assessment	187
3	References and bibliography	115	16	Profiles for south western cypress state forests	196
4	Tables and figures	129	17	Comparison of silvicultural operations for cypress on private and public land	204
5	Acronyms and glossary	131	18	Maps of proposed management and tenure arrangements for south-western cypress state forests	206
6	List of submissions	139	19	The Brigalow decision	214
7	Technical Review Panel members	141	20	EPBC Act and FNPE Act requirements	219
8	Institutional arrangements governing the south-western cypress state forests	142	21	Cypress state forests' contribution to public land in Local Aboriginal Land Councils	221
9	All vegetation types found in assessment area	149	22	Methodology for landscape function values and threats	228
10	Vegetation types found in assessment area that contain white cypress	165	23	List of the south-western cypress state forests within this assessment	241
11	Mapping methodology	169			
12	Listed endangered ecological communities and species	174			
13	Threat status of white cypress vegetation types	180			



Appendix 1

Terms of reference



Terms of reference

Assessment of riverina red gum forests

The New South Wales Government intends to make a forest agreement with respect to the river red gum and woodland forests within the NSW Riverina IBRA and the South-Western Cypress State Forests in order to determine conservation outcomes and a sustainable future for the forests, the forestry industry and local communities in the region.

To inform that agreement and in accordance with section 13 (1)(e) & (g) of the *Natural Resources Commission Act 2003*, I request that the Commission:

1. Carry out a regional forest assessment of the scientific bioregion:
 - a) for the purposes of section 15 of the *Forestry and National Park Estate Act 1998* including an assessment of the following: environment and heritage values (including Indigenous heritage), economic and social values, ecologically sustainable forest management, and timber resources; and
 - b) otherwise such that the assessment will also meet the requirements of the *Environment Protection and Biodiversity Conservation Act 1999 (C'th)*.
2. Recommend conservation, protection, economic and ecological sustainable use of public land in the bioregion.
3. Recommend water management and flooding requirements to sustain the forests and identified values and uses under the range of projected impacts of climate change.

The Commission should have regard to the following as they relate to the bioregion:

- nationally agreed criteria for a comprehensive, adequate and representative reserve system;
- other complementary methodologies for protecting conservation values;
- the impacts of drought and climate change on the forests and communities;
- opportunities for ongoing and future employment within affected local communities;
- appropriate forest management practices in order to promote long term productivity and forest health;

- international or intergovernmental obligations, agreements or arrangements;
- NSW Government policies, programs and Catchment Action Plans;
- opportunities for Indigenous involvement in forest management;
- appropriate access for commercial, recreational and community uses; and
- the existing science and body of knowledge about the region.

The Commission should consult with relevant NSW agencies including the Department of Environment, Climate Change and Water, the Department of Industry and Investment, the Land and Property Management Authority, the Treasury, the Department of Premier and Cabinet. The Commission should also consult with relevant Traditional Owners, Local Indigenous Land Councils, Elders groups and local government. The Commission should liaise with officers from the Commonwealth Department of the Environment, Water, Heritage and the Arts to inform the design and conduct of the assessment.

The Commission should undertake public consultation to inform the assessment.

The Commission is to deliver the assessment in two phases:

1. The Commission is to deliver in relation to the Riverina IBRA:
 - an assessment under reference 1 by 30 September 2009; and
 - a report on terms of reference 2 and 3 by 30 November 2009.
2. The Commission is to deliver in relation to the South-Western Cypress State Forests:
 - an assessment under reference 1 by 31 December 2009^{**}; and
 - a report on terms of reference 2 and 3 in relation by 28 February 2010^{**}.

(** The Premier has agreed to change these dates to end February 2010 and end May 2010.)

Appendix 2

Relevant legislation

Table A2.1: Legislation applying to the south-western cypress state forests

Key legislation for forestry		
Act	Key relevant provisions for forestry	Relevance to forestry in south-western cypress state forests
<i>Forestry and National Park Estate Act 1998</i>	<ul style="list-style-type: none"> • Forest Assessment (Pt 3) • Forest Agreements (s 15) • Integrated Forestry Operations Approval (IFOA) (Pt 4) 	<ul style="list-style-type: none"> • Forestry assessment on south-western cypress state forests currently being undertaken by the NRC • The NSW Government intends to make a Forestry Agreement with respect to the south-western cypress state forests (subject to the undertaking of a Forestry Assessment) • Currently no IFOA applies but will be developed subject to the establishment of a Forestry Agreement
<i>Forestry Act 1916</i>	<ul style="list-style-type: none"> • Establishes Forestry Commission (Pt 1) • Classification and dedication of forest lands (Pt 2) • Establishes commercial elements such as licensing, royalties, permits and leases (Pt 3) 	<ul style="list-style-type: none"> • Commercial cypress harvesting (timber, products and forest material) in south-western cypress State Forests
<i>Environmental Protection and Biodiversity Conservation Act 1999 (Cth)</i>	<ul style="list-style-type: none"> • Establishes matters of national environmental significance (NES) (Pt 3) • Protection of the environment, especially NES (s 3) • Approval of activities that are likely to have significant impacts on NES (Pt 3) 	<ul style="list-style-type: none"> • NES in south-western cypress state forests and listed threatened species and migratory birds • Currently no approvals apply for any activities in the south-western cypress state forests
<i>National Parks and Wildlife Act 1974</i>	<ul style="list-style-type: none"> • Licensing of activities that harm any protected fauna (s 120) 	<ul style="list-style-type: none"> • Section 120 licence for forestry activities in the south-western cypress state forests
<i>Environmental Planning and Assessment Act 1979</i>	<ul style="list-style-type: none"> • Encourage the protection of the environment, including threatened species, populations and communities (s 5(a)(vii)) • Environmental Impact Assessments (s 75(f), Pt 5) 	<ul style="list-style-type: none"> • Environmental Impact Statement for forestry activities and associated roadworks (as per Land and Environment Order) • Review of environmental factors for harvesting operations under P 5
<i>Protection of the Environment Operations Act 1997</i>	<ul style="list-style-type: none"> • Licensing of activities that have the potential to pollute waters (Ch 3) 	<ul style="list-style-type: none"> • Currently there are no environment protection licences for operations in the south-western cypress state forests • Guidelines and procedures established with the aim of minimising pollution from roadworks and harvesting operations
<i>Threatened Species Conservation Act 1995</i>	<ul style="list-style-type: none"> • Protection and conservation of threatened species, populations and communities (s 3) • Threatened species listing (Pt 2) • Requirements for species impact statements (Div 2) • Licences for the protection of threatened species (Pt 6) 	<ul style="list-style-type: none"> • Recorded threatened species in south-western cypress state forests
<i>Native Vegetation Act 2003</i>	<ul style="list-style-type: none"> • Regulate forestry on private land (Native Vegetation Amendment (Private Native Forestry)) 	<ul style="list-style-type: none"> • Not applicable to state forests

Other relevant legislation

Aboriginal Land Rights Act 1983

Catchment Management Authorities Act 2003

Crown Lands Act 1989

Game and Feral Animal Control Act 2002

Local Government Act 1993

Natural Resources Commission Act 2003

Nature Conservation Trust Act 2001

Noxious Weeds Act 1993

Rural Fires Act 1997

Rural Lands Protection Act 1998

Western Lands Act 1901

Appendix 3

References and bibliography

References

- ABS (2001), 2001 Census, Australian Bureau of Statistics, Available from: <http://www.abs.gov.au> [Accessed: 4 March 2010].
- ABS (2006), 2006 Census, Australian Bureau of Statistics, Available from: <http://www.abs.gov.au> [Accessed: 4 March 2010].
- ABS (2007), Agricultural Commodities: Small Area Data, Australia, 2005-06 reissue – Additional Datacubes, Australian Bureau of Statistics.
- Allen, MR (1995), In a writing unexpected: The landscape archaeology of two western NSW forests, unpublished Master of Letters thesis, University of New England, Armidale, NSW.
- Allen, MR (1998), Forest history projects for State Forests NSW – Case studies of three cypress pine forests in the Lachlan and Bogan River Catchments, Forbes Forestry District on Back Yamma, Euglo South and Strahorn State Forests, State Forests of NSW, Pennant Hills, NSW.
- Anon (1901), Royal Commission enquiry into the condition of the crown tenants, Western Division of NSW, Government Printer, Sydney.
- Antos, MJ & Bennett, A (2006), Foraging ecology of ground-feeding woodland birds in temperate woodlands of Southern Australia, *Emu: austral ornithology*, Vol. 106, p. 29-40.
- Antos, MJ & Bennett, AF (2005), How important are different types of temperate woodlands for ground-foraging birds, *Wildlife Research*, Vol. 32, p. 557-572.
- Arche Consulting (2009), River red gum assessment: Socio-economic impact assessment, Final assessment report, Natural Resources Commission, NSW.
- Attwill, PM & Clayton-Greene, KA (1984), Studies of gas exchange and development in a subhumid woodland, *Journal of Ecology*, Vol. 72, p. 285-294.
- Australian Forestry Standards Limited (2010), Sustainable forest management certification register, Available from: <http://www.forestrystandard.org.au/>.
- Baradine Sawmilling Company Pty Limited (2010), Submission to the NRC on cypress assessment.
- Barker, T (1965), The crossing of the mountains and the founding of Bathurst: a sesqui-centenary review, *Royal Australian Historical Society Journal*, Vol. 51, Pt. 2, p. 97-112.
- Bauer, J & Goldney, D (2000), Extinction processes in a transitional agricultural landscape system, In: Hobbs, RJ & Yates, CJ (eds), *Temperate eucalypt woodlands in Australia: Biology, conservation, management and restoration*, Surrey Beatty & Sons, Sydney, NSW, p. 107-126.
- Beadle, NCW (1981), *The vegetation of Australia*, Cambridge University Press, Cambridge.
- Beckley, TM & Sprenger, A (1995), Social, political and cultural dimensions of forest-dependence: the communities of the lower Winnipeg basin, In: *The economic, social, political and cultural dimensions of forest dependence in Eastern Manitoba*, RDI Report Series 1995-1, The Rural Development Institute, Brandon University, Manitoba p. 2-61.
- Beier, P and Noss, RF (1998), Do habitat corridors provide connectivity?, *Conservation Biology*, Vol. 12, p. 1241-52.
- Bellamy, JA & Brown, JR (1994), State and transition models for rangelands, 7 Building a state and transition model for management and research on rangelands, *Tropical Grasslands*, Vol. 28, No. 4, p. 247-255.
- Bennet, AF (1998), *Linkages in the Landscape: The role of corridors and connectivity in wildlife conservation*, IUCN, Gland, Switzerland and Cambridge, UK.
- Benson, J (1991), The effect of 200 years of European settlement on the vegetation and flora of New South Wales, *Cunninghamia*, Vol. 2(3), p. 343-370.
- Benson, JS & Redpath, PR (1997), The nature of pre-European native vegetation in south-eastern Australia: A critique of Ryan, DG, Ryan, JR & Starr, BJ (1995), The Australian landscape – Observations of explorers and early settlers, *Cunninghamia*, Vol. 5, No. 2, p. 285-328.
- Benson, JS (2006), New South Wales vegetation classification and assessment: Introduction – The classification, database, assessment of protected areas and threat status of plant communities, *Cunninghamia*, Vol. 9, No. 3, p. 331-382.
- Benson, JS (2008), New South Wales vegetation classification and assessment: Part 2, Plant communities in the NSW south-western slopes bioregion and update of NSW Western Plains plant communities, Version 2 of the NSWVCA database, *Cunninghamia*, Vol. 10, No. 4, p. 599-673.
- Benson, JS, Allen, C, Togher, C & Lemmon, J (2006), New South Wales vegetation classification and assessment: Part 1, Plant communities of the NSW Western Plains, *Cunninghamia*, Vol. 9, No. 3, p. 383-451.
- Benson, JS, Richards, P & Waller, S (in prep.), New South Wales vegetation classification and assessment: Part 3, Plant communities in the NSW North Western Slopes and West New England region and update of Western Plains and NSW South-western Slopes bioregion, Version 3 of the NSWVCA database, to be submitted to *Cunninghamia*, in 2010.
- Biddiscombe, EF (1963), A vegetation survey in the Macquarie region, NSW, CSIRO Division of Plant Industry, Technical Paper, No. 18.
- Binns, D (2009), NSWVCA type mapping in state forests of the Central West, unpublished data, State Forests NSW.
- Biodiversity and Climate Change Expert Advisory Group (2009), Australia's biodiversity and climate change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change – Summary for policy makers, a report to the Natural Resource Management Ministerial Council, Australian Government Department of Climate Change.

- Birds Australia (2010), Where to go birding, Available from: <http://www.birdsaustralia.com.au/the-organisation/where-to-go-birding.html> [Accessed: March 2010].
- Boland, DJ, Brooker, MIH, Chippendale, GM, Hall, N, Hyland, BPM, Johnston, RD, Kleinig, DA & Turner, JD (1992), *Forest trees of Australia*, CSIRO, Melbourne.
- Boutland, A (1988), Review paper: Forests and Aboriginal society, In: Frawley, KJ & Semple, NM (eds.) *Australia's ever changing forests, Proceedings of the first national conference on Australian forest history*, Department of Geography and Oceanography, Australian Defence Force Academy, ACT.
- Bradstock, RA (2010), A biogeographic model of fire regimes in Australia: Current and future implications, *Global Ecology and Biogeography*, Vol. 19, p. 145-158.
- Briggs, JD & Leigh, JH (1996), *Rare or threatened Australian plants* (4th edition), CSIRO Publishing, p. 476.
- Burbidge, AA (1985), The Regent Parrot: A report on the breeding distribution and habitat requirements along the Murray River in south-eastern Australia, Report Series No. 4, Australian National Parks and Wildlife Service, Canberra, ACT.
- Cameron, M (2006), Nesting habitat of the glossy black cockatoo in central NSW, *Biological Conservation*, Vol. 127, p. 402-10.
- Chester, S (2009), Timber family breaks into Japanese market, *Bush Telegraph Magazine* (Autumn/Winter 2009 edition), Available from: <http://www.dpi.nsw.gov.au/aboutus/news/bush-telegraph-magazine/winter-2009>.
- Coakes, S, Fenton, DM & Gabriel, M (1999), The application of repertory grid analysis in assessing community sensitivity to change in the forest sector, In: *Impact assessment and project appraisal*, Vol. 17, No. 3, p. 193-202.
- Coakes, S & Sadler, A (in preparation), Utilising a sustainable livelihoods approach to inform SIA practice: The development of the Community Resilience Index, In: Vanclay, F & Esteves, AM, *New directions in social impact assessment: Conceptual and methodological advances*, Edward Elgar Publishers, Cheltenham, UK.
- Commonwealth of Australia (1992), National Forest Policy Statement: A new focus for Australia's forests, December 1992 (2nd edition, 1995), Available from: <http://www.daff.gov.au/forestry/policies/statement>.
- Commonwealth of Australia (1997), Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia, A report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee, Canberra, ACT.
- Commonwealth of Australia (1998a), Social assessment report: North East Victoria, Commonwealth and Victorian Regional Forest Agreement (RFA) Steering Committee, Department of Natural Resources and Environment, Melbourne, Victoria.
- Commonwealth of Australia (1999a), Social assessment report: West Victoria, Commonwealth and Victorian Regional Forest Agreement (RFA) Steering Committee, Department of Natural Resources and Environment, Melbourne, Victoria.
- Commonwealth of Australia (1999b), Social assessment report: Western Australia, Commonwealth and Western Australia Regional Forest Agreement (RFA) Steering Committee, Conservation and Land Management, Perth, WA.
- Commonwealth of Australia (2000), Social assessment report: Gippsland Victoria, Commonwealth and Victorian Regional Forest Agreement (RFA) Steering Committee.
- Commonwealth of Australia (2009), Australia's biodiversity and climate change, Summary for policy makers 2009, Prepared for the Australian Government by the Biodiversity and Climate Change Expert Advisory Group, Australian Government Department of Climate Change and Energy Efficiency.
- Cramer, LA, Kennedy, JJ, Krannich, RS & Quigley, TM (1993), Changing forest values and their implications for land management decisions affecting resource-dependent communities, *Rural Sociology*, Vol. 58, No. 3, p. 475-91.
- Cremer, KW, Unwin, GK & Tracey, JG (1990), Natural regeneration, In: Cremer, KW (ed.), *Trees for Rural Australia*, Inkata Press, Sydney, p. 107-129.
- Croft, M, Goldney, D & Cardale, S (1997), Forest and woodland cover in the central-western region of NSW prior to European settlement, Hale, P & Lamb, D (eds), In: *Conservation outside nature reserves*, Centre for Conservation Biology, University of Queensland.
- CSIRO (2008), Implications of climate change for the National Reserve System, report by CSIRO Sustainable Ecosystems to the Australian Greenhouse Office, Canberra, ACT.
- CSIRO (2010), The virus that stunned Australia's rabbits, Available from: <http://www.csiro.au/science/MyxomatosisHistory.html> [Accessed: 13 April 2010].
- Curby, P (1997), Forest history project for State Forests of NSW, Narrandera study on Buckingbong, Gillenbah and Matong State Forests, State Forests of NSW, Pennant Hills, NSW.
- Cypress Industry Strategic Plan Group (2003), NSW Cypress Industry Strategic Plan 2004-2010, An initiative of the NSW Cypress Sawmillers, Forests Products Association of NSW, NSW Department of State and Regional Development and State Forests of NSW, Available from: <http://cypressnsw.com/bwWebsite/followon.asp?PageID=49> [Accessed 19 February 2010].
- DAFF (2009), Australian forest profiles – *Callitris*, Australian Department of Agriculture, Fisheries and Forestry, Available from: http://www.daff.gov.au/brs/publications/series/forest-profiles/australian_forest_profiles_callitris [Accessed: 24 February 2010].
- Dargavel, J, Hart, D & Libbis, B (eds) (2001), *Perfumed Pineries: Environmental history of Australia's Callitris forests*, Centre for Resource and Environmental Studies, Australian National University, ACT.

- Date, EM, Goldney, DC, Bauer, JJ & Paull, DC (2000), The status of threatened vertebrate fauna in NSW cypress woodlands: Implications for state forest management, In: Craig, JL, Mitchell, N, & Suanders DA, (eds) *Nature Conservation 5: Nature conservation in production environments – Managing the Matrix*, p. 128-145, Surrey Beatty and Sons, Sydney, NSW.
- DEC (2006a), Reconstructed and extant distribution of native vegetation in the Central West Catchment, NSW Department of Environment and Conservation, Dubbo, NSW.
- DEC (2006b), Reconstructed and extant distribution of native vegetation in the Lachlan Catchment, NSW Department of Environment and Conservation, Dubbo, NSW.
- DECC (2007), The native vegetation of the Southern Wheat-Sheep Belt, unpublished data.
- DECC (2008), Private native forestry code of practice for cypress and western hardwood forests, NSW Department of Environment and Climate Change, Sydney, NSW.
- DECCW (2005), Aboriginal scarred trees in NSW – A field manual, Available from: <http://www.environment.nsw.gov.au/resources/culturalheritage/ScarredTreeManual.pdf>.
- DECCW (2009a), Brigalow and Nandewar Western Regional Assessment, Available from: <http://www.environment.nsw.gov.au/forestagreements/BrigalowNandewar.htm> [Accessed: 18 February 2010].
- DECCW (2009b), Community conservation area agreement, Available from: <http://www.environment.nsw.gov.au/forestagreements/cca.htm> [Accessed: 18 February 2010].
- DECCW (2009c), Timber industry assistance, Available from: <http://www.environment.nsw.gov.au/forestagreements/industry.htm> [Accessed: 18 February 2010].
- DECCW (2009f), ADS40 mapping on the Ardlethan-Narrandera, Cootamundra–Junee and Urana–Lockhart 1:100,000 map sheets, unpublished data, NSW Department of Environment, Climate Change and Water, Queanbeyan, NSW.
- DECCW (2010) Public register of approved clearing PVPs and development applications, Available from: <http://www.environment.nsw.gov.au/vegetation/approvedclearing.htm> [Accessed: 14 April 2010].
- Degens, P (1997), Macro-aggregation of soils by biological bonding and binding mechanisms and the factors affecting these: a review, *Australian Journal of Soil Research*, Vol. 35, p. 431-459.
- DEST (1996), National Strategy for the Conservation of Australia's Biological Diversity, Australian Government Department of the Environment, Sport and Territories, Available from: <http://www.environment.gov.au/biodiversity/publications/strategy/index.html>.
- DFID (1999), Sustainable livelihoods guidance sheets, Department for International Development, London.
- DIPNR (2004), Economic and social regional profile of the Nandewar bioregion, prepared by Hassall & Associates.
- Dobson, A, Ralls, K, Foster, M, Soulé, ME, Simberloff, D, Doak, D, Estes, JA, Mills, LS, Mattson, D, Dirzo, R, Arita, H, Ryan, S, Norse, EA, Noss, RF & Johns, D (1999), Corridors: Reconnecting fragmented landscapes, In: Soulé, ME & Terborgh, J (eds), *Continental Conservation: Scientific foundations of regional reserve networks*, The Wildlands Project, Island Press, Washington DC, p. 129–70.
- Doerr, VAJ, Doerr, ED & Davies, MJ (in review), Draft systematic review 44: Does structural connectivity facilitate dispersal of native species in Australia's fragmented terrestrial landscapes?, Collaboration for Environmental Evidence, Available from: <http://www.environmentalevidence.org/Draftreviews.html>.
- Doerr, VAJ, Doerr, ED, McIntyre, S, Howling, G, Stol, J, Davies, M, Drew, A, Warren, G & Moore, D (2009), Managing invasive native scrublands for improved biodiversity outcomes in agricultural landscapes, Report to the Central West Catchment Management Authority, Dubbo, NSW.
- DPI (2005), Recreation in NSW state forests interactive map, Available from: <http://www.dpi.nsw.gov.au/forests/recreation/outback> [Accessed: 10 April 2010].
- DPI (2008a), Prime facts – Profitable and sustainable primary industries, forest and forestry in NSW (687), Available from: http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0016/231091/Forests-and-forestry-in-NSW.pdf.
- DPI (2008b), Prime facts – Collecting firewood and craft timber from state forests (645), Available from: http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0004/239017/Collecting-firewood-and-craft-timber-from-state-forests.pdf.
- DPI (2009), Harvesting and associated roadwork operations in south-western NSW – Environmental impact statement, GHD Pty Limited.
- Drielsma, M, Manion, G & Ferrier, S (2007), The spatial links tool: Automated mapping of habitat linkages in variegated landscapes, *Ecological Modelling*, Vol. 200, p. 403–411.
- Dunlop M & Brown, PR (2008), Implications of climate change for Australia's National Reserve System: A preliminary assessment, Department of Climate Change, Canberra, ACT.
- Dwyer, JM, Fensham, R & Buckley, YM (2010), Restoration thinning accelerates structural development and carbon sequestration in an endangered Australian ecosystem, *Journal of Applied Ecology*, vol. 47, p. 681–691.
- Eardley, KA (1999), A foundation for conservation in the Riverina bioregion, unpublished report, NSW National Parks and Wildlife Service.
- Eco Logical Australia (2008), A vegetation map for the Namoi Catchment Management Authority, Project no. 125-004, prepared for the Namoi Catchment management Authority.
- Eco Logical Australia (2010), Regional vegetation community profiles, Project no. 09COFNRM-0017, prepared for the Namoi Catchment Management Authority.

- Eldridge, DJ & Greene, RSB (1994), Microbiotic soil crusts: A review of their roles in soil and ecological processes in the rangelands of Australia, *Australian Journal of Soil Research*, Vol. 32, p. 389-415.
- Eldridge, DJ & Pickard, J (1994), Effects of ants on sandy soils in semi-arid eastern Australia: II – Relocation of nest entrances and consequence for bioturbation, *Australian Journal of Soil Research*, Vol. 32, p. 323-333.
- Eldridge, DJ (2002), *Condition and biodiversity of vegetation remnants in the Murrumbidgee Irrigation Area*, Murrumbidgee Irrigation, Griffith, NSW.
- FCNSW (1972), Schedule of sawmills in NSW licensed under the Forestry Act as at 29 February 1972, to mill native log timber, Forestry Commission of NSW.
- FCNSW (1988), Notes on the silviculture of major NSW forest types, Forestry Commission of NSW, Sydney, NSW.
- Feary, S (1988), Aboriginal use of forests in south-eastern Australia: Past and present, In: Frawley, KJ & Semple, NM (eds), *Australia's ever changing forests, Proceedings of the first national conference on Australian forest history*, Department of Geography and Oceanography, Australian Defence Force Academy, ACT.
- Fensham, RJ & Holman, JE (1999), Temporal and spatial patterns in drought related tree dieback in Australian savanna, *Journal of Applied Ecology*, Vol. 36, p. 1035-1050.
- Fenton, M, Coakes, S & Marshall, N (2003), Vulnerability and capacity measurement, In: Elgar, E, Henk, A & Vanclay, F (eds.), *The international handbook of social impact assessment*, Edward Elgar Publishing Limited, p. 211-230.
- Fischer, J, Lindenmayer, DB & Manning, AD (2006), Biodiversity, ecosystem function and resilience: Ten guiding principles for commodity production landscapes. *Frontiers in Ecology and the Environment*, Vol. 4, p. 80-86.
- Forest Stewardship Council (2008), Group certification requirements review, Available from: <http://www.fsc.org/>.
- Forests NSW (2004), Strategic Industry Plan 2005-10: Broombush Industry, Commissioned by Forests NSW on behalf of Broombush Industry Group, Forests NSW and NSW Department of State and Regional Development.
- Forests NSW (2006a), Operational guidelines for Aboriginal cultural heritage management, NSW Department of Primary Industries, Sydney, NSW.
- Forests NSW (2006b), Grazing Management Plan 2006 – Western Region.
- Forests NSW (2008a), Ecologically sustainable forest management plan, Riverina region NSW, NSW Department of Primary Industries, Sydney, NSW.
- Forests NSW (2008b), State forests native forest silviculture manual, NSW Department of Primary Industries, Sydney, NSW.
- Forests NSW (2008c), Ecologically Sustainable Forest Management plan, Western region NSW, Forests NSW, Beecroft, NSW.
- Forests NSW (2009), Social, environmental and economic performance, Forests NSW Annual Report 2008-09, Available from: <http://www.dpi.nsw.gov.au/aboutus/resources/corporate-publications/forests-nsw-annual-report-2008-09>.
- Game Council of NSW (2010), Available from: <http://www.gamecouncil.nsw.gov.au/> [Accessed: 9 March 2010].
- Gammage, B (1986), Narrandera Shire, Narrandera Shire Council, Netley, South Australia, In: Curby, P (1997), Forest history project for State Forests of NSW, Narrandera study on Buckingbong, Gillenbah and Matong State Forests, State Forests of NSW, Pennant Hills, NSW.
- Garnaut, R (2007), Chapter 22: Transforming rural land use, Final report, Garnaut Climate Change Review, Available from: <http://www.garnautreview.org.au/>.
- Garnaut, R (2008), The Garnaut climate change review – Final report, Cambridge University Press, Melbourne.
- Garnett, ST, Crowley, GC (2000), The action plan for Australian birds 2000, Environment Australia, Canberra, ACT.
- Gibbons, P & Lindenmayer, D (2002), Tree hollows and wildlife conservation in Australia, CSIRO Publishing, Melbourne, Victoria.
- Gibbons, P, Ayers, D, Seddon, J, Doyle, S & Briggs, S (2008), BioMetric 2.0: A Terrestrial Biodiversity Assessment Tool for the NSW Native Vegetation Assessment Tool – Operational Manual, NSW Department of Environment and Climate Change.
- Grants Holdings Company Pty Limited (2010), Available from: www.GrantsSawmillingCo.com.au [Accessed: 8 February 2010].
- Harrington, G (1979), The effects of feral goats and sheep on the shrub populations in a semi-arid woodland, *Australian Rangeland Journal*, Vol. 1, p. 334-345.
- Harrington, GN, Dawes, GT & Ludwig, J (1981), Vegetation patterns in a semi-arid eucalypt woodland in north-west NSW, *Australian Journal of Ecology*, Vol. 6, p. 279-287.
- Harris, M & Lamb, D (2001), Recent disturbances to *Callitris* forests in southern Queensland, In: *J Dargavel, D & Libbis, B (eds), Perfumed Pineries – Environmental History of Australia's Callitris Forests*, p. 125-135, Centre for Resource and Environmental Studies, The Australian National University, Canberra, ACT.
- Harris, MR & Lamb, D (2004), A history of recent disturbances in white cypress pine forests in southern Queensland, *Proceedings of the Royal Society of Queensland*, Vol. 111, p. 19-30.

- Harris, MR, Lamb, D, & Erskine, PD (2003), An investigation into the possible inhibitory effects of white cypress pine (*Callitris glaucophylla*) litter on the germination and growth of associated ground cover species, *Australian Journal of Botany*, Vol. 51, p. 93–102.
- Hart, DM (1995), Litter-fall and decomposition in the Pilliga State Forests, NSW, Australia, *Australian Journal of Ecology*, Vol. 20, p. 266–272.
- Hassall & Associates together with Briggs, SV & Norman, P, in consultation with the INS working group (2006), Documenting the science behind the invasive native scrub tool, A report prepared for the Central West Catchment Management Authority, Dubbo, NSW.
- Hawkins, PJ (1966), Seed production and litter fall studies of *Callitris columellaris*, *Australian Forest Research*, Vol. 2 No. 2, pp. 3–16.
- Hodgkinson, KC & Harrington, GN (1985), The case for prescribed burning to control shrubs in eastern semi-arid woodlands, *Australian Rangeland Journal*, Vol. 7, p. 64–74.
- Horne, R (1990a), Early espacement of wheatfield white cypress pine regeneration: the effect on secondary regeneration, limb size, and stand merchantability, *Australian Forestry*, Vol. 53, p. 160–167.
- Horne, R (1990b), Stand height response following variable spacing of wheatfield white cypress pine regeneration in NSW, *Australian Forestry*, Vol. 53, p. 47–54.
- Horner, GJ, Baker, PJ, Mac Nally, R, Cunningham, SC, Thomson, JR & Hamilton, F (2010), Forest structure, habitat and carbon benefits from thinning floodplain forests: Managing early stand density makes a difference, *Forest Ecology and Management*, vol. 259, p. 286–293.
- IPCC (2007), Climate Change 2007: Synthesis report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Core Writing Team, Pachauri, RK & Reisinger, A (eds), Geneva, Switzerland, p. 104.
- Iwaszkiewicz, A, & Semple, WS (1988), A review of information relevant to the Bimble box pine and associated rangelands of western NSW, Soil Conservation Service of NSW, Sydney, NSW.
- Jacobs, MR (1957), History of the use and abuse of wooded lands in Australia, Section K: Agriculture and Forestry, Presidential address, Australian and New Zealand Association for the Advancement of Science report, *Australian Journal of Science*, Vol. 19, p. 132–139.
- Jervis, J (1956), The exploration and settlement of the Western Plains, *Journal of the Royal Australian Historical Society*, Vol. 42, p. 1–15, 67–86.
- Johnston, TN (1967), The effect of sheep and rabbit grazing on regeneration of white cypress pine, *Australian Forest Research*, Vol. 4, p. 3–12.
- Johnston, TN (1975), Thinning studies in cypress pine in Queensland, Research paper no. 7, Department of Forestry Queensland, Brisbane, Queensland.
- Jones, R (1980), Cleaning the country: the Gidjingali and their Arnhem Land environment, *BHP Journal*, Vol. 1, p. 11–15.
- Jurskis, V (2009), River red gum and white cypress forests in south-western NSW, Australia: Ecological history and implications for conservation of grassy woodlands, *Forest Ecology and Management*, Vol. 258, p. 2593–2601.
- Keith, DA (2004), Ocean shores to desert dunes: The native vegetation of NSW and the ACT, NSW Department of Environment and Conservation, Sydney, NSW.
- Khan, S (2008), Managing climate risks in Australia: Options for water policy and irrigation management, *Australian Journal of Experimental Agriculture*, Vol. 48, p. 265–273.
- KPMG (2006), Timber Queensland cypress industry preliminary socio-economic survey, Available from: <http://www.timberqueensland.com.au/>.
- Kusel, J (2001), Assessing wellbeing in forest-dependent communities, *Journal of Sustainable Forestry*, Vol. 13, pp. 359–384.
- Lacey, CJ (1972), Factors influencing occurrence of cypress pine regeneration in NSW, Technical paper no. 21, Forestry Commission of NSW, Sydney, NSW.
- Lacey, CJ (1973), Silvicultural characteristics of White Cypress Pine, Research note no. 26, Forestry Commission of NSW, Sydney, NSW.
- Lambeck, RJ & Saunders, DA (1993), The role of patchiness in reconstructed wheatbelt landscapes, In: Saunders D, Hobbs, R & Ehrlich, P (eds.), *Nature Conservation 3: Reconstruction of Fragmented Ecosystems*, p. 151–61.
- Law, BS & Dickman, CR (1998), The use of habitat mosaics by terrestrial fauna: Implications for conservation and management, *Biodiversity and Conservation*, Vol. 7, pp. 323–33.
- Law, BS, Chidel, M & Turner, G (2000), The use by wildlife of paddock trees in farmland, *Pacific Conservation Biology*, Vol. 6, p. 130–143.
- Lewis, SE (1995), Roost fidelity of bats: A review, *Journal of Mammalogy*, Vol. 76, p. 481–96.
- Lindenmayer, D, Hobbs, RJ et al., (2008), A checklist for ecological management of landscapes for conservation, *Ecology Letters*, Vol. 11, p. 78–91 (Note: over 35 authors).
- Lindenmayer, DB & Franklin, JF (2002), *Conserving Forest Biodiversity: A comprehensive multi-scaled approach*, Island Press, Washington, USA.
- Lindenmayer, DB & Nix, HA (1993), Ecological principles for the design of wildlife corridors, *Conservation Biology*, Vol. 7, No. 3, p. 627–30.
- Lindenmayer, DB, Cunningham, RB, Donnelly, CF, Tanton, MT and Nix, HA (1993), The abundance and development of cavities in Eucalyptus trees: A case study in montane forests of Victoria, southeastern Australia, *Forest Ecology and Management*, Vol. 60, p. 77–104.

- Lindenmayer, DB, Franklin, JF & Fischer, J (2006), General management principles and a checklist of strategies to guide forest biodiversity conservation, *Biological Conservation*, Vol. 131, p. 433–45.
- Lindenmayer, DB, Margules, CR & Botkin, DB (2000), Indicators of biodiversity for ecologically sustainable forest management, *Conservation Biology*, Vol. 14, p. 941–50.
- Lindsay, AD (1948), Notes on the cypress pine regeneration problem, *NSW Forestry Recorder*, Vol. 1(1), p. 5-16, *Forestry Commission of NSW*.
- Lindsay, AD (1967), Forest types of the NSW cypress pine zones, Technical paper no. 8, Forestry Commission of NSW, Sydney, NSW.
- Lobry de Bruyn, LA & Conacher, AJ (1990), The role of termites and ants in soil modification: A review, *Australian Journal of Soil Research*, Vol. 28, p. 55-93.
- Lunt, ID, Eldridge, DJ, Morgan, JW & Witt, GB (2007) Turner Review No. 13: A framework to predict the effects of livestock grazing and grazing exclusion on conservation values in natural ecosystems in Australia, *Australian Journal of Botany*, Vol. 55 No.4, p. 401-415.
- Lunt, ID, Jones, N, Spooner, PG & Petrow, M (2006), Effects of European colonisation on indigenous ecosystems: Post-settlement changes in tree stand structures in *Eucalyptus-Callitris* woodlands in central NSW, Australia, *Journal of Biogeography*, Vol. 33, No. 6, p. 1102-1115.
- Lunt, ID, Parker, D & Robinson, W (2001), Assessing changes in cypress pine forests from old stumps, In: Dargavel, J, Hart, D & Libbis, B (2001), *Perfumed Pineries: Environmental history of Australia's Callitris forests*, Centre for Resource and Environmental Studies, Australian National University, ACT.
- Mac Nally, R (2006), Longer-term response to experimental manipulation of fallen timber on forest floors of floodplain forest in south-eastern Australia, *Forest Ecology and Management*, Vol. 229, p. 155–160.
- Mac Nally, R & Horrocks, G (2008), Longer-term responses of a floodplain-dwelling marsupial to experimental manipulation of fallen timber loads, *Basic and Applied Ecology*, Vol. 9, p. 458–465.
- Maiden, JH (1894), Notes on ringbarking and sapping, based on Foresters' reports, *Agricultural Gazette NSW*, Vol. 5, No.1, p. 14-39.
- Major, RE, Christie, FJ, & Gowing, G (2001), Influence of remnant and landscape attributes on Australian woodland bird communities, *Biological Conservation*, Vol. 102, pp. 47–66.
- Martin TJ, Major, RE (2001), Changes in wolf spider (*Araneae*) assemblages across woodland–pasture boundaries in the central wheatbelt of New South Wales, Australia, *Australian Ecology* Vol. 26, p. 264-274.
- Merritt, B (2010), Regional forest assessment: Submission to the south-western cypress state forest assessment, Available from: <http://www.nrc.nsw.gov.au/content/documents/Forest%20Assessment%20-%20Submission%20-%20Cypress%20-%20Elder%20Mrs%20Bonnie%20Merritt.pdf> [Accessed: 1 April 2010].
- Mitchell, PB (1991), Historical perspectives on some vegetation and soil changes in semi-arid NSW, *Vegetatio*, Vol. 91, p. 169–182.
- Mitchell, TL (1839), *Three expeditions into the interior of Eastern Australia*, 2nd edition, T&W Boone, London.
- Monsons Honey and Apiary Products (2010), Submission to the Natural Resources Commission on the assessment of south-western cypress state forests, Available from: <http://nrc.nsw.gov.au/Workwedo/Forestassessment/South-westerncypresstateforestsassessment.aspx>.
- Montreal Process Implementation Group for Australia (2008a), Criteria and indicators, Available from: www.rinya.maff.go.jp/mpci.
- Montreal Process Implementation Group for Australia (2008b), Australia's state of the forests report 2008, Bureau of Rural Sciences, Canberra, ACT.
- Moore, CWE (1953a), The vegetation of the south-eastern Riverina, NSW, 1 – The climax communities, *Australian Journal of Botany*, Vol. 1, p. 485-547.
- Morgan, G & Terrey, J (1992), Nature conservation in western NSW, National Parks Association, Sydney, NSW.
- Murphy, MJ (1999), The conservation value of small woodland remnants on the NSW south-western slopes: a case study from Wagga Wagga, *Australian Zoologist*, Vol. 31, No. 1, pp. 71-81.
- Murrumbidgee Field Naturalists (2009), September 2009 Newsletter, Available from: <http://www.mfn.org.au/newsletters.html>.
- Narrandera Shire Council (2010a), Regional forests assessment, Submission to the Natural Resources Commission, 19 March 2010.
- Narrandera Shire Council (2010b), 2008–2011 Management Plan, Available from: <http://www.narrandera.nsw.gov.au/cmst/n/lp.asp?cat=26> [Accessed: 5 March 2010].
- Narrandera Shire Council (2010c), Available from: <http://www.narrandera.nsw.gov.au/cmst/n/nova.asp> [Accessed: 5 March 2010].
- Narrandera Shire Council (2010d), Strategic Plan 2006–2011, Available from: <http://www.narrandera.nsw.gov.au/cmst/n/lp.asp?cat=28> [Accessed: 5 March 2010].
- National Biodiversity Strategy Review Task Group (2009), Australia's Biodiversity Conservation Strategy 2010-20, Consultation draft, Australian Government Department of the Environment, Water, Heritage and the Arts, Canberra, ACT.
-

- NHT (2005), *The Influence of Forest Management on Sawn Timber Recovery and Value in Cypress Pine*, Rural Industries Research and Development Corporation, Barton, ACT.
- Nicholson, D (1997), *Managing cypress pine on your property*, State Forests of NSW, Western Division, Dubbo, NSW.
- NLWRA (2001), *The Native Vegetation Classification System*, National Land and Water Resources Audit, Canberra.
- Noble, JC & Tongway, DJ (1983), Herbivores in arid and semi-arid rangelands, in Russell, JS & Isbel, RF (eds), *Australian soils: the human impact*, University of Queensland Press, St Lucia, QLD, p. 243–270.
- Norris, EH, Mitchell, PB, & Hart, DM (1991), Vegetation changes in the Pilliga forests: A preliminary evaluation of the evidence, *Vegetatio*, Vol. 91, p. 209–218.
- Noss, RF, O'Connell, MA & Murphy, DD (1997), *The Science of Conservation Planning: Habitat Conservation under the Endangered Species Act*, Island Press, Washington, DC.
- NPWS (2008), *NSW National Parks Establishment Plan 2008: Directions for building a diverse and resilient system of parks and reserves under the National Parks and Wildlife Act*, NSW Department of Environment and Climate Change, Sydney, NSW.
- NRC (2005), *Recommendations: State-wide standard and targets*, September 2005, Natural Resources Commission, Sydney, NSW.
- NRC (2007), *A landscape approach to vegetation management: Final report*, June 2007, Natural Resources Commission, Sydney, NSW.
- NRC (2008), *Progress report on effective implementation of Catchment Action Plans*, November 2008, Natural Resources Commission, Sydney, NSW.
- NRC (2009), *Riverina bioregion: Regional forest assessment, River red gums and woodland forests: Final assessment report*, December 2009, Natural Resources Commission, Sydney, NSW, p. 106.
- NRMMC & DEH (2001), *National Framework for the Management and Monitoring of Australia's Native Vegetation*, adopted by the Natural Resource Management Ministerial Council, Available from: <http://www.environment.gov.au/land/publications/nvf/index.html>.
- NSW Cypress Millers, Forest Products Association, NSW Department of Primary Industries & NSW State Forests (2010), *NSW Cypress Industry Strategic Plan 2004-10*, Available from: www.cypressnsw.com [Accessed: 8 February 2010].
- NSW Government (2003), *Two Ways Together: New South Wales Aboriginal Affairs Plan 2003–2012*, Available from: <http://www.daa.nsw.gov.au/data/files/FinalPOLICY.pdf>
- NSW Government (2005), *Brigalow press release*, Available from: http://www.npansw.org.au/wwoodlands/Brigalow%20-%20Release%20_industry_.pdf.
- NSW Government (2006), *Managing invasive native scrub – Info sheet no. 9*, Available from: <http://www.environment.nsw.gov.au/resources/vegetation/nvinfo sheet9.pdf>
- NSW Government (2007), *Native Vegetation Regulation Act 2005 – Environmental Outcomes Assessment Methodology*, NSW Department of Natural Resources, Sydney.
- NSW Government (2008), *A new Biodiversity Strategy for NSW – A discussion paper*, Prepared by the NSW Department of Environment, Climate Change and Water and the NSW Department of Industry and Investment, Available from: <http://www.environment.nsw.gov.au/biodiversity/nswbiostrategy.htm>.
- NSW Government (2009), *NSW State Plan – Investing in a better future*.
- NSW Parliament (2007), *NSW State Government Hansard*, 13 November 2007, p. 3899.
- NSW Scientific Committee (2001), *Diamond firetail – Vulnerable species determination – Final*, NSW Department of Environment and Conservation, Sydney.
- Peasley, B & Walsh, A (2000), *Mapping Vegetation Landscape of the NSW North West Slopes & Plains; A Project Overview*, Natural Heritage Trust Project NW0339.97.
- Pigram, JJJ, (1986), *Issues in the management of Australia's water resources*, Longman Cheshire, Melbourne, Victoria.
- Pressey, RL, Cabeza, M, Watts, ME, Cowling, R.M. & Wilson, KA, (2007) *Conservation planning in a changing world*, *Trends in Ecology and Evolution*, Vol. 22, p. 583-592.
- Prober, SM (1996), *Conservation of the grassy white box woodlands: rangewide floristic variation and implications for reserve design*. *Australian Journal of Botany*, Vol. 44, p. 57-77.
- RACAC (2000), *Economic and Social Assessment for the Brigalow Belt South*, NSW Western Regional Assessments, Available from: www.cypressnsw.com [Accessed: 8 February 2010].
- RACAC (2002), *Aboriginal Cultural Heritage Assessment, Brigalow Belt South Stage 2*, NSW, Western Regional Assessments, Planning NSW (Sydney) and NPWS (Dubbo), NSW.
- Reid, JWR (1999), *Threatened and declining birds in the NSW sheep-wheat belt: I – Diagnosis, characteristics and management*, Consultancy report to NSW National Parks and Wildlife Service, CSIRO Wildlife and Ecology, Canberra, ACT.
- Relph, E (1976), *Place and Placelessness*, Pion Limited, London, p. 34.
- Ridges, M (2009), *The Aboriginal sites decision support tool, Product suite summary*, NSW Department of Environment, Climate Change and Water.
- Rolls, E (1981), *A million wild acres*, Penguin Books, Melbourne, Victoria.

- Ross, KA, Bedward, M, Ellis, MV, Deane, A, Simpson, CC & Bradstock, RA (2008), Modelling the dynamics of white cypress pine (*Callitris glaucophylla*) woodlands in inland south-eastern Australia, *Ecological Modelling*, Vol. 211, p. 11-24.
- Rowley, I & Chapman, G (1991), The breeding biology, food, social organisation, demography and conservation of the Major Mitchell or Pink Cockatoo, *Cacatua leadbeateri*, on the margin of the Western Australian wheat belt, *Australian Journal of Zoology*, Vol. 39, p. 211–261.
- Scanlan, JC, Pressland, AJ and Myles, DJ (1996). Run-off and soil movement on mid-slopes in north-east Queensland grazed woodlands, *Australian Rangeland Journal*. Vol. 18, p. 33-46.
- Scotts, D & Drielsma, M (2003), Developing landscape frameworks for regional conservation planning: An approach integrating fauna spatial distributions and ecological principles, *Pacific Conservation Biology*, Vol. 8, No. 4, p. 233-254.
- Scotts, D (2003), Key habitats and corridors for forest fauna: A landscape framework for conservation in north-east NSW, NSW NPWS Occasional Paper 32, NSW National Parks and Wildlife Service, Sydney, NSW.
- Shelly, D (2001), Flora and fauna of the Tottenham/Bobadah district, Department of Land and Water Conservation, Dubbo, NSW.
- Sivertsen, D Metcalfe, L (1995), Natural vegetation of the southern wheat-belt (Forbes and Cargelligo 1:250,000 map sheets), *Cunninghamia*, Vol. 4, p. 103–128.
- Smith, K (2010), Eucalyptus oil toil pays, *The Land*, Friday 12 February 2010, Available from: <http://theland.farmonline.com.au/news/state/agribusiness-and-general/general/eucalyptus-oil-toil-pays/1747513.aspx?storypage=2>.
- Spooner, PG & Briggs, SV (2008), Woodlands on farms in southern NSW: A longer-term assessment of vegetation changes after fencing, *Ecological Management & Restoration*, Vol. 9, p. 33-41.
- Sporting Shooters Association of Australia (2010), Conservation hunting opportunities control feral animals, Available from: http://www.ssaa.org.au/industry-news/2006/2006-11-27_conversation-hunting-opportunities-control-feral-animals.html.
- State Forests NSW (1996), Wahgunyah State Forest, State Forests of NSW, Narrandera, NSW.
- State Forests of NSW (1999), Managing our forests sustainably: Forest Management Zoning in NSW State Forests, Operational Circular 99/10.
- Stedman, R (2003), Sense of place and forest science: Toward a program of quantitative research, *Forest Science*, Vol. 49, p. 822 – 828.
- Street, W & Price, S (2009), Advancing poverty reduction and rural livelihoods through sustainable commercial forestry, TFD Review. The Forests Dialogue, Yale, Available from: <http://www.theforestdialogue.org>.
- Thompson, WA & Eldridge, DJ (2005a), Plant cover and composition in relation to density of *Callitris glaucophylla* (white cypress pine) along a rainfall gradient in eastern Australia, *Australian Journal of Botany*, Vol. 53, p. 545-554.
- Thompson, WA & Eldridge, DJ (2005b), White cypress pine (*Callitris glaucophylla*): A review of its roles in landscape and ecological processes in eastern Australia, *Australian Journal of Botany*, Vol. 53, p. 555–570.
- von Lendenfeld, RV (1885), Recent changes in the forest-flora of the interior of NSW, *Proceedings of the Linnean Society of NSW*, Vol. 10, p. 721-722.
- Walker, BH, Abel, N, Anderies, JM & Ryan, P (2009), Resilience, adaptability and transformability in the Goulburn-Broken Catchment, Australia, *Ecology and Society*, Vol. 14, No.1, p.12.
- Webster, R & Ahern, L (1992), Management for conservation of the superb parrot (*Polytelis swainsonii*) in NSW and Victoria, NSW National Parks and Wildlife Service and Victorian Department of Conservation and Natural Resources.
- Wentworth Group of Concerned Scientists, (2009), Optimising carbon in the Australian landscape, October 2009, Available from: www.wentworthgroup.org.
- West, NE (1990), Structure and function of microphytic soil crusts in wildland ecosystems of arid to semi-arid regions, *Advances in Ecological Research*, Vol. 20, p. 179-223.
- Western Plains Regional Development (2010), Condobolin, Available from: <http://www.wprd.org.au/bwWebsite/followon.asp?PageID=1648> [Accessed: 4 March 2010].
- Williams, J, Robson, D, Booth, T, Pongracic, S, Bush, D, Hague, J, Fung, P, Kanowski, P, Race, D, Olsen, G, Prinsley, R, Davis, S, Gascoigne, H (2001), The contribution of mid-to-low rainfall forestry and agroforestry to greenhouse and natural resource management outcomes, Prepared for the Australian Greenhouse Office and Murray-Darling Basin Commission, p. 72.
- Wilson, AD (1990), The effect of grazing on Australian ecosystems, *Proceedings of the Ecological Society of Australia*, Vol. 16, p. 235–244.
- Wilson, AD, Oxley, RE & Bratby, WJ (1997), *A grazing management strategy for Buckingbong State Forest*, Reliance Printing, Deniliquin, NSW.
- Woldendorp, G, Keenan, RJ & Ryan, MF (2002), *Coarse woody debris in Australian forest ecosystems*, A report by the Bureau of Natural Resources for the National Greenhouse Strategy, Module 6.6 (Criteria and Indicators of Sustainable Forest Management), April 2002.
- Wormington, KR, Lamb, D, McCallum, HI & Moloney, DJ (2003), The characteristics of six species of living hollow bearing trees and their importance for arboreal marsupials the dry sclerophyll forests of southeast Queensland, Australia, *Forest Ecology and Management*, Vol. 182, p. 75–92.

Bibliography

- ABARE (2008), Australian forest and wood product statistics, Australian Bureau of Agricultural and Resource Economics.
- Aboriginal Affairs NSW (2009), Environmental management, Available from:
- Aboriginal Affairs NSW (2010) Making access agreements for lands and waters in NSW, Available from: <http://www.daa.nsw.gov.au/publications/DAA%20On%20Country.pdf> [Accessed: 1 April 2010].
- AgForests, Management and forest products guide – White cypress native forests and woodlands, Ag Forests, Queensland, Available from: http://www.agforests.com.au/uploads/white_cypress_native_forests_woodlands.pdf.
- Ahoy, C & Murphy, D (1996), A preliminary investigation of Aboriginal values in the northeast forests, NSW National Parks and Wildlife Service, Sydney.
- Anderson, RH (1941), The effect of settlement upon the NSW flora, presidential address, Proceedings of the Linnean Society of NSW, part I-II, 293-294, p. v-xxiii.
- Andrews, S (2003), Regrowth white cypress pine and natural resource management, Greening Australia NSW Inc, Armidale, NSW.
- Arthur, AD, Pech, RP, Drew, A, Gifford, E, Henry, S & McKeown, A (2003), The effect of increased ground-level habitat complexity on mouse population dynamics, *Wildlife Research*, Vol. 30, p. 565-572.
- Auld, TD & Denham, AJ (2001), Flora conservation issues at Kinchega National Park, western NSW, *Cunninghamia*, Vol. 7, No. 1, p. 27-42.
- Austin, M & Williams, OB (1988), Influence of climate and community composition on the population demography of pasture species in semi-arid Australia, *Vegetatio*, Vol. 77, pp. 43-49.
- Australian Forestry Standard Limited (2010), Sustainable forest management certification register, Available from: <http://www.forestrystandard.org.au/>.
- Australian Rainforest Honey Pty Limited (2010), Submission to the Natural Resources Commission on the assessment of south-western cypress state forests, Available from: http://nrc.nsw.gov.au/Workwedo/Forestassessment/South-western_cypressstateforestsassessment.aspx.
- Ayers, D, Melville, G, Szigethy-Gyula, J, Read, D, Rees, R & Atkinson, A (2001), Woody weeds and biodiversity in western NSW, unpublished report, *West 2000*, Dubbo, NSW.
- Ayers, DI, Seddon, J, Briggs, S, Doyle, S & Gibbons, P (2006), Interim benchmarks for the BioMetric Tool, Department of Environment and Conservation, Hurstville, NSW.
- Baker, RT & Smith, HG (1910), *A research on the pines of Australia*, Government Printer, Sydney, NSW.
- Battaglia, M, Bruce, J, Brack, C & Baker, T (2009), Climate change and Australia's plantation estate: Analysis of vulnerability and preliminary investigation of adaptation options, Forestry and Wood Products Australia, Victoria.
- Beadle, NCW (1948), *The vegetation and pastures of western NSW*, Department of Conservation of NSW, Sydney, NSW.
- Becker, A (n.d.), *Grace Roberts: Her life her mystery her dreaming*, Northern Rivers College Press, Lismore, NSW.
- Benbow, CA (1901), Interior land changes, *Agricultural Gazette of NSW*, No. 515, p. 1-6.
- Benson, JS (1999), Setting the scene: The vegetation of New South Wales, Background paper 1, Native Vegetation Advisory Council NSW.
- Birds Australia (2010b), Land and culture, Available from: <http://www.daa.nsw.gov.au/landandculture/enmanage.html> [Accessed: 29 Feb 2010].
- Bonhomme, T (1987), Aboriginal burials on the Riverine Plain of NSW, Report to ANUTEK, Canberra, ACT.
- Bonhomme, T (1993), State forests of NSW Murray Valley archaeological study Lake Victoria and Koondrook State Forests, Report to NSW Forestry Commission by the NSW National Parks and Wildlife Service.
- Bowman, DMJS & Harris, S (1995), Conifers of Australia's dry forest and open woodlands, In: Enright, NJ & Hill, RS (eds.) *Ecology of Southern Conifers*, Melbourne, p. 252-270.
- Bowman, DMJS & Latz, PK (1993), Ecology of white cypress pine on the MacDonald Ranges, *Australian Journal of Botany*, Vol. 41, p. 127-225.
- Bradley, R & Gans, J (1998), Growth in Australian cities, *Economic Record*, Vol. 74(226), p. 266-278.
- Briggs, SV, Seddon, JA & Doyle, SJ (2007), Structures of bird communities in woodland remnants in central New South Wales, Australia, *Australian Journal of Zoology*, Vol. 55, pp. 29-40.
- BRS (1997), Australian forest profiles 6: White cypress pine, National Forest Inventory, Bureau of Resource Sciences, ACT.
- BRS (2008), Australia's state of the forests report, Available from: http://adl.brs.gov.au/forestsaustralia/_pubs/sofr2008reduced.pdf.
- Burrows, WH, Hoffman, MB, Compton, JF & Back, PV (2001), Allometric relationships and community biomass stocks in white cypress pine (*Callitris glaucophylla*) and associated eucalypts of the Carnarvon area – south central Queensland (with additional data for scrub leopardwood – *Flindersia dissosperma*), Australian Greenhouse Office, Available from: <http://whitepaper.climatechange.gov.au/ncas/reports/pubs/tr33final.pdf>.
- Bustard, R (1968), The reptiles of Merriwindi State Forest, Pilliga West, Northern NSW, Australia, *Herpetologica*, Vol. 24, p. 131-140.

- Cameron, M (2005), Group size and feeding rates of glossy black cockatoos in central NSW, *Emu*, Vol. 105, p. 299-304.
- Carlton, C & Paull, D (2002), Pilliga State Forest flora and fauna survey, 14-19 November 2001, National Parks Association of NSW, Sydney, NSW.
- Carron, LT (1988), The state of knowledge of the history of public forests and forestry in Australia, In: Frawley, KJ & Semple, NM (eds), *Australia's ever changing forests: Proceedings of the first national conference on Australian forest history*, Department of Geography and Oceanography, Australian Defence Force Academy, ACT.
- Chisholm, EC (1936), Birds of the Pilliga Scrub, *Emu*, Vol. 37, p. 32-38.
- Cleland, JB (1919), Birds of the Pilliga Scrub, *Emu*, Vol. 18, p. 272-85.
- Coakes, S, Fenton, M (1998), Identifying the social impacts of changes in natural resource management and use, An introduction to Town Resource Cluster Analysis (TRC-Analysis), Report to the National Land and Water Theme 6 Working Group, Canberra, ACT.
- Coakes, SJ (1998), Valuing the social dimension: Social assessment in the regional forest agreement process, *Australian Journal of Environmental Management*, Vol. 3, p. 40-47.
- Cobar Vegetation Management Committee (2006), A vegetation management plan for areas invaded by native trees and shrubs in the Cobar Peneplain, Submission to the NSW Natural Resources Commission.
- Cohn, JC (in preparation), Co-existence of tree functional types in south-eastern Australian woodlands in relation to productivity gradients and disturbance regimes, PhD Thesis, Charles Sturt University, Albury, NSW.
- Cohn, JS (1995), The vegetation of Nombinnie and Round Hill Nature Reserves, central-western NSW, *Cunninghamia*, Vol. 4, p. 81-101.
- Commonwealth of Australia (2001), MVG 7 – *Callitris* forests and woodlands, Australian Natural Resource Atlas, Commonwealth of Australia, Available from: http://www.anra.gov.au/topics/vegetation/pubs/native_vegetation/pubs/vegfsheet-mvg7.pdf.
- Commonwealth of Australia (2009), Australia's strategy for the national reserve system 2009-2030, Prepared by the Australian Government Department of the Environment, Water, Heritage and the Arts for the National Reserve System Task Group, Canberra, ACT.
- Condobolin Community Website, Available from: <http://condobolin.nsw.au/our-region> [Accessed: 4 March 2010].
- Cox, SJ, Sivertsen, DP & Bedward, M (2001), Clearing of native woody vegetation in the NSW northern wheat belt: Extent, rate of loss and implications for biodiversity and conservation, *Cunninghamia*, Vol. 7, p. 101-155.
- Cremer, H (1976), Bargandji sites in the Darling River area, Western NSW, Part II – The Darling River, Report to NSW National Parks & Wildlife Service.
- Curr, EM (1965), *Recollections of squatting in Victoria from 1841 to 1851*, Melbourne University Press, (2nd edition, First published 1883, George Robertson), Melbourne.
- DAFF (1997), Australian forest profiles: White cypress pine 1997, Available from: http://adl.brs.gov.au/data/warehouse/brsShop/data/12906_d_cypress.pdf [Accessed: 2 April 2010].
- Date, EM, Ford, HA & Recher, HF (2002), Impacts of logging, fire and grazing regimes on bird species assemblages of the Pilliga woodlands of NSW, *Pacific Conservation Biology*, Vol. 8, p. 177-195.
- DECCW (2009d), Places of significance, Available from: <http://www.environment.nsw.gov.au/nswcultureheritage/PlacesOfSignificance.htm> [Accessed: 29 March 2010].
- DECCW (2009e), Silvicultural guidelines – Private native forestry code of practice, NSW Department of Environment, Climate Change and Water, Sydney, NSW.
- DECCW (2010a), Declared Aboriginal places in NSW, Available from: <http://www.environment.nsw.gov.au/conservation/AboriginalPlacesNSW.htm> [Accessed: 11 March 2010].
- DECCW (2010b), Aboriginal cultural heritage conservation, Available from: <http://www.environment.nsw.gov.au/conservation/aboriginalculture.htm> [Accessed: 11 March 2010].
- DEWHA (2008), The Dreaming, Available from: <http://www.cultureandrecreation.gov.au/articles/indigenous/dreamtime/> [Accessed: 3 April 2010].
- DNR (2005), *Native Vegetation Regulation 2005: Environmental Outcomes Assessment Methodology*, NSW Department of Natural Resources, Sydney, NSW
- DNR (2006a), Clearing/thinning of native vegetation known as invasive scrub under the *Native Vegetation Act 2003*, NSW Department of Natural Resources.
- DNR (2006b), Managing invasive native scrub – Infosheet 9, NSW Department of Natural Resources.
- Dowling, DK, Antos, M & Sahlman, T (2003), Dispersal and recruitment of juvenile red-capped robins, *Petroica goodenovii*, *Emu*, Vol. 103, p. 109-205.
- Eco Logical Australia (2009), The native grasslands of NSW: Environmental, Indigenous and agricultural values and sustainable management, report no. 227-001 prepared for the NSW Natural Resources Advisory Council.
- Edmonds, V (1991), An archaeological survey of the 33kV transmission line from Wilcannia to White Cliffs, Western NSW, Report to Darling Electricity Construction Agency.
- Eldridge, DJ & Freudenberger, D (2005), Ecosystem wicks: Woodland trees enhance water infiltration in a fragmented agricultural landscape in eastern Australia, *Australian Ecology*, Vol. 30, p. 336-347.

- Eldridge, DJ & Wilson, BR (2002), Carbon storage in soil and vegetation in paired roadside sites in the box woodlands of eastern Australia, *Australian Forestry*, Vol. 65, p. 268-272.
- Eldridge, DJ, Wilson, BR & Oliver, I (2003), Regrowth and erosion in the semi-arid woodlands of NSW, NSW Department of Land and Water Conservation, Sydney, NSW.
- Executive Steering Committee for Australian Vegetation Information (2003), Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0, Department of the Environment and Heritage, Canberra, ACT.
- FCNSW (1981), Management plan for Narrandera management area, Forestry Commission of NSW, Sydney, NSW.
- FCNSW (1982), Management plan for Steam Plains management area, Forestry Commission of NSW, Sydney, NSW.
- FCNSW (1984), Management plan for Griffith management area, Forestry Commission of NSW, Sydney, NSW.
- FCNSW (1986), Management plan for Forbes management area, Forestry Commission of NSW, Sydney, NSW.
- FCNSW (1987), Management plan for Condobolin management area, Forestry Commission of NSW, Sydney, NSW.
- FCNSW (1989), Research note 17: Forest types in NSW, Forestry Commission of NSW, Sydney, NSW.
- Feary, S (2005), Indigenous Australians and forests, In: *Australia and New Zealand forest histories: Short overviews* Dargarvel, J (eds), Australian Forest History Society, Canberra, ACT. p. 9-16.
- Flannery, TF (1994), Is there any hope for ecological stability in the NSW inland, In: Lunney, D, Hand, S, Reed, P & Butcher, D (eds), Future of the fauna of western NSW, Transactions of the Royal Zoological Society of NSW, Mosman, NSW.
- Flint, C (2007), Forging the links: The way forward for conservation planning in south-west NSW, NSW National Parks Association, Sydney, NSW.
- Ford, HA, Barrett, G, Saunders, DA, & Recher, HF (2003), Why have birds in the woodlands of southern Australia declined, *Biological Conservation*, Vol. 97, p. 71-88.
- Forest and Wood Products R&D Corporation (2003), *Review of studies of the socio-economic impact of forest industries in Australia*, URS for Forest and Wood Products R&D Corporation, Victoria.
- Forest Resources Committee (1987), Present areas and estimates of future availability of wood, Australian Forestry Council, Canberra, ACT.
- Forests NSW (2005), Living, working, playing forests: 2005-2009, NSW Department of Primary Industries, Available from: <http://www.dpi.nsw.gov.au/aboutus/resources/corporate-publications/living>.
- Frawley, KJ & Semple, NM (1988), Australia's ever changing forests: Proceedings of the first national conference on Australian forest history, Department of Geography and Oceanography, Australian Defence Force Academy, Canberra, ACT.
- Freudenberger, D & Stol, J (2002), Savernake and Native Dog Farmscapes Project: Integrating production and biodiversity, A report commissioned by the Native Dog Landcare Group (sub-committee of Berrigan Shire, NSW), CSIRO Sustainable Ecosystems, Canberra, ACT.
- Glanzign, A (1995), Native vegetation clearance, habitat loss and biodiversity decline, Biodiversity Series Paper no. 6, Commonwealth of Australia, Department of Environment, Sport and Territories, Canberra, ACT.
- Graetz, RD, Wilson, MA & Campbell, SK (1995), Land cover disturbance over the Australian continent - A contemporary assessment, Biodiversity Series Paper No. 7, Commonwealth of Australia, Department of Environment, Sport and Territories, Canberra, ACT.
- Grant, TC (1989), *History of Forestry in New South Wales 1788 to 1988*, Star Printery Pty Limited, Erskineville, NSW.
- Griffiths, T (2002), How many trees make a forest: Cultural debates about vegetation change in Australia, *Australian Journal of Botany*, Vol. 50, p. 375-389.
- Guilfoyle, D (2006), Aboriginal cultural heritage and regional studies: An illustrative approach, NSW Department of Environment and Conservation, Available from: <http://www.environment.nsw.gov.au/resources/cultureheritage/RegionalStudiesfinal.pdf> [Accessed: 25 February 2010].
- Hamilton, AG (1892), On the effect which settlement in Australia has produced upon Indigenous vegetation, *Journal and proceedings of the Royal Society of NSW*, Vol. 26, pp.178-239.
- Harris, B, James, D, Ohlsen, E, Griffiths, P & Barker, C (2000), Pilaarrkiyalu of the Cobar Peneplain: Ngilyampaa traditional uses of plants and animals, NSW National Parks and Wildlife Service, Sydney, NSW.
- Heritage Office & Department of Urban Affairs and Planning (1996), Regional histories of NSW, NSW Heritage Office, Sydney, NSW.
- Horne, R, & Robinson, G (1987), White cypress pine in NSW: growth patterns and optimal thinning regimes for 60- to 80-year-old stands, *Australian Forestry*, Vol. 50, p. 216-223.
- Johnston, TN & Jennings, KS (1991), Management of cypress pine forests in Queensland, In: McKinnell, FH, Hopkins, ER & Fox, JED (eds.), *Forest Management in Australia*, Surrey Beatty and Sons, Sydney, p. 182-189.
- Jones, R (1969), Firestick farming, *Australian Natural History*, Vol. 16(7), p. 224-28.
- Jurskis, V (2009), River red gum and white cypress forests in south-western NSW, Australia: Ecological history and implications for conservation of grassy woodlands, *Forest Ecology and Management*, Vol. 258, p. 2593-2601
- Klaver, J (1987), Old ovens are soon hot: A study of function and location of Aboriginal mounds in the Upper Murrumbidgee region, Thesis, Australian National University, Canberra, ACT.

- KN Partitions Pty Limited (2010), Submission to the Natural Resources Commission on the assessment of south-western cypress state forests, Available from: <http://nrc.nsw.gov.au/Workwedo/Forestassessment/South-westerncypressstateforestsassessment.aspx>.
- Knott, J (1995), White cypress pine thinning trials of the western region, Australia, Research paper no. 27, State Forests of NSW, Sydney, NSW.
- Lachlan Shire Council (2004), Lachlan Shire Council Social Community Plan – December 2004, Available from: <http://www.lachlan.nsw.gov.au/files/1403/File/socialcommunityplan.pdf>, [Accessed: 4 March 2010].
- Lachlan Shire Council (2010), Assessment of cypress state forests, Submission to the Natural Resources Commission.
- Lachlan Shire Council (n.d.), Available from: <http://www.lachlan.nsw.gov.au> [Accessed: 4 March 2010].
- Lewis, G (1883), Report on pine scrubs to the NSW Legislative Assembly, Votes and Proceedings of the NSW Legislative Assembly, Mitchell Library, Sydney, NSW.
- Lunt, ID & Spooner, PG (2005), Using historical ecology to understand patterns of biodiversity in fragmented agricultural landscapes, *Journal of Biogeography*, Vol. 32, pp. 1859–1873.
- Lunt, ID (2002), Grazed, burnt and cleared: how ecologists have studied century-scale vegetation changes in Australia, *Australian Journal of Botany*, Vol. 50, p. 391–407.
- Lyons, K (1988), Prehistoric Aboriginal relationships with the forests of the riverine plan in south-eastern Australia, In: Frawley, KJ & Semple, NM (eds), *Australia's ever changing forests: Proceedings of the first national conference on Australian forest history*, Department of Geography and Oceanography, Australian Defence Force Academy, ACT.
- Mac Nally, R, Bennett, AF, Thomson, JR, Radford, JQ, Unmack, G, Horrocks, G & Vesk, PA (2009a), Collapse of an avifauna: Climate change appears to exacerbate habitat loss and degradation, *Diversity and Distributions*, Vol. 15, pp. 720–730.
- Mac Nally, R, Horrocks, G, Lada, H, Lake, PS, Thomson, JR & Taylor, AC (2009b), Distribution of anuran amphibians in massively altered landscapes in south-eastern Australia: Effects of climate change in an aridifying region, *Global Ecology and Biogeography*, Vol. 18, p. 575–585.
- Major, RE, Christie, FJ, Gowing, G & Ivison, TJ (1999), Age structure and density of red-capped robin populations vary with habitat size and shape, *Journal of Applied Ecology*, Vol. 36, p. 901–908.
- Major, RE, Christie, FJ, Gowing, G, Cassis, G & Reid, CAM (2003), The effect of habitat configuration on arboreal insects in fragmented woodlands of south-eastern Australia, *Biological Conservation*, Vol. 113, No. 1, p. 35–48.
- Major, RE, Smith, D, Cassis, G, Gray, M & Colgan, DJ (1999), Are roadside strips important reservoirs of invertebrate diversity? A comparison of the ant and beetle faunas of roadside strips and large remnant woodlands, *Australian Journal of Zoology*, Vol. 47, p. 611–624.
- Maron, M (2007), Threshold effect of eucalypt density on an aggressive avian competitor, *Biological Conservation*, Vol. 136, p. 100–107.
- Martin, S (1987), Archaeological survey of a proposed route for 33kV powerline between Menindee and Wilcannia, Report to Broken Hill City Council, Broken Hill, NSW
- McCarthy, F (1976), Rock art of the Cobar pediplain in central western NSW: Research and regional studies no. 7, Australian Aboriginal studies, Australian Institute of Aboriginal Studies, Canberra, ACT.
- McHenry, MT, Wilson, BR, Lemon, JM, Donnelly, DE & Grown, IG (2006), Soil and vegetation response to thinning white cypress pine (*Callitris glaucophylla*) on the north-western slopes of NSW, Australia, *Plant Soil*, Vol. 285, pp. 245–255.
- McHenry, MT, Wilson, BR, Lockwood, PV, Guppy, CN, Sindel, BM, Matthew, K, Tighe, MK, Ivor, O, Grown, IO & Lemon, JM (2009), The impact of individual *Callitris glaucophylla* (white cypress pine) trees on agricultural soils and pastures of the north-western slopes of NSW, Australia, *The Rangelands Journal*, Vol. 31, p. 321–328.
- Menz, W (2002), Draft assessment of crown land at Coleambally (lease blocks), Parish of Argoon, Boona, Coleambally, Mycotha, Ugobit, Waddi and Yamma, County of Boyd, NSW Department of Land and Water Conservation, Wagga Wagga, NSW.
- Metcalfe, L, Sivertsen, DP, Tindall, D & Ryan, KM (2003), Natural vegetation of the NSW wheat belt (Cobar-Nyngan-Gilgandra, Nymagee-Narromine-Dubbo 1:250,000 vegetation sheets), *Cunninghamia*, Vol. 8, p. 253–284.
- Michael, DR, Lunt, ID & Robinson, WA (2004), Enhancing fauna habitat in grazed native grasslands and woodlands: use of artificially placed log refuges by fauna, *Wildlife Research*, Vol. 31, p. 65–71.
- Minister for Climate Change and the Environment and the Minister for Primary Industries (2009), Brigalow and Nandewar Community Conservation Area Agreement, Developed by the Community Conservation Council in conjunction with the Central West, Border Rivers Gwydir and Namoi, Community Conservation Advisory Committees.
- Moore, CWE (1953b), The vegetation of the south-eastern Riverina, NSW, 2 – The disclimax communities, *Australian Journal of Botany*, Vol. 1, p. 548–567.
- Navin Officer Heritage Consultants (2009), Forests NSW harvesting and associated road work operations in south-western NSW: Environmental assessment Aboriginal cultural heritage desktop review, Available from: <http://www.dpi.nsw.gov.au/forests/info/riverinaea/Volume-2-Appendix-D.pdf> [Accessed: 9 March 2010].
- Noble, JC (1997), The Delicate and Noxious Scrub: CSIRO Studies on Native Tree and Shrub Proliferation in the Semi-Arid Woodlands of Eastern Australia, CSIRO, Canberra, ACT.
- Nowland, A (1997), *Sustainable management strategy for travelling stock routes and reserves in central western NSW*, Rural Lands Protection Boards, GK Craig Printers, Orange, NSW.

- NPA (2007), Forging the links: The way forward for conservation planning in South West NSW, NSW National Parks Association, Sydney, Available from: http://www.npansw.org.au/web/conservation/NPA_West.
- NPWS (1991), Yathong Nature Reserve, Nombinnie Nature Reserve and Round Hill Nature Reserve, Draft Plan of Management, Sydney.
- NPWS (2001), New South Wales South West Slopes Bioregion Scoping Study, NSW Biodiversity Strategy, unpublished report. NSW National Parks and Wildlife Service, Dubbo.
- NPWS (2002), Brigalow Belt South bioregion scoping study, NSW Biodiversity Strategy, Draft Report, unpublished report NSW National Parks and Wildlife Service, Sydney.
- NPWS (2003), The Bioregions of NSW – Their biodiversity, conservation and history, NSW National Parks and Wildlife Service, Hurstville, Available from: <http://www.environment.nsw.gov.au/bioregions/Bioregions.htm> [Accessed: 25 February 2010].
- NSW (1969), Report of the Inter-Departmental Committee on Scrub and Timber Regrowth in the Cobar-Byrock district and other areas of the Western Division of NSW, Government Printer, Sydney.
- NSW Aboriginal Lands Council (2009b), About NSWALC, Available from: <http://www.alc.org.au/about-nswalc/our-organisation.aspx> [Accessed: 11 March 2010].
- NSW Forest Products Association (2009a), Initial Submission with respect to cypress forests, made to the NRC assessments of Red Gum Forests in the Riverina and cypress Forests in south-western NSW.
- NSW Forest Products Association (2009b), Submission to the Productivity Commission Inquiry into Native Vegetation 2004.
- NSW Parliament (2005), Brigalow Belt South bioregion, *NSW State Government Hansard*, 5 May 2005, p. 15657.
- NSW Parliament (2006a), Brigalow Belt South Bioregion wood production extraction operations, *NSW State Government Hansard*, 9 May 2006, p. 22708.
- NSW Parliament (2006b), Brigalow Timber Companies, *NSW State Government Hansard*, 26 September 2006, p. 2482.
- NSW Aboriginal Lands Council (2009a), Map of local Aboriginal Land Council boundaries, Available from: <http://www.alc.org.au/land-councils/lalc-regions--boundaries.aspx> [Accessed: 11 March 2010].
- Olsen, P Weston, M, Tzaros, C Silcocks, A (2005), *The state of Australia's birds 2005, Woodlands and Birds*, Supplement to *Wingspan* Vol. 15, No. 4, Birds Australia, Melbourne.
- Paton, D, O'Connor, J (2010), *The state of Australia's birds 2009, restoring woodland habitats for birds*, Supplement to *Wingspan* Vol. 20, No. 1, Birds Australia, Melbourne.
- Paull, D (1997), Conservation management options for vertebrate fauna with respect to forestry operations in the north west and south west cypress management areas, unpublished report.
- Paull, DC & Date, EM (1999), Patterns of decline in the native mammal fauna of the north-west slopes of New South Wales, *Australian Zoologist*, Vol. 31, 210-224.
- Pearson, M (1981), Seen through different eyes: Changing land use and settlement patterns in the Upper Macquarie River Region of NSW, from Prehistoric times to 1860, PhD thesis, Australian National University, Canberra.
- Pickard, J (2007), Australian rural fences: Heritage challenges for conserving the unconservable, *International Journal of Heritage Studies*, Vol. 13, No. 6, p. 489-510.
- Price, O & Bowman, DMJS (1994), Fire-stick forestry: A matrix model in support of skilful fire management of *Callitris intratropica*, *Journal of Biogeography*, Vol. 21, p. 573-580.
- Purcell, P (2002), Aboriginal cultural heritage assessment, NSW western regional assessments: Brigalow Belt South, Planning NSW, Sydney.
- Purcell, P (2007), Data audit and overview of Aboriginal cultural heritage in the Lachlan catchment: Report to the Lachlan CMA Regional Aboriginal Reference Group, In: Relph, E (1976), *Place and placelessness*, Pion Limited, London.
- Pyne, SJ (1991), *Burning bush: A fire history of Australia*, University of Washington Press, Washington.
- Read, J (1995), Recruitment characteristics of the white cypress pine (*Callitris glaucophylla*), In: Arid South Australia, *Rangeland Journal*, Vol.17, p. 228-240.
- Rhoades, CC (1997), Single-tree influences on soil properties in agroforestry: Lessons from natural forest and savanna ecosystems, *Agroforestry Systems*, Vol. 35, p. 71-94.
- Roche, M & Denlow, A (n.d.), Social, environmental and economic performance, Forests NSW Annual Report 2008-09, Available from: <http://www.dpi.nsw.gov.au/aboutus/resources/corporate-publications/forests-nsw-annual-report-2008-09>.
- Ryan, DG, Ryan, JE & Starr, BJ (1995), The Australian landscape – Observations of explorers and early settlers, An unpublished report prepared for the Murrumbidgee Catchment Management Committee, NSW Farmers Association.
- Sass, S (2006), The reptile fauna of Nombinnie Nature Reserve and State Conservation Area, western NSW, *Zoologist*, Vol. 33, No. 4, p. 511-518.
- Scanlan, JC, Pressland, AJ & Myles, DJ (1996), Run-off and soil movement on mid-slopes in north-east Queensland grazed woodlands, *Australian Rangeland Journal*, Vol. 18, p. 33-46.
- Schnierer, S, Faulkner, A & Fisher, C (2001), *Aboriginal cultural values of the native vegetation of NSW: A background paper of the Native Vegetation Advisory Council of NSW*, Background paper no. 5, NSW Department of Land and Water Conservation.
- Scott, L (1970), Temperatures for testing germination of *Callitris* seeds, *Australian Forest Research*, Vol. 4(3), p. 37-40.

- Shelly, D (1998), Preliminary fauna survey of belah and cypress/box woodland near West Wyalong NSW and recommendations for forest management, *Australian Forestry*, Vol. 61, p. 147-154.
- Simpfendorfer, KJ (1992), *An Introduction to trees for South-eastern Australia*, Inkata Press, Sydney, NSW.
- Sivertsen, D & Clarke, PJ (2000), Temperate woodlands in NSW: A brief overview of distribution, composition and conservation, In: Hobbs RS & Yates CJ (eds), *Temperate eucalypt woodlands in Australia: Biology, Conservation, Management and Restoration* (Hobbs, RJ & Yates, CJ eds.), Surrey Beatty & Sons, Chipping Norton, NSW, p. 6-16.
- South Australian Museum (2010), Tindale tribal boundaries, Available from: http://www.samuseum.sa.gov.au/page/default.asp?site=2&page=TIN_Tribal [Accessed: 11 March 2010].
- Spooner, P, Lunt, I & Robinson, W (2002), Is fencing enough? The short-term effects of stock exclusion in remnant grassy woodlands in southern NSW, *Ecological Management and Restoration*, Vol. 3, p. 117-126.
- Stafford, MJ & Eldridge, DJ (2000), Vegetation, soils and management of Zara: A sandhill remnant on the Riverine Plain, *Cunninghamia*, Vol. 6, No. 3, p. 717-746.
- State Forests of NSW (1999), Managing our forests sustainably – Forest management zoning, NSW State Forests' Operational Circular 99/10.
- Sterling Kershaw and Co. (2010), Submission to the Natural Resources Commission on the assessment of south-western cypress state forests, Available from: <http://nrc.nsw.gov.au/Workwedo/Forestassessment/South-westerncypressstateforestsassessment.aspx>.
- Taylor, D, King, J, Swift, S, Hopewell, G, Debuse, V, Roberts, S & Cotter, D (2005), The influence of forest management on sawn timber recovery and value in cypress pine, A report for the RIRDC/Land & Water Australia/FWRPDC/MDBC – Joint venture Agroforestry Program, Publication number 04/184, Available from: <https://rirdc.infoservices.com.au/downloads/04-184.pdf>.
- Thackway, R & Cresswell, ED (1995), *An Interim biogeographic regionalisation for Australia: A framework for setting priorities in the National Reserves System Cooperative Program*, Version 4.0, Australian Nature Conservation Agency, Canberra, ACT.
- Thompson, J & Johnson, LAS (1986), *Callitris glaucophylla*, Australia's white cypress pine – a new name for an old species, *Telopea*, Vol. 2, p. 731-736.
- Thompson, WA, Eldridge, DJ & Bonser, SP (2006), Structure of biological soil crust communities in *Callitris glaucophylla* woodlands of NSW, Australia, *Journal of Vegetation Science*, Vol. 17, No. 3, p. 271-280.
- Tighe, M, Reid, N, Wilson, B & Briggs, SV (2009), Invasive native scrub and soil condition in semi-arid south-eastern Australia, *Agriculture, Ecosystems and Environment*, Vol. 132, p. 212-222.
- Tindale, N (1974), *Aboriginal tribes of Australia*, University of California Press, Los Angeles, USA.
- Venn, T (2004), Visions and realities for a Wik forestry industry on Cape York Peninsula, Australia, *Small-scale Forest Economics, Management and Policy*, Vol. 3, No. 3, pp. 431-451.
- Westbrooke, ME & Miller, JD (1995), The vegetation of Mungo National Park, western NSW, *Cunninghamia*, Vol. 4, pp. 63-80.
- Westbrooke, ME, Kerr, MKC & Leversha, J (2001), The vegetation of Kincheha National Park, western NSW, *Cunninghamia*, Vol. 7, p. 1-25.
- Westbrooke, ME, Miller, JD & Kerr, MKC (1998), The vegetation of the Scotia 1:100,000 map sheet, western NSW, *Cunninghamia*, Vol. 5, p. 665-684.
- Whipp, RK, Lunt, ID, Deane, A & Spooner, PG (2009), Historical forest survey data from *Eucalyptus*–*Callitris* forests: A valuable resource for long-term vegetation studies, *Australian Journal of Botany*, Vol. 57, p. 541–555.
-

Appendix 4

Tables and figures

List of tables

Table 1.1	Timeline for consultation and communication	Table 5.4	Mills currently supplied with cypress sawlog by Forests NSW under 20-year wood supply agreements
Table 1.2	Organisations consulted	Table 5.5	Other mills, manufacturers and distributors
Table 1.3	Consultation visits and forest tours	Table 5.6	Forests NSW staff employed to manage south-western cypress state forests
Table 2.1	Extent of white cypress forest and associated woodland across all tenures	Table 5.7	Estimated regional economic contribution of the south-western cypress industry
Table 2.2	Chronology of non-Indigenous land use and impacts on south-western cypress state forests	Table 6.1:	Forest management zoning – objectives and activities
Table 2.3	Change in land tenure as a result of the Brigalow decision	Table 6.2:	Management treatments for white cypress acting as invasive native scrub
Table 3.1	Major fauna groups and species found in white cypress forests and associated woodlands	Table 6.3:	Area of approved Invasive Native Scrub and Thinning PVPs
Table 3.2	Comparison between white cypress and eucalypt species basal area in pre-settlement and current stands	Table 6.4	Management strategies for reserves in the assessment area
Table 3.3	Comparison of estimated white cypress and eucalypt species basal area in pre-settlement and current stands using different data sources	Table 6.5	Proposed management objectives for landscape management of cypress in the central division
Table 3.4	Proportion of stands in contrasting basal areas categories in pre-settlement and current times	Table 6.6	Proposed management objectives for landscape management of cypress in the western division
Table 3.5	Clearing statistics for white cypress types	Table 6.7	JANIS targets for white cypress and other native vegetation types in the assessment area
Table 3.6	DECCW expert panel assessments of likely changes in biodiversity in NSW	Table 6.8:	Cypress state forests that should be managed for production and environmental values under state forest tenure
Table 4.1	Description of Indigenous heritage site features	Table 6.9:	Cypress state forests with high value for landscape function which may be threatened by grazing
Table 4.2	AHIMS-recorded Indigenous heritage sites in some of the south-western cypress state forests	Table 6.10:	Cypress state forests which may be particularly vulnerable to harvesting impacts
Table 4.3	Recorded Indigenous heritage sites in Forests NSW's Environmental Impact Statement for Harvesting and Associated Roadworks of South-western NSW	Table 6.11:	Cypress state forests that should be primarily managed for conservation
Table 4.4	Values and uses of state forests		
Table 4.5	The 10 state forests with the highest number of permitted hunters		
Table 5.1	Age cohorts found in white cypress forests		
Table 5.2	Estimated annual sustainable yields from state forests		
Table 5.3	Volume of cypress timber harvest recorded in Forests NSW's current sales system		

Appendix 4

Tables and figures

List of figures

Figure 1.1	Analytical framework for making recommendations to NSW Government for south-western cypress state forests of NSW	Figure 5.1	Western Region Supply Area
Figure 2.1	Location of south-western cypress state forests and extent of white cypress forest and associated woodland	Figure 6.1	Nominal silviculture for white cypress stands
Figure 2.2	Fragmentation of south-western cypress state forests in the central division	Figure 6.2	Location of approved PNF PVPs for white cypress and western hardwoods
Figure 2.3	Map of Indigenous nations in the region of the south-western cypress forests	Figure 6.3	Potential corridors linking major areas of refuge in the white cypress landscape. Methodology is explained in Appendix 11
Figure 2.4	Industry consolidation across NSW	Figure 6.4	Map of proposed management and associated tenure arrangements for south-west cypress state forests
Figure 2.5	Landscape change in the south-western cypress forests		
Figure 3.1	Generalised model of changes in vegetation over time for the white cypress woodlands in the central and western divisions		
Figure 3.2:	Estimated basal area of white cypress and eucalyptus at 39 sites at the time of settlement		
Figure 3.3:	Percentage of inventory plots containing differing proportions of eucalypt species and white cypress basal area		
Figure 3.4:	Percentage of inventory plots containing differing levels of basal area of eucalypt species and white cypress		
Figure 3.5:	Temperature and rainfall anomalies in the Murray Darling Basin (1900–2008)		
Figure 4.1	Location of state forests for which grazing occupation permits are issued		
Figure 4.2	Location of state forests for which apiary permits are held		
Figure 4.3	Location of state forests for which hunting permits have been issued in the past by the Game Council NSW		
Figure 4.4	Communities with direct and indirect linkages to south-western cypress state forests		
Figure 4.5	Community Sensitivity Index scores for communities with a linkage to south-western cypress state forests		
Figure 4.6	Capital vulnerability sub-indices for communities with a linkage to the south-western cypress state forests (in order of decreasing overall CSI)		

Appendix 5

Acronyms and glossary

Acronyms

ABS	Australian Bureau of Statistics	IPCC	Intergovernmental Panel on Climate Change
ACT	Australian Capital Territory	IUCN	International Union for the Conservation of Nature
AHIMS	Aboriginal Heritage Information Management System	JANIS	Joint ANZECC National Forest Policy Statement Implementation Sub-Committee
ARIA+	Accessibility/Remoteness Index of Australia	LALC	Local Aboriginal Land Council
CAP	Catchment Action Plan	Lidar	Light Detection and Ranging (optical remote sensing technology)
CAR	Comprehensive, Adequate and Representative	NES	National Environmental Significance
CCA	Community Conservation Area	NLWRA	National Land and Water Resources Audit
CMA	Catchment Management Authority	NPA	National Parks Association of NSW
CSA	Community Sensitivity Analysis	NPWS	NSW National Parks and Wildlife Service
CSI	Community Sensitivity Index	NRC	Natural Resources Commission
CSIRO	Commonwealth Scientific and Industrial Research Organisation	NRM	Natural resource management
Cth	Commonwealth	NRMCMC	Natural Resource Management Ministerial Council
DAFF	Australian Government Department of Agriculture, Fisheries and Forestry	NSW	New South Wales
DECC	Former NSW Government Department of Environment and Climate Change	NV	<i>Native Vegetation Act 2003</i>
DECCW	NSW Department of Environment, Climate Change and Water	OP	Occupation Permit
DEH	Former Australian Government Department of Environment and Heritage	PEFC	International Programme for the Endorsement of Forest Certification schemes
DEST	Former Australian Government Department of Education, Science and Training	PNF	Private Native Forestry
DEWHA	Australian Government Department of Environment, Water, Heritage and the Arts	PNF PVP	Private Native Forestry Property Vegetation Plan
DFID	United Kingdom Department for International Development	PVP	Property Vegetation Plan
DII	NSW Department of Industry and Investment	RAAF	Royal Australian Air Force
DIPNR	Former NSW Department of Infrastructure, Planning and Natural Resources	RACAC	NSW Resource and Conservation Assessment Council
DNR	Former NSW Department of Natural Resources	RVC	Regional Vegetation Communities
DPC	NSW Department of Premier and Cabinet	TRC	Town Resource Cluster Analysis
DPI	Former NSW Department of Primary Industries	TSC	<i>Threatened Species Conservation Act 1995</i>
DSE	Dry Sheep Equivalents	TSR	Travelling Stock Reserve
EcoAus	Eco Logical Australia	VCA	Vegetation Classification Assessment
EEC	Endangered Ecological Community		
EPA	<i>Environmental Planning and Assessment Act 1979</i>		
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>		
ESFM	Ecologically Sustainable Forest Management		
FCNSW	Forestry Commission of New South Wales		
FNPE	<i>Forestry and National Park Estate Act 1998</i>		
FRAMES	Forest Resource and Management Evaluation System		
GVP	Gross Value of Production		
IBRA	Interim Biogeographic Regionalisation of Australia		
IFOA	Integrated Forestry Operations Approval		
INS	Invasive Native Scrub		
INS PVP	Invasive Native Scrub Property Vegetation Plan		

Glossary

Term	Description
Abiotic	Non-living components of the environment, including chemical factors (such as water and gases), geological factors (such as rocks and minerals) and physical factors (such as climate).
Adaptive capacity	The ability of a socio-ecological system, for example a town or community, to adjust positively to significant change.
Adaptive management	A systematic and iterative process for decision-making that focuses on learning-by-doing.
Agroforestry	Integration of commercial tree growing with crop or animal production systems.
Allocation	See 'quota'.
Angiosperms	The group of vascular flowering plants that produce seeds enclosed in an ovary.
Apiary	Beekeeping operations.
Associated woodland	A woodland within the NRC's mapping units in which white cypress is found in association with other species (mainly with Eucalyptus species) and in which white cypress is not a dominant species.
Basal area	A measurement of tree density for a unit land area, based on the sum of tree basal areas for all trees on that unit area. Tree basal area is the cross-sectional area of a tree measured in square metres at breast height (~1.3 metres above the ground), including the bark.
Biodiversity	The variety of all life forms: different plants, animals and microorganisms, the genes they contain and the ecosystems in which they live.
Bioregion	A broad-scale unit that captures large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The bioregions are described in the Interim Biogeographic Regionalisation for Australia (IBRA) framework. See http://www.environment.gov.au/parks/nrs/science/bioregion-framework/index.html
Biota	All the plant and animal life of a particular geographic area or time period.
Biotic resources	The resources represented by biota, including living organisms and their products.
Brigalow Belt South and Nandewar bioregions	Two bioregions in northern NSW. These regions were the focus of a NSW Government regional assessment process, which ultimately led to the 2005 Brigalow decision.
Brigalow decision	The NSW Government's 2005 Brigalow decision outlined a suite of proposals for the Brigalow Belt South and Nandewar bioregions including: changes in land tenure; a regional wood supply commitment and 20-year wood supply agreements; and funding packages for conservation outcomes and for the cypress timber industry.
Broom bush	Broom bush, or broom honey-myrtle (<i>Melaleuca uncinata</i>) is a dominant, or sub-dominant, shrub that occurs in eucalypt and associated woodlands. Broom bush is harvested from coppiced shrubs and used predominantly in fencing.
Cadastral landscape	The term given to the public records, surveys or maps that record information about the land; for instance, land boundaries, ownership, tenure or value.
Carbon sequestration	Storage of carbon dioxide to prevent its release into the atmosphere, where it would otherwise contribute to global warming.
Catchment	The area of land drained by a creek or river system, or a place set aside for collecting water which runs off the surface of the land.
Central division	A NSW land management division, established under the <i>Crown Lands Act of 1889</i> .
Chenopods	Salt-tolerant and drought-resistant flowering shrubs, sub-shrubs or forbs in the 'goosefoot' (<i>Chenopodiaceae</i>) family, for example spinach, beets and pigweed.
Climate change	Any change in climate over time (generally considered to be as a result of human activity).
Climate gradient	The rate of change in climate related to spatial location.
Coarse woody debris	Fallen dead trees and the remains of large branches on the forest floor.
Cobar Penepplain	A bioregion in central NSW. It lies to the west of the Great Dividing Range, and extends from just south of Bourke to just north of Griffith.
Cohort	A generational group defined by statistical or demographic characteristics; in this instance, referring to trees that germinated within the same time period.

Term	Description
Commercial harvest	The harvest of merchantable trees; in cypress forest, the terminology is used to describe the final harvest of a particular cohort.
Commercial thinning	Operation in which commercial grade timber is thinned to extract timber products while simultaneously creating a more open canopy to promote further growth of remaining trees and regeneration of a new cohort.
Community sensitivity	A community's capacity to respond and adapt to change (relates to adaptive capacity).
Community Sensitivity Analysis (CSA)	Developed by Coakes and Sadler (in preparation), CSA assesses the adaptive capacity of communities. CSA is based on the assumption that a community's adaptive capacity is dependent on the status of its capital assets across five key areas: natural, economic, human, physical and social.
Community Sensitivity Index (CSI)	Developed by Coakes and Sadler (in preparation), CSI is a tool used within Community Sensitivity Analysis. A CSI provides a relative assessment of the strength of communities' capital assets, and therefore a relative measure of the communities' adaptive capacity. The CSI comprises a number of specific sub-indices that are weighted to form an additive index.
Comprehensive, Adequate and Representative	Principles for the establishment a national reserve system. Comprehensive: being a network of forest parks protecting the full range of native forest communities found within the state. Adequate: being a reserve system large enough to protect the vast range of forest dwelling plants. Representative: being a reserve system including all natural varieties within each forest type or species. Refer to: http://www.environment.gov.au/parks/nrs/science/scientific-framework.html
Cobar Peneplain	A bioregion in central NSW. It lies to the west of the Great Dividing Range, and extends from just south of Bourke to just north of Griffith.
Contiguous vegetation	Vegetation communities that are in contact at a shared boundary, adjacent or near to one another.
Corridors	See 'habitat corridors'.
'Country'	Refers to the lands and waters to which an Indigenous community has a cultural connection. Access to these lands and waters is important in maintaining the language, identity and socio-economic self-determination of Indigenous people.
Crown timber lands	Crown lands, specified in Schedule 1 of the <i>Forestry Act 1916</i> .
Dodai	Structural timber of a specific size and quality used in traditional Japanese domestic construction.
Dominant plant or shrub	The plant species in an ecological community that contributes the most cover, basal area or biomass when compared to other plant species. Often the dominant plant or shrub is the largest tree or shrub species within the overstorey of an ecological community.
Ecological burning	A form of prescribed burning. Treatment with fire of vegetation in nominated areas to achieve specified ecological objectives.
Ecological community	An assemblage of two or more populations of different species occupying the same geographical area.
Ecological thinning	Where the primary aim of forest thinning is to increase growth of selected trees, favouring development of wildlife habitat (such as hollows) rather than focusing on increased timber yields.
Ecologically sustainable development	Development which aims to meet the needs of current populations, while conserving ecosystems for the benefit of future generations.
Ecologically Sustainable Forest Management plans	Developed by Forests NSW to guide the sustainable management of state forests in NSW. They set out broad forest management strategies, performance indicators and measurable outcomes for key areas of forest management, including conservation and forest health, Indigenous and non-Indigenous cultural heritage, sustainable timber supplies and social and economic development.
Economic capital	Relates to the wealth and income of individuals within a community, and the economic resources and nature and diversity of key industrial sectors within the community.
Ecosystem	The combined physical and biological components of an environment. An ecosystem is generally an area within the natural environment in which physical (abiotic) factors of the environment, function together along with interdependent (biotic) organisms, within the same habitat. Ecosystems can be permanent or temporary.
Ecosystem productivity	The ability of an ecosystem to produce, grow or yield products – whether trees, shrubs or other organisms.

Term	Description
Ecosystem services	Benefits people obtain from ecosystems, including provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis and nutrient cycling.
Ecotone	A transition area between two adjacent but different plant communities.
El Niño	Extensive warming of the central and eastern tropical Pacific Ocean, which leads to a major shift in weather patterns across the Pacific. Generally this occurs every three to eight years and is associated with drier conditions in eastern Australia.
Endangered ecological community	Under the NSW Threatened Species Conservation Act 1995 and the Commonwealth EPBC Act 1999, a critically endangered ecological community is an assemblage of native species that has a very high risk of extinction in the immediate future. The risk may stem from an extreme reduction in abundance, geographic distribution or genetic diversity within the ecological community, and/or the effects of key threatening processes.
Environmental stewardship	A concept that people have a duty to manage and care for the whole natural environment and are responsible for the continued health of the whole ecosystem. It involves integrating and applying environmental values into a process.
Epicormic buds	Buds that lay dormant in the stems or branches of woody plants and trees. The buds will grow new shoots after the plant is injured or exposed to fire or increased light.
Floristic	Refers to the species composition of a vegetation community.
Forbs	Broad leaved, herbaceous ('non-woody') flowering plants that are not classified as a grass, sedge or rush; for instance, clover and sunflowers are both forbs.
Forest condition	The capacity of a forest stand to support the key elements of ecosystem function that operate in and underpin a reference stand. Condition takes into account forest health, but also includes structural and floristic changes to the forest arising from human activities such as continuous grazing, inappropriate use of fire and logging.
Forest health	The perceived condition of a forest, usually assessed from the vigour of the tree canopy. Poor health is denoted by canopy dieback relating to stress factors such as drought, insects, disease or soil chemical imbalance.
Forest Management Zone	A system of zoning developed by Forests NSW within their Ecologically Sustainable Forest Management plans to help achieve specific management objectives.
Forests NSW	A public trading enterprise within the NSW Department of Industry and Investment (Primary Industries) that is responsible for managing the sustainable supply and extraction of timber from Crown timber lands.
Fossickers	People who search for items, such as gold, precious gems and minerals or fossils, in places like abandoned mine workings, waste piles or rivers. On state forests, fossicking must be non-commercial and carried out using only handtools. There are also restrictions on the volume of minerals that can be extracted over a 48-hour period.
Geomorphology	The study of the arrangement and form of the Earth's crust and the relationship between these physical features and the geologic structures beneath.
Granivores	Mammals, birds and insects that feed on the seeds of plants.
Green sawn timber	Timber that has been cut from the sawlog, but not dried or further processed.
'Growth-locked' stands	When growing in dense stands, cypress saplings thin extremely slowly. While the plants increase in height as time progresses, the stem diameter (or girth) of individual saplings increases little, creating dense stands of growth-locked cypress.
Habitat	A place or environment in which an organism naturally occurs, or to which it has adapted.
Habitat connectivity	The linkages across landscapes between habitats, through which biota can move across variegated landscapes. It is a key feature of natural environments.
Habitat corridors	Parts of the landscape that provide habitat connectivity; particularly habitat areas that are otherwise surrounded by non-habitat areas (for example, human developments and agricultural fields). In agricultural landscapes, these corridors are often, but not necessarily, linear strips of habitat retained along roadside verges and along watercourses.
Harvesting	Process involving tree felling, removal of branches and cutting the stem to product lengths.
Haulage	Taking harvested trees from the forest and delivering them to the processing plant.
Hazard reduction burning	Controlled or 'prescribed' burning of vegetation to remove excess ground litter and other hazards, often used in strategic bushfire management.

Term	Description
Herbivorous	Herbivory is a form of predation in which an organism consumes principally autotrophs such as plants, algae and photosynthesising bacteria.
Human capital	Relates to the skills, ability, health and education of individuals within a community, and the proportion of at-risk or vulnerable groups within the community.
Incompletely mapped vegetation	In the NRC's mapping of the cypress state forests, this term refers to areas where mapped vegetation data is not available, or not covered by the composite vegetation layer.
Insectivores	Mammals, birds, plants and insects that feed primarily on insects and other small creatures, including invertebrates (for example, worms) or vertebrates (for example, small fish and lizards).
Integrated Forestry Operations Approval	Describes the forestry operations and area to which a Forest Agreement applies. It may contain the terms of relevant licences under the <i>Protection of the Environment Operations Act 1997</i> , the <i>Threatened Species Conservation Act 1995</i> and the <i>Fisheries Management Act 1994</i> . The approval may also contain other relevant conditions.
Interim Biogeographic Regionalisation of Australia (IBRA)	IBRA is a planning framework used for the national reserve system. It maps bioregions and subregions across the landscape. This mapping can be cross referenced with information about protected areas, which allows progress towards a Comprehensive, Adequate and Representative reserve system to be monitored. For more information, see: http://www.environment.gov.au/parks/nrs/science/bioregion-framework/index.html
Intra-specific competition	Competition between members of the same species for the same resources, for example, competition for nutrients, water, light, space.
Invasive Native Scrub	Denotes a species that, within its natural range, (A) invades vegetation communities where it has not been known to occur previously, OR a species that regenerates densely following natural or artificial disturbance; and (B) where the invasion and/or dense regeneration of the species results in change of structure and/or composition of the vegetation community. For more information see: http://www.environment.nsw.gov.au/resources/vegetation/nvinfosheet9.pdf
ISO 14001	International environmental management systems standard.
JANIS criteria	The criteria for achieving the principles of comprehensiveness, adequacy and representativeness in Australia's reserve system developed by the Commonwealth and state governments. For more information, see: http://www.daff.gov.au/rfa/about/reserve-criteria
Lagoon	A body of comparatively shallow salt or brackish water separated from a deeper waterbody by a shallow or exposed sandbank, reef or similar feature.
Landform	A physical feature on the earth's surface. Examples of landforms include mountains, plateaus, rivers, valleys, plains and canyons.
Landscape	Comprises the visible features of an area of land, including physical elements such as landforms, living elements of flora and fauna, abstract elements like lighting and weather conditions, and human elements like human activity and the built environment.
Lidar	Stands for Light Detection and Ranging. It is an optical remote sensing technique that analyses scattered light from laser pulses to obtain information about objects some distance away from the sensor. Lidar technology can be used to measure and monitor the extent, composition, growth and health of trees and forests.
Litter dams	Accumulations of leaves, twigs, animal droppings and other organic matter deposited by water flowing over the land surface after rains. Litter dams may be temporary, or can last for up to a decade.
Macropores	Cavities in the soil which are large enough to allow surface and ground water to move through the soil without capillary effects affecting this movement. Macropores can be caused by tree roots, cracks and animals living in the soil.
Locked growth or stands	A stand condition in which individual trees within a dense stand of white cypress stop growing, but do not die. 'Growth locked' stands are the result of white cypress' capacity for prolific regeneration, combined with their inability to rapidly self-thin. 'Growth locked' stands will not produce commercial timber, and have lower biodiversity value compared to more structurally diverse stands.
Mullock heaps	Piles of mine waste and tailings.
National Environmental Significance	Matters of National Environmental Significance are those protected under the Commonwealth EPBC Act 1999. They include listed threatened species and communities, listed migratory species, Ramsar wetlands, Commonwealth marine environment, world heritage properties, national heritage places, the Great Barrier Reef Marine Park and nuclear actions.

Term	Description
National Reserve System	A network of protected areas that conserve examples of natural landscapes and native plants and animals. The national reserve system is based around being comprehensive, adequate and representative and is informed by the IBRA framework. For more information see: http://www.environment.gov.au/parks/nrs/index.html .
Natural capital	Resources and ecosystems associated with, used or accessed by a community, as well as incorporating aspects of the natural beauty or attractiveness of the community's surrounds.
Non-commercial thinning	Thinning activities where the trees removed have little or no economic value.
Occupation permit	Issued by Forests NSW to manage the use of land within a state forest. Occupation permits can be for grazing, recreation or infrastructure (towers, pipelines etc.).
Other vegetation	In the NRC's mapping of the cypress state forests, this term refers to vegetation which is not considered to represent cypress-dominant or cypress-associated woodland. This includes all non-cypress types mapped in state forests (Appendix 16), and is mainly comprised of poplar box grassy woodlands, inland grey box grassy woodlands, and black box woodlands. White cypress may be scattered through these types, but is not considered to be a common associate. It also captures areas of cleared or semi-cleared derived native grassland or low shrubland.
Overstorey	The upper level of the forest created by the crowns of trees or shrubs.
Phenological	Of or pertaining to phenology, it is the study of periodic plant and animal life cycle events and how these are influenced by seasonal and inter-annual variations in climate.
Physical capital	Relates to the built infrastructure, accessibility of information and key community services within a community, in combination with the remoteness and isolation of the community.
Playa lakes	Areas of dry land below sea level, also known as sinks, dry lakes or pans. Playa lakes are formed when rainfall temporarily fills these areas. Salt is often deposited as these lakes evaporate.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Property Vegetation Plan	Voluntary but legally binding agreements between landholders and CMAs relating to the management of native vegetation on a landholder's property, covering a period of up to 15 years. Refer to: http://www.environment.nsw.gov.au/vegetation/pvp.htm .
Quota	The ongoing allocation of sawlogs made available to a sawmill by Forests NSW.
Refugia	Refugia are biological communities or geographic entities, which, because of their moderating structural characteristics and/or physical isolation, provide a sanctuary to which species or groups of species have retreated or been confined in response to threatening processes, including climatic change.
Regional Forest Agreements	20-year plans for the conservation and sustainable management of Australia's native forests to provide certainty for forest-based industries, forest-dependent communities and conservation. See http://www.rfa.gov.au .
Regional vegetation communities	Communities of vegetation that are consistently associated with a particular combination of geology, landform, soil and climate in a bioregion.
Remnant vegetation	Vegetation remaining after an area has been cleared or modified.
Resilience	A measure of a system's capacity to cope with shocks and undergo change while retaining essentially the same structure and function.
Ringbarking	A process of completely removing a strip of bark around a tree's outer circumference, causing its death.
River catchment	The area of land drained by a creek or river system, or a place set aside for collecting water which runs off the surface of the land.
Sawlogs	A log or tree that meets minimum size and maximum defect specifications, sufficient to be sawn into boards for appearance grade or structural products.
Semi-arid	A climatic region that receives low annual rainfall (200–500 mm).
Sheep-wheat belt	Areas in central and southern NSW, Victoria and South Australia in which sheep grazing and wheat cropping are the primary land uses.
Silviculture	The art and science of controlling the establishment, growth, composition, health, and quality of forests to meet diverse needs and values of the many landowners, societies and cultures; implemented through a planned series of treatments ('silvicultural systems').

Term	Description
Social capital	Relates to the governance, networks, volunteering, participation and inter-relationships within a community. Social capital relates to the 'sense of community' within a town, and is influenced by the community's history and heritage.
Soil aggregates	Groups of soil particles bound together by organic matter; for example, bound by strands of fungi or secretions produced by soil biota.
Special purpose permit	Issued by Forests NSW for activities which take place on state forest land. These can be issued for activities such as tourism or special events.
Stand	A group of trees in a forest that can be distinguished from other groups by their age, species, composition and condition. The age of the stand refers to the mean age of the dominant and co-dominant trees in the stand.
Standing volume	The total volume of sawlogs within a stand of trees.
Stocking rates	The number of domestic animals that can be grazed on a specified area of land. The stocking rate for grazing depends on the type of animal, fertility of the land and climatic influences. This term can also refer to the number of trees per unit area of land.
Stumpage	Is the price charged by a landholder for the right to harvest timber on that land, usually charged per unit volume (for example, per cubic metre). It represents the value of the unprocessed wood, prior to harvesting or milling.
Sub-dominant plant or shrub	A species in an ecological community that has significant cover, biomass or basal area when compared to other species within the community; however is not the dominant species.
Sustainable yield	The volume of wood that a forest can produce continuously at a given intensity of management.
Tenure	A broad concept that includes ownership, tenancy and other arrangements for the use of forests.
Thermoregulate	To control and maintain body temperature within a certain acceptable range, despite variability in the surrounding temperature.
Thinning	Cutting down and (usually) removal of a proportion of trees in a forest to provide more growing space for the remaining trees, which leads to an increase in volume of the remaining individual trees.
Threatened species	Native plants and animals in danger of becoming extinct.
Threatening processes	Under the NSW <i>Threatened Species Conservation Act 1995</i> and Commonwealth EPBC Act 1999, threatening processes are things that threaten, or could potentially threaten, the continued survival or development of species, populations or ecological communities. Threatening processes can include pest animals and weeds, diseases and habitat loss or change. For more information see: http://www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcesses.htm .
Town Resource Cluster Analysis	Developed by Fenton, Coakes and Marshall (2003) and enables the identification of communities with a linkage to a resource. For example, in the current study the process was applied to determine which communities had a connection to the cypress state forests under assessment.
Travelling stock reserve	Crown reserves historically declared to provide for the movement of stock across the landscape. They also function as habitat corridors as they often contain good quality native vegetation and provide habitat for flora and fauna.
Understorey	The layer of vegetation that grows below the canopy formed by the tallest trees or plants in the forest.
Variiegated vegetation	Vegetation with discrete patches or areas that differ in appearance or colour.
Vectors	A force, influence or agent of transfer. For example, a river can act as a vector, eroding and carrying sediment from upland areas and depositing it downstream. A bee is a vector of pollination, by transferring pollen from one flower to another.
Vegetation classes	Groupings of vegetation communities based on floristic, structural and ecological features.
Vegetation mosaic	The pattern of different plant communities, or stages of the same community, in a landscape.
Western division	Is a NSW land management division, originally established under the <i>Crown Lands Act of 1884</i> .
Western Lands Lease	A contract for sustainable land management in the Western Division of NSW, under the Western Lands Act 1901.

Term	Description
White cypress	White cypress (<i>Callitris glaucophylla</i>) is a native Australian coniferous tree that commonly occurs throughout inland NSW and southern and central Queensland. The common name 'white cypress' is also sometimes used to describe the eastern coastal cypress (<i>Callitris columellaris</i>).
White cypress forest	In the NRC's mapping of the cypress state forests, this term refers to areas dominated by white cypress (<i>Callitris glaucophylla</i>).
Wood supply agreement	Legal agreement between Forests NSW, the State of NSW and a sawmilling company that specifies an agreed volume of timber that will be harvested over an agreed time period.

Appendix 6

List of submissions

Table A6.1: List of submissions received

Submissions from organisations	Submissions from individuals
1. Advanced Timber Systems Pty Limited	1. Adam Noll
2. Area Builders Supply Company	2. Barry Keaton
3. Australian Rainforest Honey Pty Limited	3. Cecile van der Burgh
4. Baradine Sawmilling Company Pty Limited	4. Claire Merritt
5. Blaxlands Ridge Transport Pty Limited	5. Daniel Grant
6. Boots Constructions Pty Limited	6. Elder Mrs Bonnie Merritt
7. Canopy Native Forest Committee (TEC)	7. Employees – Grants Sawmilling Company
8. Central West Tyre Service Pty Limited	8. Employees – NJL Packham Pty Limited
9. Charles Sturt Hotel	9. John Adams
10. Coles Hardware and Glass	10. Julian Domaracki
11. Frencham Cypress	11. Marcelle Steele
12. G and S Fabricators	12. Matt Weeks
13. General and Precision Engineering	13. Michael McKinnon
14. Gordon Logging Pty Limited	14. Neville Schrader OAM
15. Grants Holdings Company Pty Limited – 1	15. Raymond Holmes
16. Grants Holdings Company Pty Limited – 2	16. Stephen Beattie
17. GS and BD Electrics Pty Limited	17. Stephen Donelan
18. Hartwigs	18. Tammy Bugg
19. Hayllar Transport Pty Limited	19. Wayne Mathieson
20. Jack Taylor Electrical	
21. KN Partitions Pty Limited	
22. Lachlan Shire Council	
23. MBS Building Supplies	
24. MD and NK Hoare	
25. Monsons Honey and Apiary Products	
26. Moorooduc Timber and Hardware	
27. Moses and Son Woolbrokers	
28. Narrandera Bowling and Recreation Club	
29. Narrandera Football Club Inc	
30. Narrandera Rodeo Committee Inc	
31. Narrandera Shire Council	
32. National Parks Association of NSW	

Submissions from organisations	Submissions from individuals
33. NJL Packham Pty Limited	
34. Nowaste Tyre Recycling	
35. NSW Bird Atlassers Inc	
36. NSW Forest Products Association – 1	
37. NSW Forest Products Association – 2	
38. Peninsula Timber	
39. Ramiens Timber Company Pty Limited	
40. Redenbach and Carey	
41. Riverina Lift Trucks Pty Limited	
42. RJ and JR Stephenson Sawmilling Company	
43. Robinson's Department Store	
44. Scandinavian Forestry and Engineering Pty Limited	
45. Sterling Kershaw and Company	
46. Sutherlands Transport	
47. The Institute of Foresters of Australia	
48. Toomey Pegg Drevikovsky – Lawyers	
49. Twynam Agricultural Group	
50. Wagga Wagga City Council	
51. W Clark and Sons Pty Limited	
52. Whitby's Betta Electrical	

Note: In addition to the above, the NRC received four submissions that were confidential.

Appendix 7

Technical Review Panel members

Technical Review Panel members	Expertise
Professor Peter Kanowski (Panel Chair)	Forest policy and management
Mr Mark Allen	Cypress forestry and history
Ms Di Bentley	Natural resource management
Dr Matthew Colloff	Ecosystem function and resilience
Mr Rob de Fégely	Integrated forest management
Dr David Freudenberger	Landscape ecology and restoration
Mr Daryl Green	Rangeland management and administration
Dr Glen Kile	Forestry and wood product research and development
Professor Stewart Lockie	Social impact assessment and planning
Associate Professor Ian Lunt	Vegetation ecology and management
Dr Denis Saunders AM	Landscape ecology and conservation biology

Appendix 8

Institutional arrangements governing the south-western cypress state forests

A8.1 Framework at the national level

The National Forest Policy Statement (Commonwealth of Australia, 1992) guides the management of Australia's forests. The Statement outlines agreed objectives and policies for Australia's public and private forests and commits all governments to ecologically sustainable management of Australia's forests.

The Statement specifies a split in responsibilities. State governments have responsibility for forest management, local governments are responsible for land use planning and the Australian Government has responsibility for coordinating national approaches to environmental and industry development issues.

This Statement was followed by the development of Regional Forest Agreements between the Australian and some state governments. Enacted through the *Regional Forest Agreement Act 2002* (Cth), Regional Forest Agreements are 20-year plans that guide the conservation and management of native forests in 10 regions across four states. They are negotiated between governments in consultation with stakeholders. Regional Forest Agreements are seen to provide certainty for forest-based industries, forest-dependent communities and conservation. However, none of the south-western cypress state forests are covered by a Regional Forest Agreement. Regional Forest Agreements should not be confused with a NSW Forest Agreement made under the *NSW Forestry and National Park Estate Act 1998*.

The national *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also plays a role in the regulation of forestry activity. The EPBC Act is the Australian Government's key piece of environmental legislation covering environment and heritage protection and biodiversity conservation. It is administered by the Australian Government Department of Environment, Water, Heritage and the Arts.

The EPBC Act focuses on protecting matters of national environmental significance. The relevant matters of national environmental significance for this assessment are listed threatened species and ecological communities.

Under the EPBC Act, an action requires approval by the Minister for the Environment if the action has, will have or is likely to have a significant impact upon any matter of national environmental significance. The EPBC Act provides an exemption from the need for approval if the action is undertaken in accordance with a Regional Forest Agreement, except for actions undertaken in a property included in a Ramsar wetland or incidental to another action whose primary purpose does not relate to forestry.

As there is no Regional Forest Agreement for the south-western cypress state forests, the EPBC Act potentially applies to forestry operations, if they entail significant impacts on any matter of National Environmental Significance.

Australia's Strategy for the National Reserve System 2009–2030 (Commonwealth of Australia, 2009) identifies priority actions for the ongoing development of a national system of protected areas and reserves for the next 20 years. This Strategy describes the National Reserve System as the "cornerstone of (Australia's) efforts to protect terrestrial biodiversity".

The National Reserve System is made up of national parks, public reserves, Indigenous lands, reserves run by non-profit conservation organisations and ecosystems protected on private land. These protected areas are managed for conservation according to international guidelines. The Strategy's focus is to secure long-term protection for samples of all ecosystems, and the plants and animals they support. It is intended to complement other measures to achieve conservation and sustainable use of biodiversity across the landscape.

The National Strategy for the Conservation of Australia's Biological Diversity (DEST, 1996), fulfils Australia's obligations as a party to the United Nations Convention on Biological Diversity. A review of this Strategy is being conducted by the Natural Resource Management Ministerial Council and a new strategy is expected to be released in 2010.

The National Framework for the Management and Monitoring of Australia's Native Vegetation (NRMMC & DEH, 2001) outlines a coordinated national approach to native vegetation management. This Framework is currently being reviewed, and a new framework is expected to be released in late 2010 or early 2011.

A8.2 Framework at the state level

South-western cypress state forests are also guided by several NSW state policies and legislative instruments.

Legislation

State forests in NSW are managed under the *Forestry Act 1916* (*Forestry Act*), developed to consolidate and amend the law in NSW relating to forestry and to provide for the dedication, reservation, control and use of state forests, timber reserves and other Crown timber lands.

In addition, the *Forestry and National Park Estate Act 1998* (FNPE Act) applies to all forestry areas within the state (excluding plantations), including Regional Forest Agreement areas. It provides a legal basis for the making of NSW Forest Agreements and for environmental assessment of forest areas prior to undertaking forestry operations. The FNPE Act's main objectives are to:

- make provision with respect to forestry operations and the national park estate following regional resource and conservation assessments
- transfer certain state forest and Crown lands to the national park estate or Indigenous ownership
- provide for Ministerial agreements and a system of integrated approvals for future forestry operations.

NSW Forest Agreements are NSW Government documents setting out agreements between various NSW Ministers under the FNPE Act, and differ from the Australian Government's Regional Forest Agreements outlined earlier. NSW Forest Agreements outline various NSW agency obligations, tasks and undertakings or milestones. Regional Forest Agreements milestones may also be mirrored in NSW Forest Agreements.

Where land is covered by a NSW Forest Agreement, both the FNPE Act and the Forestry Act apply. Where no agreement exists, only the Forestry Act applies.

Some forestry operations are subject to approvals under the NSW *Environmental Planning and Assessment Act 1979* (EPA Act). However, the EPA Act does not apply to forestry operations approved under the FNPE Act. Forestry activities in an area zoned for that use in a local environment plan do not require consent under Part 4 of the EPA Act (as guided by the Standard Instrument – Principal Local Environment Plan). Such activities do however require environmental assessment under Part 5 or Part 3A of the EPA Act. Under Part 5, a public authority may be both the proponent and determining authority. Under Part 5, if it is determined that the activity is likely to have a significant effect on the environment, an environmental impact statement must be prepared in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulations 2000*, publicly exhibited. The Minister for Planning determines whether proposals are of state or regional planning significance and to which Part 3A applies. Under Part 3A, environmental impact assessment is not prescribed but rather customised for each proposal by the Director-General's requirements.

Forests in NSW national parks are managed under the *National Parks and Wildlife Act 1974*.

State Plan

The NSW Government's State Plan (NSW Government, 2009) includes commitments to meeting state-wide targets for natural resources management. Natural resources management priorities include:

- increasing the extent and improving the condition of native vegetation and habitats
- continuing to build a 'comprehensive, adequate and Representative' reserve system, based on national parks and reserves as the core biodiversity conservation mechanism, as well as other public and private land conservation
- developing incentives to help farmers be sustainable stewards of their land as well as successful producers
- securing water entitlements to protect iconic wetlands in the Lachlan, Murrumbidgee and Murray valleys, and sustain river ecosystems
- managing fires, weeds, and pest species through sustainable fire management, improved fire ecology science and tackling priority threats such as introduced weeds and pests

- introducing a new biodiversity strategy to protect threatened native species and ecosystems and address the impacts of climate change
- providing greater opportunities for Indigenous people to take part in management of Country, including joint management of national parks
- increasing the number of visits to state government parks by 20 per cent by 2016.

Forestry policies

The regulatory regime for forestry policies encompasses approvals and licences issued pursuant to Commonwealth and NSW environmental legislation.

Forests NSW prepare Ecologically Sustainable Forest Management plans (ESFM plans) that guide forest management for each of the eight Forests NSW regions.¹ ESFM plans provide the strategic framework for managing planted and native forests over a five-year period. They include broad strategies, performance indicators and measurable outcomes for forest management. The majority of south-western cypress state forests are in the region covered by the Western ESFM Plan, however some forests lie within the Riverina ESFM Plan or Southern ESFM Plan areas.

In areas where a NSW Forest Agreement has been created, an Integrated Forestry Operations Approval under the FNPE Act is issued. This Approval sets out the terms and conditions under which logging may occur. There are currently four Integrated Forestry Operations Approvals in NSW. The Upper North East, Lower North East, and Eden Integrated Forestry Operations Approvals commenced on 1 January 2000 and another for the Southern Region commenced on 13 May 2002. An Integrated Forestry Operations Approval for the Brigalow and Nandewar Community Conservation Area is currently being developed. Currently, there is no Integrated Forestry Operations Approval in place or in development for the south-western cypress state forests.

Conservation policies

Management of forest ecosystems will also be influenced by the NSW Biodiversity Strategy when this is finalised. Development of this Strategy is a requirement of the *Threatened Species Conservation Act 1995*. The new strategy will encompass terrestrial, aquatic and marine biodiversity and will aim to meet the NSW Government obligations under the National Strategy for the Conservation of Australia's Biological Diversity. The discussion paper on the new Biodiversity Strategy for NSW identifies a number of goals, principles and objectives for inclusion in the Strategy (NSW Government, 2008). It adopts the NSW natural resource management targets for 2015 and proposes a 20-year strategic goal for widespread biodiversity recovery and increasing landscape connectivity, with the involvement of the whole community. It also proposes a 100-year vision of minimising the effects of climate change on biodiversity so that ecological change does not equate to loss of diversity.

¹ North East, Central, Southern and Western native forest regions and Northern, Hume, Macquarie and Monaro planted forest regions.

The National Parks and Wildlife Service within the Department of Environment, Climate Change and Water released a NSW National Parks Establishment Plan 2008 (NPWS, 2008). The Plan states:

To conserve the full diversity of this state's landscapes, fauna and flora and to protect places of important Indigenous and non-Indigenous cultural heritage, more parks and reserves are needed. Furthermore, many existing reserves require augmentation to improve their size and configuration in order to better buffer and manage the values they were established to protect. To this end, the NSW Government is committed to the long-term objective of building a fully comprehensive, adequate and representative reserve system and providing increased opportunities for public nature-based recreation in a more diverse range of environments across NSW.

The Plan also “acknowledges that the establishment and management of DECC public reserves alone cannot ensure the achievement of healthy and sustainable landscapes, and that this can only occur through a broad range of conservation activities across the whole landscape on both public and private land”.

Land-use planning policies

Regional strategies are the key instruments for managing and integrating development and guiding land-use planning in NSW. These strategies consider issues such as service and infrastructure delivery, environmental sustainability, housing demand and economic development. They provide the broader context within which local strategies are formulated.

Although not statutory plans, regional strategies are given statutory force through the Local Planning Directions No. 30 – Implementation of Regional Strategies under s 117(2) of the EPA Act. This direction gives legal effect to the vision, land-use strategy, policies, outcomes and actions contained in regional strategies. Draft local environment plans prepared by local councils must be consistent with regional strategies.

A8.3 Organisational framework

A8.3.1 Roles and responsibilities of Australian Government agencies

There are two main Australian Government agencies with responsibilities across the south-western cypress state forests.

The Department of Environment, Water, Heritage and the Arts:

- develops and implements national policy, programs and legislation to protect and conserve Australia's environment and heritage
- administers the EPBC Act.

The Department of Agriculture, Fisheries and Forestry:

- develops and implements policy, programs and legislation for sustainable forestry (among other things)
- oversees the implementation of the 1992 National Forest Policy Statement

- supports research and innovation in the forestry industry and has provided innovation funding to support the production of higher-value products.

Many cross-jurisdictional matters are managed through the Natural Resource Management Ministerial Council (NRMMC). The NRMMC is the peak government forum for consultation, coordination and, where appropriate, integration of action by governments on natural resource management issues, particularly those issues related to conservation reserve estate and environmental outcomes. In addition, the Primary Industries Ministerial Council is also a relevant forum, particularly for social and economic issues surrounding natural resource management.

A8.3.2 Roles and responsibilities of NSW Government agencies

There are a number of NSW Government agencies with responsibilities across the south-western cypress state forests. **Table A8.1** lists these agencies and describes their responsibilities in relation to forest management.

Table A8.1: Responsibilities of NSW Government agencies in forest management

Agency	Responsibility
Forests NSW	<ul style="list-style-type: none"> Manages (and proponent of) forestry activities on Crown timber land in NSW, as regulated by the <i>Forestry Act 1916</i> and the <i>Forestry and National Park Estate Act 1998</i> Manages licensing mills and harvest contractors, and providing allocations of timber volumes to mills Manages state forests for commercial, ecological and social objectives Prepares and implements ecological sustainable forest management plans to meet multiple objectives, including prescriptions to minimise the environmental impact of harvesting and biodiversity management.
Department of Environment, Climate Change and Water	<ul style="list-style-type: none"> Regulates activities that may impact upon the natural environment under a range of legislation Undertakes biodiversity management planning to provide information and coordinated action for the conservation of the natural environment of NSW Manages lands vested in the Minister of Environment, including national parks, nature reserves, regional parks and state conservation areas Approves Property Vegetation Plans (PVPs) to harvest timber from private lands.
Catchment Management Authorities	<ul style="list-style-type: none"> Delivers NSW and Australian Government's natural resource management (NRM) investment through Catchment Action Plans Invests in native vegetation (among other things) for rehabilitation, biodiversity conservation, water quality and bank stability. Approves PVPs under the <i>NSW Native Vegetation Act 2003</i>.
Land and Property Management Authority	<ul style="list-style-type: none"> Manages state-owned lands in NSW, over a total area of approximately 12.7 million hectares, including Western Lands Leases, travelling stock reserves and state parks.
NSW Department of Planning	<ul style="list-style-type: none"> Establishes land-use planning policy that guides development either directly or through local government land-use planning schemes Develops regional strategies that represent the NSW Government's priorities for managing a region's growth over the next 25 years Consent authority for developments of state significance under Part 3A of the <i>Environmental Planning and Assessment Act 1979</i>.

A8.3.3 Roles and responsibilities of local government

Local governments are responsible for managing public land under the *Local Government Act 1993* and often manage Crown land in trust. Local government works with statutory agencies to protect landscape function. Depending on the local government policies, they also manage issues of timber removal and weed control for land under local government control (an obligation under the *Noxious Weeds Act 1993*).

Local governments have the primary responsibility for determining land-use configurations and controls through local environment plans. They employ a variety of planning tools, such as zonings and development control plans, to achieve stated environmental outcomes. Local governments are also responsible for assessing development proposals on private land, against established controls.

A8.4 Management arrangements for public land tenures

Along with south-western cypress state forests, white cypress forests are found across a diverse range of tenures on Crown land that is owned and managed by the state government.

This section describes different public land-use categories and the management arrangements associated with each.

A8.4.1 Crown land

Crown land is owned and managed by the state government. It accounts for over half of all land in NSW and includes:

- Crown lands held under lease, licence or permit
- community-managed reserves
- lands retained in public ownership for environmental purposes

- lands within the Crown public roads network
- other unallocated lands.

Crown timber land includes state forests, and Crown land leased or sold to private owners for which the government retains the right to take timber. Forestry activities on Crown land must be in accordance with relevant environmental legislation.

Crown lands managed by the Land and Property Management Authority are different to other forms of Crown or state-owned lands such as national parks, state forests and Rail Corporation property.

A8.4.2 State forests

Forestry on Crown timber land is regulated primarily by the Forestry Act and the FNPE Act. Where land is covered by a Forest Agreement, both the FNPE Act and the Forestry Act apply. Where no agreement exists, only the Forestry Act applies.

Forests NSW uses five-year strategic plans to identify the policies, objectives and targets for the south-western cypress state forests. The plans also describe how values will be

managed, compliance with regulatory regimes and how ecological sustainability in forest-based activities—including timber production—will be achieved.

The silvicultural systems and management practices applied in cypress forests have evolved as a result of experience and research since formal forest management began in the region. Within this context, and subject to other environmental and economic constraints, Forests NSW has developed a range of silvicultural systems and management prescriptions to meet quota sawlog commitments, promote growth and regeneration of the stand remaining after harvesting and reduce impacts, and promote environmental values (Forests NSW, 2008a; 2008b; 2008c).

Management for multiple objectives is achieved through Forest Management Zoning. Forest Management Zoning is a land classification system which sets out in map format the way Forests NSW intends to manage forest areas (**Table A8.2**). Through Forest Management Zoning, a protected area network comprising dedicated reserves and informal reserves can be created.

Table A8.2: State Forest Management Zones (State Forests of NSW, 1999)

Zone type	Management principles
Special Protection (Zone 1)	Management to maximise protection of very high natural and cultural conservation values.
Special Management (Zone 2)	Specific management and protection of natural and cultural conservation values, where it is not possible or practicable to include them in Zone 1.
Harvesting Exclusion and Special Prescription (Zone 3)	Management for conservation of identified values and/or forest ecosystems and their natural processes, while also facilitating other management and production activities.
General Management (Zone 4)	Management of native forests for timber production, utilising the full range of silvicultural options as appropriate, and for conservation of broad area habitat and environmental values that are not dependant on the structure of the forest.
Hardwood Plantation (Zone 5)	Management of hardwood plantations to maximise sustainable timber production on a continuing and cyclical basis.
Softwood Plantation (Zone 6)	Management of softwood plantations to maximise sustainable timber production on a continuing and cyclical basis.
Non-Forestry Use (Zone 7)	Management of cleared (non-forested) areas, such as those used for special developments.
Areas for Further Assessment (Zone 8)	An interim zoning of areas where field investigation is required to determine final Forest Management Zoning.

A8.4.3 National parks

Under the *National Parks and Wildlife Act 1974*, the Director-General of the Department of Environment, Climate Change and Water is responsible for the care, control and management of the National Parks Estate. This includes all national parks, historic sites, nature reserves, reserves, Aboriginal areas, state game reserves, state conservation areas, karst conservation reserves and regional parks.

The Act establishes the management principles for each type of reserve (summarised in **Table A8.3**). Different categories of reserves accommodate a variety of uses.

DECCW prepares plans of management for reserves in consultation with park users and the community. A plan of management outlines how a reserve will be managed. It sets out the values of the area, its management objectives and management strategies.

Table A8.3: National Parks Estate reserve types

Reserve type	Purpose
National parks	<ul style="list-style-type: none"> Identify, protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features, or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor use and enjoyment.
Nature reserves	<ul style="list-style-type: none"> Identify, protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.
State conservation areas	<ul style="list-style-type: none"> Identify, protect and conserve areas that: <ul style="list-style-type: none"> - contain significant or representative ecosystems, landforms or natural phenomena or places of cultural significance - are capable of providing opportunities for sustainable visitor use and enjoyment, the sustainable use of buildings and structures or research - are capable of providing opportunities for uses permitted under other provisions of the <i>National Parks and Wildlife Act 1974</i> in such areas, including uses permitted under section 47J of the Act (provisions relating to mining). These areas often contain important natural environments, which have been set aside for conservation, public enjoyment and potential mineral exploration.
Regional parks	<ul style="list-style-type: none"> Identify, protect and conserve areas in a natural or modified landscape that are suitable for public recreation and enjoyment.
Aboriginal areas	<ul style="list-style-type: none"> Identify, protect and conserve areas associated with a person, event or historical theme, or containing a building, place, object, feature or landscape: <ul style="list-style-type: none"> - of natural or cultural significance to Aboriginal people - of importance in improving public understanding of Aboriginal culture and its development and transitions.
Historic sites	<ul style="list-style-type: none"> Identify, protect and conserve areas associated with a person, event or historical theme, or containing a building, place, feature or landscape of cultural significance.

A8.4.4 Western Lands Leases

The western division of NSW makes up 42 per cent of NSW. It lies west of a line from Mungindi on the Queensland border to Balranald on the Victorian border.

Nearly all the land in the western division is held under Western Lands Leases granted under the *Western Lands Act 1901*. The purpose of this Act is to ensure the appropriate management of the semi-arid rangelands.

Each Western Lands Lease has conditions to ensure the land is managed sustainably. The conditions require that land must not be overgrazed, and that approvals must be obtained to cultivate land and to subdivide or transfer the lease. The Western Lands Commissioner has the power to impose notices on leaseholders to destock areas, refrain from certain activities, or rehabilitate damaged or degraded areas.

Western Lands Leases are bought and sold in the same way as freehold property. However, when people buy leases they are only buying the improvements on the lease and the right to lease the land. Leaseholders do not have the right to exploit the fisheries, mineral or forestry resources on the land. These rights are retained by the Crown though the leaseholder may be paid a royalty if these resources are utilised.

A8.4.5 Travelling stock reserves

The majority of travelling stock reserves are in the central and western divisions of NSW. They are Crown reserves historically formed to provide for the movement of stock across the landscape. They are used as emergency refuge for stock during floods and drought, as well as for local agistment. They can also provide opportunities for recreation, particularly where these reserves include watercourses.

Travelling stock reserves often contain good-quality native vegetation and therefore can function as habitat corridors for flora and fauna. They can contain white cypress woodlands.

Travelling stock reserves are managed by Livestock Health and Pest Authorities. Forests NSW requires the consent of the responsible Livestock Health and Pest Authority before it issues any licence to cut or remove timber on a controlled travelling stock reserve.

A8.4.6 Crown reserve trusts

The Crown reserve system promotes the cooperative care, control and management of Crown reserves by the community, with assistance from government agencies. Multiple uses of reserves are encouraged, where those uses are consistent with the purpose of the reserve.

A government order or notification of reservation or dedication of a reserve sets out the purposes for which that reserve may be used. The use of a reserve must be consistent with or support the purposes stated in the reservation or dedication. The *Crown Lands Regulation 2006* also lists various additional purposes for which reserves can be used under temporary licences.

A Crown reserve trust is a corporation established under the *Crown Lands Act 1989* to manage a Crown reserve. It is not a department of government. A trust is responsible – under the oversight of the Minister – for the care, control and management of a specific Crown reserve. Reserve trusts are not conducted for private profit.

Trusts can be managed by a community or local organisation, a local council, Ministerial Corporation, community trust board or an administrator. A reserve trust can enter into maintenance contracts, determine the development of the land (subject to Crown consent), set entry fees and employ people to work for it. The Land and Property Management Authority provides each trust with operational support, financial assistance and guidance.

A8.4.7 Local government reserve

All local government public land must be classified by council as either community or operational land according to the *Local Government Act 1993*. Operational land has no special restrictions other than those that may apply to any piece of land. Classification as community land reflects the importance of the land to the community because of its use or special features.

Community land is generally intended for public access and use. Community land must be categorised (for example, as a sportsground or natural area). All current and intended uses of the land must comply with the core objectives of the category assigned to that area of land.

A8.5 Management arrangements for private land

Vegetation management on private land in non-urban areas is primarily governed by the *Native Vegetation Act 2003*. Under the Act it is an offence to clear native vegetation unless it is approved, permitted or excluded. Clearing of remnant native vegetation or protected regrowth will only be approved if management actions improve or maintain environmental outcomes overall.

The NSW Government holds the rights to the control, use and flow of all water in rivers, lakes and aquifers and water that occurs naturally on or below the surface of land. Landholders have the right to extract and use water for some purposes without permission from the government, but in other circumstances landholders may need to obtain permission. The NSW Office of Water is responsible for granting water access licences and water-use approvals.

A8.5.1 Private native forestry

Private native forestry is the sustainable logging of native vegetation on private property. Following changes to the *Native Vegetation Act 2003*, harvesting of timber for the purposes of private native forestry requires approval through a private native forestry PVP.

A8.5.2 Conservation on private land

There are a number of programs through which landholders can voluntarily conserve areas of ecological value on their property. Programs range from non-binding, temporary agreements to binding agreements that are attached in perpetuity to the title of the land. Such agreements may require landholders to carry out particular actions to improve the ecological value of the land, or may impose restrictions on use of the land.

In-perpetuity programs include voluntary conservation agreements under the *National Parks and Wildlife Act 1974*, and Conservation Agreements under the *Nature Conservation Trust Act 2001*. The NSW Nature Conservation Trust uses a revolving fund to purchase high-conservation-value land, protect these values through an in-perpetuity agreement and resell the property so that the money can be revolved to purchase other properties of high conservation value.

Private in-perpetuity conservation covenanted land should also meet the criteria to be included in the national reserve system.

Appendix 9

All vegetation types found in assessment area

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
1. VCA 283: Apple Box – Blakelys Red Gum moist valley and footslopes grass-forb open forest of the NSW South-western Slopes bioregions	-	-	-
2. VCA 305: Apple Box – Broad-leaved Peppermint – Red Stringybark shrubby hill open forest in the upper NSW South-western Slopes bioregion and adjacent South Eastern Highlands bioregion	-	-	-
3. VCA 298: Apple Box – Nortons Box – Blakelys Red Gum valley flat moist grassy tall open forest in the southern NSW South-western Slopes and adjoining South East Highlands bioregions	-	-	-
4. VCA 314: Apple Box – Red Stringybark basalt scree open forest in the upper Murray River region	-	-	-
5. VCA 337: Apple Box – Silver Banksia – Drooping Sheoak open woodland – tall shrubland in protected gullies of the Coolac – Tumut serpentinite belt, NSW South-western Slopes bioregion.	-	-	-
6. VCA 344: Argyle Apple – <i>Acacia mearnsii</i> valley open forest of the Yass – Rye Park region of the South Eastern Highlands and adjoining NSW South western Slopes bioregions	-	-	-
7. VCA 55: Belah woodland on alluvial plains and low rises in the central NSW wheatbelt	-	-	-
8. VCA 59: Belah/Black Oak – Western Rosewood – Leopardwood low open woodland on sandplain and sandy flats in semi-arid (hot) and arid climate zones	-	-	-
9. VCA 57: Belah/Black Oak – Western Rosewood – Wilga woodland of central NSW including the Cobar Peneplain bioregion	-	•	-
10. VCA 357: <i>Beyeria</i> – Mintbush – Tumbledown Red Gum shrubland – low woodland on conglomerate outcrops in the Wellington region, NSW Central western slopes	-	-	-
11. VCA 153: Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	-	-	-
12. VCA 13: Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina and Murray Darling Depression bioregions)	-	•	-
13. VCA 16: Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (mainly Riverina and Murray Darling Depression bioregions)	-	•	-
14. VCA 15: Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina and Murray Darling Depression bioregions)	-	•	-
15. VCA 37: Black Box woodland wetland on NSW central and northern floodplains including the DRP and BBS bioregions.	-	-	Listed TSC Act (E)
16. VCA 309: Black Cypress Pine – Red Stringybark – Red gum – Box low open forest on siliceous rocky outcrops in the NSW South-western Slopes bioregion	-	-	Nominated EPBC Act
17. VCA 58: Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray-Darling Depression	-	-	-
18. VCA 216: Black Roly Poly low open shrubland of the Riverina and Murray-Darling Depression bioregions	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
19. VCA 303: Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South-western Slopes bioregion and western South Eastern Highlands bioregion	-	-	-
20. VCA 195: Bladder Saltbush chenopod shrubland on alluvial plains mainly in the Darling Riverine Plain bioregion	-	-	Nominated TSC Act
21. VCA 157: Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina bioregion	-	•	-
22. VCA 280: Blakelys Red Gum – Long-leaved Box – Red Stringybark shrub/grass hill woodland of the NSW South-western Slopes bioregion	-	•	-
23. VCA 341: Blakelys Red Gum – Red Box – Black Cypress Pine grass–shrub woodland on hills in the upper slopes sub-region of the NSW South-western Slopes and western South Eastern Highlands bioregions	-	-	-
24. VCA 338: Blakelys Red Gum – Red Stringybark – Long-leaved Box woodland on Wyangala granite in the NSW South-western Slopes bioregion	-	-	-
25. VCA 282: Blakelys Red Gum – White Box – Yellow Box – Black Cypress Pine box grass–shrub woodland on clay loam soils on undulating hills of central NSW South-western Slopes bioregion	-	-	-
26. VCA 279: Blakelys Red Gum – White Cypress Pine woodland on footslopes of hills in central part of the NSW South-western Slopes bioregion	•	•	Listed TSC Act (E) Listed EPBC Act (CE)
27. VCA 277: Blakelys Red Gum – Yellow Box grassy tall woodland of the NSW South-western Slopes bioregion	-	•	Listed TSC Act (E) Listed EPBC Act (CE)
28. VCA 356: Blakelys Red Gum – Dirty Gum – White Cypress Pine tall woodland lining sandy watercourses in the NSW South-western Slopes bioregion	•	-	Listed TSC Act (E) Listed EPBC Act (CE)
29. VCA 177: Blue Mallee – Bull Mallee – Green Mallee very tall mallee shrubland of the West Wyalong region, NSW South-western Slopes bioregion	-	-	-
30. VCA 325: Blue-leaved Stringybark open forest of the Mudgee region NSW Central-western Slopes	-	-	Prel. listing TSC Act
31. VCA 333: Bottlebrush riparian shrubland wetland of the northern NSW South-western Slopes and southern BBS bioregions	-	-	-
32. VCA 35: Brigalow – Belah open forest or woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South bioregion	-	-	-
33. VCA 629: Brigalow – Bladder Saltbush open woodland to tall open shrubland in the Come-By-Chance region, DRP and BBS bioregions	-	-	Listed TSC Act (E)
34. VCA 29: Brigalow open woodland on clay soils in the Nyngan-Bourke-Enngonia regions of the NSW north-western plains	-	-	Listed EPBC Act (E)
35. VCA 313: Brittle Gum – Broad-leaved Peppermint open forest with tall dense shrub understorey on riparian coarse grained granitic soils in the South-western Slopes bioregion	-	-	Listed TSC Act (E)
36. VCA 296: Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South-western Slopes bioregion	-	-	Listed EPBC Act (E)
37. VCA 478: Broad-leaved Ironbark – Black Cypress Pine – Stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong – Mendooran region, southern BBS bioregion	-	-	Listed TSC Act (E)

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
38. VCA 297: Broad-leaved Peppermint – Nortons Box – Red Stringybark tall open forest on red clay on hills in the southern part of the NSW South-western Slopes bioregion	-	-	Listed EPBC Act (E)
39. VCA 285: Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South-western Slopes and adjoining South Eastern Highlands bioregions	-	-	-
40. VCA 178: Broombush – Green Mallee – Blue Mallee very tall shrubland on stony rises in the NSW South-western Slopes bioregion	-	-	-
41. VCA 142: Broombush shrubland in the mallee landscapes of the temperate and semi-arid (warm) climate zones	-	-	-
42. VCA 375: Budda Pea – Channel Millet ephemeral reedland wetland on floodplains in north-western NSW	-	-	-
43. VCA 355: Bull Mallee – White Mallee tall mallee woodland on red sandy loam soils in the Central western Slopes of NSW	-	-	-
44. VCA 20: Buloke – Moonah – Black Box open woodland on sandy rises of semi-arid (warm) climate zone (mainly Riverina and Murray Darling Depression bioregions)	-	-	Prelim. listing TSC Act
45. VCA 54: Buloke – White Cypress Pine woodland in the NSW South-western Slopes bioregion	•	•	-
46. VCA 304: Candlebark – Apple Box – Narrow-leaved Peppermint tall open forest on granite in the Tumbarumba region of the South East Highlands and upper NSW South-western Slopes bioregions	-	-	-
47. VCA 350: Candlebark – Blakelys Red Gum – Long-leaved Box grassy woodland in the Rye Park to Yass region of the NSW South-western Slopes and South-Eastern Highland bioregions	-	-	Prelim. listing TSC Act
48. VCA 24: Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	-	•	Listed TSC Act (E) Listed EPBC Act (E)
49. VCA 71: Carbeen – White Cypress Pine – River Red Gum – bloodwood tall woodland on sandy loam alluvial and aeolian soils in the northern BBS and DRP bioregions	•	-	-
50. VCA 628: Carbeen +/- Coolabah grassy woodland on floodplain clay loam soil on north-western NSW floodplains, mainly Darling Riverine Plain bioregion	-	-	Nominated TSC Act
51. VCA 212: Chenopod low open shrubland – ephemeral partly derived forbland saline wetland on occasionally flooded pale clay scalds in the NSW North Western Plains	-	-	Nominated TSC Act
52. VCA 170: Chenopod sandplain mallee woodland–shrubland of the arid and semi-arid (warm) zones	-	-	-
53. VCA 181: Common Reed – Bushy Groundsel aquatic tall reedland grassland wetland of inland river systems	-	-	Listed TSC Act, (E)
54. VCA 39: Coolabah – River Coobah – Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains bioregion	-	-	Listed TSC Act, (E)

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
55. VCA 40: Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains	-	-	-
56. VCA 164: Cotton Bush open shrubland of the semi-arid (warm) zone	-	•	-
57. VCA 50: Couch Grass grassland wetland on river banks and floodplains of inland river systems	-	-	-
58. VCA 182: Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses	-	-	Listed TSC Act Nominated EPBC Act
59. VCA 46: Curly Windmill Grass – Speargrass – Wallaby Grass grassland on alluvial clay and loam on the Hay Plain, Riverina bioregion	-	-	Listed TSC Act Nominated EPBC Act
60. VCA 317: Currawang very tall shrubland on siliceous rocky ridges and cliffs mainly in the NSW South-western Slopes bioregion	-	-	-
61. VCA 19: Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains	•	•	-
62. VCA 168: Derived Copperburr shrubland of the NSW northern inland alluvial floodplains	-	-	-
63. VCA 165: Derived corkscrew grass grassland/forbland on sandplains and plains in the semi-arid (warm) climate zone	-	-	Nominated EPBC Act
64. VCA 236: Derived Giant Redburr low shrubland on alluvial plains of the semi-arid (warm) climate zone	-	-	-
65. VCA 229: Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain bioregion	-	-	Listed TSC Act Nominated EPBC Act
66. VCA 250: Derived tussock grassland of the central western plains and lower slopes of NSW	-	•	-
67. VCA 100: Desert Bloodwood – Mulga low woodland of the semi-arid plains	-	-	-
68. VCA 138: Desert Paperbark shrubland wetland of semi-arid and arid climate zone watercourses.	-	-	-
69. VCA 163: Dillon Bush (Nitrate Bush) shrubland of the semi-arid and arid zones	-	-	-
70. VCA 206: Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plain and BBS bioregions	•	-	-
71. VCA 166: Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
72. VCA 301: Drooping Sheoake – <i>Ricinocarpus bowmannii</i> – grasstree tall open shrubland of the Coolac – Tumut Serpentine Belt	-	-	-
73. VCA 186: Dwyers Red Gum – Black Cypress Pine – Currawang shrubby low woodland on rocky hills mainly in the NSW South-western Slopes bioregion	-	•	-
74. VCA 257: Dwyers Red Gum – Currawang grassy low woodland of the central western plains of NSW	-	-	-
75. VCA 188: Dwyers Red Gum – Quinine Tree open woodland on igneous intrusive hills of the Macquarie River floodplain (NSW)	-	-	-
76. VCA 184: Dwyers Red Gum – White Cypress Pine – Currawang low shrub-grass woodland of the Cobar Peneplain bioregion	•	•	-
77. VCA 185: Dwyers Red Gum – White Cypress Pine – Currawang shrubby woodland mainly in the NSW South-western Slopes bioregion	•	•	-
78. VCA 307: Eurabbie – Robertson’s Peppermint very tall, fern open forest of gullies and sheltered hillslopes in the southern most part of the NSW South-western Slopes bioregion	-	-	-
79. VCA 115: Eurah shrubland of inland floodplains	-	-	-
80. VCA 44: Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina bioregion	-	-	-
81. VCA 201: Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South-western Slopes bioregion	-	•	-
82. VCA 466: Galvanised Burr derived low shrubland of the BBS and DRP bioregions	-	-	-
83. VCA 118: Gidgee chenopod woodland on red-brown clays in the semi-arid (hot) climate zone mainly in the Mulga Lands bioregion.	-	-	-
84. VCA 360: Gilgai wetland mosaic in the southern NSW South-western Slopes bioregion	-	-	Nominated EPBC Act
85. VCA 161: Golden Goosefoot shrubland wetland in swamps of the arid and semi-arid (hot summer) zones	-	-	Listed TSC Act
86. VCA 176: Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain bioregion	•	•	-
87. VCA 218: Grey Mallee – Mulga shrubland of the north-western Cobar Peneplain bioregion	-	-	-
88. VCA 180: Grey Mallee – White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain bioregion	•	•	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
89. VCA 258: Gum Coolabah – Mugga Ironbark – White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain bioregion and central NSW South-western slopes bioregion	•	-	-
90. VCA 108: Gum Coolabah – Mulga open woodland on gravel ridges of the Cobar Peneplain bioregion	-	-	-
91. VCA 104: Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain bioregion	•	•	-
92. VCA 253: Gypseous shrubland on rises in the semi-arid and arid plains	-	-	-
93. VCA 275: Herbaceous White Box – Apple Box valley woodland of the NSW Central western Slopes	-	-	-
94. VCA 130: Horse Mulga – Umbrella Mulga shrubland on ranges in the arid and semi-arid climate zones	-	-	-
95. VCA 110: Inland Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South western Slopes and Riverina bioregions	-	•	-
96. VCA 82: Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain bioregion	•	-	-
97. VCA 80: Inland Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South-western Slopes and Riverina bioregions	•	•	Listed TSC Act (E) Listed EPBC Act (CE)
98. VCA 76: Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina bioregions	-	•	-
99. VCA 291: Inland Scribbly Gum – Black Cypress Pine – Mugga Ironbark – Daphne Heath low woodland of the Wagga Wagga region in the southern NSW South-western Slopes bioregion	-	-	Listed TSC Act (E)
100. VCA 327: Inland Scribbly Gum – Black Cypress Pine – Red Ironbark open forest of the NSW Central western Slopes	-	-	Listed EPBC Act (E)
101. VCA 477: Inland Scribbly Gum – Red Stringybark – Black Cypress Pine – Broad-leaved Ironbark open forest on sandstone hills in the southern BBS and northern NSW SWS bioregions	-	-	Listed TSC Act (E)
102. VCA 322: Inland Scribbly Gum – Red Stringybark – Black Cypress Pine hillslope shrub-tussock grass open forest on mainly sandstone ranges in the NSW Central western Slopes	-	-	Listed EPBC Act (E)
103. VCA 353: Inland Scribbly Gum – Red Stringybark – Box – <i>Daviesia latifolia</i> – Snow Grass open forest on sandy loam soils from acid volcanics in the Boorowa – Young region of the NSW South-western Slopes bioregion	-	-	Listed TSC Act (E)
104. VCA 349: Inland Scribbly Gum – Red Stringybark open forest on hills composed of siliceous substrates in the mid-Murrumbidgee and upper Lachlan catchments mainly in the western South Eastern Highlands bioregion	-	-	Listed EPBC Act (E)

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
105. VCA 324: Inland Scribbly Gum grassy open forest on hills in the Mudgee Region, NSW Central-western Slopes	-	-	Listed TSC Act (E)
106. VCA 134: Ironwood woodland of the semi-arid plains	•	-	Listed EPBC Act (E)
107. VCA 320: Kangaroo Grass – Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW SWS and SEH bioregions	-	-	-
108. VCA 144: Leopardwood low woodland mainly on clayey soils in the semi-arid zone	-	-	-
109. VCA 17: Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina and Murray Darling Depression bioregions)	-	•	-
110. VCA 247: Lignum shrubland wetland on regularly flooded alluvial depressions in the Brigalow Belt South and Darling Riverine Plains bioregions	-	-	-
111. VCA 288: Long-leaved Box – Black Cypress Pine granitic hillcrest shrubby open forest of the upper Murray Valley region, NSW South-western Slopes bioregion	-	-	-
112. VCA 287: Long-leaved Box – Red Box – Red Stringybark mixed open forest on hills and hillslopes in the NSW South-western Slopes bioregion	-	-	-
113. VCA 326: Long-leaved Box – Red Box grass-shrub open forest on hillslopes in the Mudgee Region, NSW Central-western Slopes	-	-	-
114. VCA 174: Mallee – Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain bioregion	-	-	-
115. VCA 190: Mallee Box open woodland mainly in the Murray Darling Depression bioregion	-	-	Nominated EPBC Act
116. VCA 205: Marsh Club-rush wetland very tall sedgeland of inland watercourses	-	-	-
117. VCA 43: Mitchell Grass grassland – chenopod low open shrubland on floodplains in the semi-arid (hot) and arid zones	-	-	-
118. VCA 248: Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW	-	-	-
119. VCA 251: Mixed Eucalypt woodlands of floodplains in the southern-eastern Cobar Peneplain bioregion	-	-	-
120. VCA 376: Mixed scrub low open woodland on sand rises and dunes on floodplains in the DRP and BBS bioregions	-	-	-
121. VCA 330: Mugga Ironbark – Black Cypress Pine – Red Stringybark – Blakelys Red Gum – Red Ironbark woodland on hillslopes and in valleys on ranges in the NSW Central western Slopes	-	•	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
122. VCA 255: Mugga Ironbark – Buloke – Pilliga Box – White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South bioregion	•	-	-
123. VCA 217: Mugga Ironbark – Inland Grey Box – Cypress Pine tall woodland on footslopes of low hills in the NSW South-western Slopes bioregion	-	•	-
124. VCA 289: Mugga Ironbark – Inland Scribbly Gum – Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South-western Slopes bioregion	-	-	Nominated TSC Act
125. VCA 342: Mugga Ironbark – mixed box woodland on hills in the Cowra – Boorowa – Young region of the NSW South-western Slopes bioregion	-	•	-
126. VCA 343: Mugga Ironbark – Red Box – Red Stringybark – Inland Grey Box grass/shrub woodland on metamorphic substrates in the Tarcutta – Gundagai region, NSW SWS bioregion	-	-	-
127. VCA 358: Mugga Ironbark – Red Box – White Box – Black Cypress Pine tall woodland on rises and hills in the northern NSW South-western Slopes bioregion	-	-	-
128. VCA 243: Mugga Ironbark – White Cypress Pine woodland on low rises mainly in the Cobar Peneplain bioregion	•	•	-
129. VCA 318: Mugga Ironbark -Tumbledown Red Gum – Red Box – Black Cypress Pine open forest on shallow stony soils on hills in the NSW South-western Slopes bioregion	-	-	-
130. VCA 123: Mulga – Dead Finish on stony hills mainly of the Channel Country and Broken Hill Complex bioregions	-	-	-
131. VCA 125: Mulga – Ironwood shrubland on loams and clays mainly of the Cobar Peneplain bioregion	-	-	-
132. VCA 213: Murray’s Wattle sparse shrubland/forbland on sand rises of the Darling Riverine Plain bioregion	-	-	-
133. VCA 143: Narrow-leaved Hopbush-Scrub Turpentine-Senna shrubland on semi-arid and arid sandplains and dunes.	-	-	-
134. VCA 479: Narrow-leaved Ironbark- Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern BBS – Sydney Basin bioregions	-	-	-
135. VCA 476: Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW SWS and southern BBS bioregions	-	-	-
136. VCA 214: Native Millet – Cup Grass grassland of the Darling Riverine Plain bioregion	-	-	-
137. VCA 128: Nelia tall open shrubland of semi-arid sandplains	-	-	-
138. VCA 160: Nitre Goosefoot shrubland wetland on clays of the inland floodplains	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
139. VCA 316: Nortons Box – Red Box – Red Stringybark +/- Nodding Flax Lily forb-grass open forest mainly on the Tumut region	-	-	-
140. VCA 294: Nortons Box – Red Box – White Box tussock grass open forest of the southern section of the NSW South-western Slopes bioregion	-	-	-
141. VCA 310: Nortons Box – Red Stringybark grassy tall open forest on sheltered slopes in the Tumbarumba – Murray River region of the NSW South-western Slopes bioregion	-	-	-
142. VCA 293: Nortons Box shrubby low woodland on sandstone and conglomerate escarpments in the far southern part of the NSW South Western Slopes	-	-	-
143. VCA 158: Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (north-western NSW)	-	-	-
144. VCA 159: Old Man Saltbush shrubland mainly of the semi-arid (warm) climate zone (south-western NSW)	-	-	-
145. VCA 154: Pearl Bluebush low open shrubland of the arid and semi-arid plains	-	-	-
146. VCA 238: Permanent and semi-permanent freshwater lakes wetland of the inland slopes and plains	-	-	-
147. VCA 416: Pilliga “tank gilgai” wetland sedgeland rushland, BBS bioregion	-	-	-
148. VCA 88: Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South bioregion	•	•	-
149. VCA 245: Pine – Belah low open woodland of the western Cobar Peneplain and northern Murray-Darling Depression bioregions	•	-	-
150. VCA 246: Pine shrubland of the western Cobar Peneplain bioregion	•	-	-
151. VCA 45: Plains Grass grassland on alluvial mainly clay soils in the Riverina and NSW South-western Slopes bioregions	-	-	Nominated EPBC Act
152. VCA 56: Poplar Box – Belah woodland on clay-loam soils on alluvial plains of north-central NSW	•	•	-
153. VCA 87: Poplar Box – Coolabah floodplain woodland on light clay soil mainly in the Darling Riverine Plain bioregion	-	-	-
154. VCA 103: Poplar Box – Gum Coolabah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain bioregion	-	•	-
155. VCA 109: Poplar Box – Mulga – Ironwood woodland on red loam soils on plains in the Cobar Peneplain and north-eastern Mulga Lands bioregions	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
156. VCA 98: Poplar Box – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains and BBS bioregions	•	-	-
157. VCA 207: Poplar Box grassy low woodland of drainage lines and depressions of the semi-arid (hot) and arid zone climate zones	-	-	-
158. VCA 244: Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheat belt)	-	•	-
159. VCA 105: Poplar Box grassy woodland on flats mainly in the Cobar Peneplain and Murray-Darling Depression bioregions	•	•	-
160. VCA 139: Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions	-	-	-
161. VCA 220: Purple Wood wattle shrubland of the arid zone sandplains	-	-	-
162. VCA 52: Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plain bioregion	-	-	Listed EPBC Act (CE)
163. VCA 242: Rat's Tail Couch sod grassland wetland of inland floodplains	-	-	-
164. VCA 286: Red Box – Blakelys Red Gum sedge woodland on colluvial clay drainage lines in the NSW South-western Slopes bioregion	-	-	Listed TSC Act (E) Listed EPBC Act (CE)
165. VCA 315: Red Box – Dwyers Red Gum low woodland on shallow red earths on upper hillslopes and hillcrests in the upper Murray River region	-	-	-
166. VCA 306: Red Box – Red Stringybark – Nortons Box hill heath shrub – tussock grass open forest of the Tumut region	-	-	-
167. VCA 345: Red Box – Tumbledown Red Gum – Red Stringybark – Long-leaved Box dry woodland on fine-grained metamorphic substrates in the western South Eastern Highlands and upper NSW South-western Slopes bioregions	-	-	-
168. VCA 426: Red Box – White Box +/- Red Stringybark hill woodland in the NSW South-western Slopes bioregion	-	-	-
169. VCA 328: Red Ironbark – Black Cypress Pine shrubby woodland of the NSW South-western Slopes bioregion	-	•	-
170. VCA 329: Red Ironbark – Red Stringybark – Tumbledown Red Gum heath low woodland on siliceous ridges of the NSW Central western Slopes	-	-	-
171. VCA 193: Red Mallee – White Mallee extremely tall "tree mallee" on silty-loam-clay soils of central south-western NSW	-	-	-
172. VCA 284: Red Stringybark – Blakelys Red Gum – tea tree herbaceous swampy valley open forest of the southern NSW South-western Slopes bioregion	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
173. VCA 280: Red Stringybark – Blakelys Red Gum +/- Long-leaved Box shrub/grass hill woodland of the NSW South-western Slopes bioregion	-	-	-
174. VCA 352: Red Stringybark – Blakelys Red Gum hillslope open forest on meta-sediments in the Yass – Boorowa – Crookwell region of the NSW South-western Slopes and South Eastern Highlands bioregions	-	-	-
175. VCA 311: Red Stringybark – Broad-leaved Peppermint – Nortons Box heath open forest on in the upper slopes subregion in the NSW SWS bioregion and adjoining South East Highlands bioregion	-	-	-
176. VCA 239: Red Stringybark – Dwyers Red Gum – Black Cypress Pine woodland on siliceous ranges in the south-eastern Cobar Peneplain bioregion	-	-	-
177. VCA 323: Red Stringybark – Inland Scribbly Gum open forest on steep hills in the Mudgee – northern section of the NSW South-western Slopes bioregion	-	-	-
178. VCA 464: Red Stringybark – Kurrajong – mixed eucalypt grassy open forest of the Coonabarabran – Gulgong region in the BBS and NSW South-western Slopes bioregions	-	-	-
179. VCA 354: Red Stringybark – Long-leaved Box – Black Cypress Pine – hummock grass – shrubby low woodland on siliceous volcanic and sedimentary ranges in the Peak Hill region, central west NSW	-	-	-
180. VCA 321: Red Stringybark – Long-leaved Box – Black Cypress Pine shrub/grass woodland on siliceous sedimentary ranges in the upper NSW South-western Slopes and South Eastern Highlands bioregions	-	-	-
181. VCA 348: Red Stringybark – Long-leaved Box – <i>Joycea pallida</i> grassy open forest in the upper Lachlan catchment, NSW South-western Slopes and South Eastern Highlands bioregions	-	-	-
182. VCA 290: Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass – shrub low open forest on hills in the southern part of the NSW South-western Slopes bioregion	-	-	-
183. VCA 340: Red Stringybark – Red Gum – Black Cypress Pine – Kunzea – Tea Tree shrubby open forest on granite ranges of the Boorowa – Wyangala region, NSW South-western Slopes bioregion	-	-	-
184. VCA 331: Red Stringybark woodland on siliceous hillslopes in of the Hervey Range region in the northern part of the NSW South-western Slopes bioregion	-	-	-
185. VCA 300: Ribbon Gum – Narrow-leaved (Robertson's) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW SWS bioregion and western Kosciuszko escarpment	-	-	-
186. VCA 175: Ridge mallee woodland on hills of meta-sediments and volcanics, eastern Cobar Peneplain bioregion	-	-	-
187. VCA 278: Riparian Blakelys Red Gum – box – shrub – sedge – grass tall open forest of the central NSW South-western Slopes bioregion	-	-	Listed TSC Act (E) Listed EPBC Act (CE)
188. VCA 302: Riparian Blakelys Red Gum – Broad-leaved Sally woodland – tea-tree – bottlebrush – wattle shrubland wetland of the NSW South-western Slopes and South East Highlands bioregions	-	-	-
189. VCA 299: Riparian Ribbon Gum – Robertsons Peppermint – Apple Box riverine very tall open forest of the NSW South Western Slopes and South East Highlands bioregions	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
190. VCA 241: River Coobah swamp wetland on the floodplains of the Darling Riverine Plains and Brigalow Belt South bioregions	-	-	-
191. VCA 240: River Coobah tall shrubland wetland of the floodplains in the Riverina and Murray-Darling Depression bioregions	-	-	-
192. VCA 85: River Oak forest and woodland wetland of the NSW South-western Slopes and South Eastern Highlands bioregions	-	-	-
193. VCA 10: River Red Gum – Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina and Murray Darling Depression bioregions)	-	•	-
194. VCA 11: River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina and Murray Darling Depression bioregions)	-	•	-
195. VCA 233: River Red Gum – Poplar Box grassy woodland wetland on Quaternary alluvial sandy-loam soils of the Cobar Peneplain	-	-	-
196. VCA 9: River Red Gum – Wallaby Grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina bioregion	-	•	-
197. VCA 8: River Red Gum – Warrego Grass – Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina and Murray Darling Depression bioregions)	-	-	-
198. VCA 7: River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina bioregion	-	-	-
199. VCA 454: River Red Gum grassy chenopod open tall woodland (wetland) on floodplain clay soil of the Darling Riverine Plain and western Brigalow Belt South bioregions	-	-	-
200. VCA 5: River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South West Slopes bioregion and the eastern Riverina bioregion	-	•	-
201. VCA 208: River Red Gum low woodland wetland of rocky gorges and creeks in the Cobar Peneplain	-	-	-
202. VCA 79: River Red Gum shrub/grass riparian tall woodland or open forest wetland mainly in the upper slopes sub-region of the NSW South Western Slopes bioregion and western South East Highlands bioregion	-	-	-
203. VCA 249: River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	-	-	-
204. VCA 36: River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains bioregion	-	-	-
205. VCA 2: River Red Gum–sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW	-	•	-
206. VCA 237: Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone	-	•	Listed TSC Act (E) Listed EPBC Act (E)

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
207. VCA 295: Robertson's Peppermint – Broad-leaved Peppermint – Nortons Box – Stringybark shrub-fern open forest of the NSW South Western Slopes and SEH bioregions	-	-	-
208. VCA 281: Rough-Barked Apple – Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South-western Slopes and BBS bioregions	-	-	Listed TSC Act (E) Listed EPBC Act (CE)
209. VCA 336: Rush – Sedge – Common Reed mainly lentic channel wetland of the Upper Murray and mid-Murrumbidgee River floodplains in the NSW South-western Slopes bioregion	-	-	-
210. VCA 388: Rusty Fig – Mock Olive – Red Ash dry vine rainforest on siliceous substrates in the Brigalow Belt South bioregion	-	-	Listed TSC Act (E) Listed EPBC Act (E)
211. VCA 173: Sandplain mallee of central NSW	-	•	-
212. VCA 119: Sandplain Mulga tall shrubland – open shrubland of the semi-arid and arid climate zones	-	-	-
213. VCA 228: Semi-mesic woodland on basalt hills of the dry subtropical climate zone, North-western Slopes of NSW	-	-	-
214. VCA 53: Shallow freshwater wetland sedgeland / grassland in depressions on floodplains on inland alluvial plains and floodplains	-	-	-
215. VCA 12: Shallow marsh wetland of regularly flooded depressions on floodplains mainly in the semi-arid (warm) climatic zone (mainly Riverina and Murray Darling Depression bioregions)	-	-	-
216. VCA 292: She Oak – Fringe Myrtle heathland on rocky ranges in the NSW South-western Slopes bioregion	-	-	-
217. VCA 192: Silver-leaved Ironbark – Poplar Box +/- Ironwood shrub – grass woodland on rises in the north-western plains of NSW	-	-	-
218. VCA 227: Silver-leaved Ironbark – White Cypress Pine – Rough-barked Apple woodland on alluvial terraces in central-north NSW	•	-	-
219. VCA 21: Slender Cypress Pine – Sugarwood – Western Rosewood open woodland on sandy rises mainly in the Riverina and Murray Darling Depression bioregions	-	-	Listed TSC Act (E) Nominated EPBC Act
220. VCA 18: Slender Glasswort low shrubland in saline wetland depressions in the semi-arid and arid climate zones, far western NSW	-	-	-
221. VCA 211: Slender Saltbush – Samphire – Copperburr low open shrubland wetland on irregularly inundated floodplains mainly in the Darling Riverine Plains and BBS bioregions	-	-	-
222. VCA 171: Spinifex linear dune mallee mainly of the Murray–Darling Depression bioregion	-	-	-
223. VCA 63: Spiny Lignum – Slender Glasswort open forbland saline wetland on lake edges in the semi-arid and arid climate zones	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
224. VCA 271: Spotted Fuchsia shrubland wetland in drainage depressions on inland plains	-	-	-
225. VCA 47: Swamp grassland wetland of the Riverine Plain	-	-	Nominated EPBC Act
226. VCA 363: Swamp Paperbark sodic scald wetland / shrubland of the Yetman – Yalarbon region DRP and BBS bioregions	-	-	-
227. VCA 334: Tick Bush – Drooping She Oak tall shrubland on granite hills of the NSW Central-western Slopes	-	-	-
228. VCA 461: Tumbledown Gum woodland on hills in the northern NSW South-western Slopes and southern BBS bioregions	-	-	-
229. VCA 339: Tumbledown Red Gum – Black Cypress Pine – Red Stringybark – Currawang shrubby low woodland on Wyangala granite and metasediments of the Wyangala Dam region, NSW South-western Slopes bioregion	-	-	-
230. VCA 332: Tumbledown Red Gum – Black Cypress Pine – Red Stringybark woodland on rocky hills in the NSW Central- western slopes	-	•	-
231. VCA 319: Tumbledown Red Gum – White Cypress Pine hill woodland in the southern part of the NSW South-western Slopes bioregion	•	•	-
232. VCA 335: Tussock grass – sedgeland fen – rushland – reedland wetland in impeded creeks in valleys in the upper slopes sub-region of the NSW South-western Slopes bioregion	-	-	-
233. VCA 204: Water Couch marsh grassland wetland of frequently flooded inland watercourses	-	-	-
234. VCA 27: Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South bioregions	-	-	Listed TSC Act (E) and EPBC Act (E)
235. VCA 26: Weeping Myall open woodland of the Riverina and NSW South-western Slopes bioregions	-	•	Listed TSC Act (E) and EPBC Act (E)
236. VCA 145: Western Rosewood – Wilga – Wild Orange – Belah low woodland of the Brigalow Belt South and eastern Darling Riverine Plains bioregions	-	-	-
237. VCA 364: Wetland on sodic soils in the Yetman-Yalarbon region, mainly Brigalow Belt South bioregion	-	-	-
238. VCA 272: White Box – Black Cypress Pine – Red Gum +/- Mugga Ironbark shrubby woodland in hills of the NSW Central-western Slopes	-	-	-
239. VCA 268: White Box – Blakelys Red Gum – Long-leaved Box – Nortons Box – Red Stringybark grass-shrub woodland on shallow soils on hills in the NSW South-western Slopes bioregion	-	-	-
240. VCA 269: White Box – Blakelys Red Gum – Red Box – Red Stringybark shrubby woodland on shallow soils on metamorphic hills in the Albury region of the NSW South-western Slopes bioregion	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
241. VCA 346: White Box – Blakelys Red Gum – White Cypress Pine shrubby woodland on metamorphic hills in the Wagga Wagga – Cootamundra region of the NSW South-western Slopes bioregion	•	-	-
242. VCA 347: White Box – Blakelys Red Gum shrub/grass woodland on metamorphic hillslopes in the mid-southern part of the upper slopes sub-region of the NSW South-western Slopes bioregion	-	-	Listed TSC Act (E) Listed EPBC Act (CE)
243. VCA 412: White Box – Cypress Pine shrubby hill woodland in the east Pilliga – Mendooran – Gulgong regions, mainly BBS bioregion	-	-	-
244. VCA 274: White Box – Rough-barked Apple alluvial woodland of the NSW Central-western Slopes including in the Mudgee region	-	•	Listed TSC Act (E) Listed EPBC Act (CE)
245. VCA 267: White Box – White Cypress Pine – Inland Grey Box shrub/grass/forb woodland in the NSW South-western Slopes bioregion	•	•	Listed TSC Act (E) Listed EPBC Act (CE)
246. VCA 435: White Box – White Cypress Pine shrub grass hills woodland in the BBS and Nandewar bioregion	•	-	Listed TSC Act (E) Listed EPBC Act (CE)
247. VCA 266: White Box grassy woodland in the upper slopes sub-region of the NSW South-western Slopes bioregion	-	-	Listed TSC Act (E) Listed EPBC Act (CE)
248. VCA 273: White Box shrubby open forest on fine-grained sediments on steep slopes in the Mudgee region of the of Central-western Slopes of NSW	-	-	-
249. VCA 48: White Cypress Pine – Drooping Sheoak grassy open woodland of the Riverine Plain	•	-	Listed TSC Act (E)
250. VCA 106: White Cypress Pine – Mulga low woodland on siliceous rocky ranges mainly of the Cobar Peneplain	•	-	-
251. VCA 69: White Cypress Pine – Mulga shrubland on plains and sandplains in the arid and semi-arid (hot summer) climate zones.	•	-	-
252. VCA 72: White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain bioregion	•	•	-
253. VCA 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	•	•	Listed TSC Act, (E), Listed EPBC Act (E)
254. VCA 70: White Cypress Pine woodland on sandy loams in central NSW wheat belt	•	•	-
255. VCA 137: Whitewood – Western Rosewood low woodland of the NSW north western plains	-	-	-
256. VCA 146: Whitewood low open woodland of the BBS and north-eastern DRP bioregions	-	-	-
257. VCA 49: Windmill Grass – Copperburr alluvial plains shrubby partly derived grassland of the Darling Riverine Plains and BBS bioregions	-	-	-

Vegetation Type Name (from NSWVCA database – Benson, 2006; Benson, 2008; Benson et al., 2006 in prep)	White Cypress type	Mapped in state forest (Binns, 2009)	Legal status *
258. VCA 215: Woollybutt open grassland on red earths of the inland plains	-	-	-
259. VCA 77: Yarran shrubland of the NSW central to northern slopes and plains	-	•	Nominated TSC Act
260. VCA 23: Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones-	-	-	-
261. VCA 235: Yelarbon Buloke – Inland Grey Box – spinifex low open woodland / hummock grassland on sandy sodic soils	-	-	Listed TSC Act (E)
262. VCA 74: Yellow Box – River Red Gum tall grassy riverine woodland of NSW South West Slopes and Riverina bioregions	-	-	-
263. VCA 75: Yellow Box - White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South-western Slopes bioregions	•	•	-
264. VCA 276: Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South-western Slopes bioregion	-	•	Listed TSC Act (E) Listed EPBC Act (CE)
265. VCA 312: Yellow Box grassy tall woodland on valley flats in the upper slopes of the South-western Slopes bioregion and South Eastern Highlands bioregion	-	-	Listed TSC Act (E) Listed EPBC Act (CE)
266. VCA 83: Yellow Box woodland on sandy loam soils on alluvial plains mainly in the upper Darling Riverine Plain bioregion	-	-	-
267. VCA 86: Yellow Gum tall woodland of the Murray River floodplain, Riverina bioregion	-	-	Yellow Gum listed under TSC Act

BBS Brigalow Belt South
 DRP Darling Riverine Plains
 E Endangered
 CE Critically endangered
 SEH South East Highlands
 SWS South-western Slopes
 * Parts of the VCA types may conform to the EECs .

Appendix 10

Vegetation types found in assessment area that contain white cypress

NSWVCA database (Benson et al., 2006; Benson, 2008)	NSW vegetation classes (Keith, 2004)	Australian vegetation types (Beadle, 1981)	NSW forest types* (FCNSW, 1981)	NVIS Sub- Groups (NLWRA, 2001)
1. VCA 279: Blakely's Red Gum – White Cypress Pine woodland on footslopes of hills in central part of the NSW South-western Slopes bioregion	Western Slopes Grassy Woodlands	<i>Eucalyptus melliodora</i> – <i>E. blakelyi</i> Alliance	192 – White Cypress Pine – Red Gum (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
2. VCA 356: Blakely's Red Gum – Dirty Gum – White Cypress Pine tall woodland lining sandy watercourses in the NSW South-western Slopes bioregion	Inland Riverine Forests	<i>Eucalyptus camaldulensis</i> Alliance	192 – White Cypress Pine-Red Gum (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
3. VCA 54: Buloke – White Cypress Pine woodland in the NSW South-western Slopes bioregion	Western Slopes Dry Sclerophyll Forests	<i>Casuarina luehmanii</i> Alliance	213 – Bull Oak (P)	<i>Casuarina</i> and <i>Allocasuarina</i> forests and woodlands
4. VCA 71: Carbeen – White Cypress Pine – River Red Gum – bloodwood tall woodland on sandy loam alluvial and aeolian soils in the northern Brigalow Belt South and Darling Riverine Plain bioregions	North-west Alluvial Sand Woodlands	<i>Eucalyptus polycarpa</i> – <i>E. tessellaris</i> Suballiance	200 – River Red Gum-Black Box/Coolabah (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
5. VCA 19: Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains	Riverine Sandhill Woodlands	<i>Casuarina cristata</i> Alliance	193 – White Cypress Pine-Box (P)	<i>Callitris</i> forests and woodlands
6. # VCA 229: Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain bioregion	North-west Plain Shrublands	n/a	224 – Scrub (P)	Other shrublands
7. VCA 206: Dirty Gum – White Cypress Pine tall woodland of alluvial sandy lenses (sand monkeys) mainly of the Darling Riverine Plain bioregion	North-west Alluvial Sand Woodlands	<i>Eucalyptus populnea</i> – <i>Callitris glauca</i> Suballiance	209 – Brown Bloodwood-Ironbark/Red Gum (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
8. # VCA 184: Dwyers Red Gum – White Cypress Pine – Currawang low shrub-grass woodland of the Cobar Peneplain bioregion	Inland Rocky Hill Woodlands	<i>Eucalyptus intertexta</i> – <i>Acacia</i> ssp. Suballiance	195 – White Cypress Pine-Hillside Red Gum (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
9. VCA 185: Dwyers Red Gum – White Cypress Pine – Currawang shrubby woodland of the NSW South-western Slopes bioregion	Inland Rocky Hill Woodlands	<i>Eucalyptus sideroxylon</i> – <i>E. dealbata</i> Suballiance	195 – White Cypress Pine-Hillside Red Gum (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
10. # VCA 176: Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain bioregion	Inland Rocky Hill Woodlands	<i>Eucalyptus viridis</i> Alliance	225 – Mallee (P)	Mallee <i>Eucalyptus</i> low open woodlands

NSWVCA database (Benson et al., 2006; Benson, 2008)	NSW vegetation classes (Keith, 2004)	Australian vegetation types (Beadle, 1981)	NSW forest types* (FCNSW, 1981)	NVIS Sub- Groups (NLWRA, 2001)
11. # VCA 180: Grey Mallee – White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain bioregion	Inland Rocky Hill Woodlands	<i>Eucalyptus viridis</i> Alliance	225 – Mallee (P)	Mallee Eucalyptus low open woodlands
12. VCA 258: Gum Coolabah – Mugga ironbark – White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain bioregion and central NSW SWS bioregion	Inland Rocky Hill Woodlands	<i>Eucalyptus intertexta</i> – <i>Callitris “glauca”</i> Suballiance	193 – White Cypress Pine-Box (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
13. # VCA 104: Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain bioregion	Inland Rocky Hill Woodlands	<i>Eucalyptus intertexta</i> – <i>Callitris “glauca”</i> Suballiance	193 – White Cypress Pine-Box (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
14. VCA 82: Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain bioregion	Floodplain Transition Woodlands	<i>Eucalyptus populnea</i> – <i>Callitris glauca</i> Suballiance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
15. VCA 80: Inland Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South-western Slopes and Riverina bioregions	Floodplain Transition Woodlands	<i>Eucalyptus woollsiana</i> Alliance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
16. # VCA 134: Ironwood woodland of the semi-arid plains	Western Peneplain Woodlands	<i>Acacia excelsa</i> Alliance	214 – Wattle (P)	Arid and semi-arid <i>Acacia</i> low open woodlands and shrublands with tussock grass
17. VCA 255: Mugga Ironbark – Buloke – Pilliga Box – White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South bioregion	Western Slopes Dry Sclerophyll Forests	<i>Eucalyptus pilligaensis</i> Alliance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
18. VCA 243: Mugga Ironbark – White Cypress Pine woodland on low rises mainly in the Cobar Peneplain bioregion	Western Slopes Dry Sclerophyll Forests	<i>Eucalyptus sideroxylon</i> – <i>E. dealbata</i> Suballiance	206 – Red Ironbark (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
19. VCA 88: Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion	Pilliga Outwash Dry Sclerophyll Forests	<i>Eucalyptus pilligaensis</i> Alliance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
20. # VCA 245: Pine – Belah low open woodland of the western Cobar Peneplain and northern Murray-Darling Depression Bioregions	Western Peneplain Woodlands	<i>Casuarina cristata</i> Alliance	212 – Belah (P); 224 – Scrub (P)	<i>Callitris</i> forests and woodlands;
21. # VCA 246: Pine shrubland of the western Cobar Peneplain Bioregion	Western Peneplain Woodlands	<i>Casuarina cristata</i> Alliance	224 – Scrub (P)	<i>Callitris</i> forests and woodlands
22. VCA 56: Poplar Box – Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Floodplain Transition Woodlands	<i>Eucalyptus populnea</i> – <i>Casuarina cristata</i> Suballiance	212 – Belah 203 – western Box	<i>Eucalyptus</i> woodlands with a grassy understorey

NSWVCA database (Benson et al., 2006; Benson, 2008)	NSW vegetation classes (Keith, 2004)	Australian vegetation types (Beadle, 1981)	NSW forest types* (FCNSW, 1981)	NVIS Sub- Groups (NLWRA, 2001)
23. # VCA 103: Poplar Box – Gum Coolabah – White Cypress Pine shrubby woodland mainly in the Cobar Penneplain bioregion	Western Penneplain Woodlands	<i>Eucalyptus intertexta</i> – <i>Callitris “glauca”</i> Suballiance; <i>Eucalyptus populnea</i> – <i>Callitris glauca</i> Suballiance	193 – White Cypress Pine-Box (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
24. # VCA 105: Poplar Box grassy woodland on flats mainly in the Cobar Penneplain and Murray–Darling Depression bioregions	Western Penneplain Woodlands	<i>Eucalyptus populnea</i> – <i>Callitris glauca</i> Suballiance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
25. # VCA 98: Poplar Box – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains and Brigalow Belt South bioregions	Western Penneplain Woodlands	<i>Eucalyptus populnea</i> – <i>Eremophila mitchellii</i> Suballiance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
26. VCA 227: Silver-leaved Ironbark – White Cypress Pine on alluvial sandy loam soils in central–north NSW	North-west Alluvial Sand Woodlands	<i>Eucalyptus melanophloia</i> Suballiance	203 – Western Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
27. VCA 319: Tumbledown Gum – White Cypress Pine hill woodland in the southern part of the NSW South-western Slopes bioregion	Inland Rocky Hill Woodlands;	<i>Eucalyptus sideroxylon</i> – <i>E. dealbata</i> Suballiance	195 – White Cypress Pine–Hillside Red Gum (E)	<i>Eucalyptus</i> forests with a grassy understorey
28. VCA 346: White Box – Blakelys Red Gum – White Cypress Pine shrubby woodland on metamorphic hills in the Wagga Wagga region of the NSW South-western Slopes bioregion	Western Slopes Dry Sclerophyll Forests;	<i>Eucalyptus sideroxylon</i> – <i>E. dealbata</i> Suballiance	176 – White Box–Stringybark (P)	<i>Eucalyptus</i> woodlands with a shrubby understorey
29. VCA 435: White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South and Nandewar bioregions	Western Slopes Grassy Woodlands	<i>Eucalyptus albens</i> Alliance	175 – White Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
30. VCA 267: White Box – White Cypress Pine – Inland Grey Box shrub/grass/forb woodland in the NSW South-western Slopes bioregion	Western Slopes Grassy Woodlands	<i>Eucalyptus albens</i> Alliance	175 – White Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey
31. VCA 48: White Cypress Pine– Drooping Sheoak grassy open woodland of the Riverine Plain	Riverine Sandhill Woodlands	<i>Acacia excelsa</i> Alliance	188 – White Cypress Pine (P)	<i>Callitris</i> forests and woodlands
32. # VCA 106: White Cypress Pine – Mulga low woodland on siliceous rocky ranges mainly of the Cobar Penneplain	Inland Rocky Hill Woodlands	<i>Acacia aneura</i> Alliance	193 – White Cypress Pine-Box (P)	<i>Callitris</i> forests and woodlands
33. # VCA 69: White Cypress Pine – Mulga shrubland on plains and sandplains in the arid and semi-arid (hot summer) climate zones	Sand Plain Mulga Shrublands	<i>Acacia aneura</i> Alliance	188 – White Cypress Pine (P)	<i>Callitris</i> forests and woodlands

NSWVCA database (Benson et al., 2006; Benson, 2008)	NSW vegetation classes (Keith, 2004)	Australian vegetation types (Beadle, 1981)	NSW forest types* (FCNSW, 1981)	NVIS Sub- Groups (NLWRA, 2001)
34. # VCA 72: White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain bioregion	Western Peneplain Woodlands	<i>Eucalyptus populnea</i> – <i>Callitris glauca</i> Suballiance	193 – White Cypress Pine-Box (P)	<i>Callitris</i> forests and woodlands
35. VCA 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Riverine Sandhill Woodlands	<i>Casuarina cristata</i> Alliance	188 – White Cypress Pine (P)	<i>Callitris</i> forests and woodlands
36. VCA 70: White Cypress Pine woodland on sandy loams in central NSW wheatbelt	Floodplain Transition Woodlands	<i>Eucalyptus populnea</i> – <i>Callitris glauca</i> Suballiance <i>Eucalyptus woollsiana</i> Alliance	193 – White Cypress Pine-Box (P)	<i>Callitris</i> forests and woodlands
37. VCA 75: Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South-western Slopes bioregions	Riverine Sandhill Woodlands	<i>Eucalyptus melliodora</i> – <i>E. blakelyi</i> Alliance	193 – White Cypress Pine-Box (P)	<i>Eucalyptus</i> woodlands with a grassy understorey

Types associated with semi-arid rangeland

* Based on FNSW assignment of NSWVCA types to available mapping datasets including Forest Typing

Appendix 11

Mapping methodology

A11.1 Mapping datasets

For this assessment, the NRC mapped the current extent of white cypress woodlands by drawing together 12 separate mapping datasets to form a composite vegetation layer. Each dataset used to derive the composite map is listed in **Table A11.1** and the coverage of these datasets is shown in **Figure A11.1**.

The complete extent of the composite map totals close to 24 million hectares, or 30 per cent of the area of NSW. Around 12 per cent of this area had no mapping available.

A11.2 Vegetation classification

There is considerable difference in the floristic attribution of polygons in each of the vegetation mapping datasets. However, the NRC has classified and mapped white cypress woodlands into three broad categories:

1. **White cypress forest**, which means white cypress dominates the forest.
2. **Associated woodland**, which means that white cypress is found in association with other species (mainly with *Eucalyptus* species).
3. **Other vegetation**, which means other vegetation which is not considered to represent white cypress-dominant or associated woodland.¹ This includes all non-cypress types mapped in state forests (**Appendix 16**). White cypress may be scattered through these types, but is not considered to be a common associate. It also captures areas of cleared or semi-cleared derived native grassland or low shrubland.
4. **Incompletely mapped vegetation**, which means all areas where mapped vegetation data are not available, or not covered by the composite vegetation layer.

White cypress forest was assigned to any map polygon represented by a vegetation type in which cypress appeared as the first (or only) species in the name (for example, white cypress pine woodland on sandy loams in central NSW wheat belt), or was otherwise identified as the prominent species in the floristic tag.

The NSW VCA used for this category are (NSW VCA identification number in brackets):

1. Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains (19)
2. Pine – Belah low open woodland of the western Cobar Penneplain and northern Murray-Darling Depression bioregions (245)
3. Pine shrubland of the western Cobar Penneplain bioregion (246)

4. White Cypress Pine – Drooping sheoak grassy open woodland of the Riverine Plain (48)
5. White Cypress Pine – Mulga low woodland on siliceous rocky ranges mainly of the Cobar Penneplain (106)
6. White Cypress Pine – Mulga shrubland on plains and sandplains in the arid and semi-arid (hot summer) climate zones (69)
7. White Cypress Pine – Poplar Box woodland on footslopes and penneplains mainly in the Cobar Penneplain Bioregion (72)
8. White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone (28)
9. White Cypress Pine woodland on sandy loams in central NSW wheatbelt (70).

Associated woodland was assigned to any map polygon represented by a vegetation type in which cypress appeared in the name, but preceded another species (for example, inland grey box – white cypress pine tall woodland on loam soil on alluvial plains of NSW South-western Slopes and Riverina bioregions), or was otherwise considered to be a co-dominant species in the floristic tag.

The NSWVCA used for this category are (NSW VCA identification number in brackets):

1. Blakelys Red Gum – White Cypress Pine woodland on footslopes of hills in central part of the NSW South-western Slopes bioregion (279)
2. Blakelys Red Gum x Dirty Gum – White Cypress Pine tall woodland lining sandy watercourses in the NSW South-western Slopes bioregion (356)
3. Buloke – White Cypress Pine woodland in the NSW South-western Slopes bioregion (54)
4. Carbeen – White Cypress Pine – River Red Gum – bloodwood tall woodland on sandy loam alluvial and aeolian soils in the northern BBS and DRP bioregions (71)
5. Derived mixed shrubland on loamy-clay soils in the Cobar Penneplain bioregion (229)
6. Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plain and BBS bioregions (206)
7. Dwyers Red Gum – White Cypress Pine – Currawang low shrub-grass woodland of the Cobar Penneplain bioregion (184)
8. Dwyers Red Gum – White Cypress Pine – Currawang shrubby woodland mainly in the NSW South-western Slopes bioregion (185)

¹ Mainly comprised of poplar box grassy woodlands, inland grey box grassy woodlands, and black box woodlands.

9. Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain bioregion (176)
10. Grey Mallee – White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain bioregion (180)
11. Gum Coolabah – Mugga ironbark – White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW SWS bioregion (258)
12. Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain bioregion (104)
13. Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain bioregion (82)
14. Inland Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South-western Slopes and Riverina Bioregions (80)
15. Ironwood woodland of the semi-arid plains (134)
16. Mugga Ironbark – Buloke – Pillga Box – White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South bioregion (255)
17. Mugga Ironbark – White Cypress Pine woodland on low rises mainly in the Cobar Peneplain bioregion (243)
18. Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South bioregion (88)
19. Poplar Box – Belah woodland on clay-loam soils on alluvial plains of north-central NSW (56)
20. Poplar Box - Gum Coolabah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain bioregion (103)
21. Poplar Box grassy woodland on flats mainly in the Cobar Peneplain and Murray-Darling Depression bioregions (105)
22. Poplar Box – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains and BBS bioregions (98)
23. Silver-leaved Ironbark – White Cypress Pine – Rough-barked Apple woodland on alluvial terraces in central-north NSW (227)
24. Tumbledown Red Gum - White Cypress Pine hill woodland in the southern part of the NSW South-western Slopes bioregion (319)
25. White Box – Blakelys Red Gum – White Cypress Pine shrubby woodland on metamorphic hills in the Wagga Wagga – Cootamundra region of the NSW South-western Slopes bioregion (346)
26. White Box – White Cypress Pine shrub grass hills woodland in the BBS and Nandewar bioergions (435)

27. White Box – White Cypress Pine – Inland Grey Box shrub/ grass/forb woodland in the NSW South-western Slopes bioregion (267)

28. Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South-western Slopes bioregions (75)

Other vegetation was assigned to all non-cypress types where cypress is not considered to be a common associate. It also captures areas of cleared or semi-cleared derived native grassland or low shrubland.

All areas where mapped vegetation data were not available, or not covered by the composite vegetation layer, have been classified as **incompletely mapped vegetation**.

A11.3 Calculating vegetation areas across tenures

Vegetation extent in **Table A11.2** was calculated by dividing the composite vegetation layer across the NSW land divisions (central and western divisions), and by then extracting relevant areas using the following datasets:

- South-western cypress state forests
- NPWS Estate (2009, version 2)
- Crown lands estate – Crown lease land
- Crown lands estate – travelling stock reserves

All remaining vegetation areas, not covered by the listed datasets, were grouped as 'Private land'. Due to the nature of this analysis, the grouping of 'Private land' also encompasses other tenures, such as Crown land licence/permits/roads, and as such, this grouping is only intended as a rough indication of the approximate area of private lands.

A11.4 Corridor mapping

Corridor mapping was undertaken at a broad scale by delineating paths of greatest connectedness of native vegetation, using expert visual interpretation of vegetation continuity from SPOT5 imagery and native vegetation mapping data. Corridor delineation was also informed by travelling stock routes and major watercourses.

An automated approach, such as the 'Spatial Links Tool' (Drielsma et al, 2007) was not employed for this project given an absence of consistent data across the region, and issues with the computer running time required to conduct analyses over this large region. Corridors were set at one kilometre width in line with work undertaken by Doerr et al. (in review), Scotts (2003) and Scotts & Drielsma (2003).

Table A11.1: Vegetation datasets the NRC used to map the current extent of white cypress

Dataset	Citation	Scale
1. North-west Slopes-Moree/Walgett	Peasley & Walsh (2000)	1 :100 000
2. Namoi Catchment Management Authority	Eco Logical Australia (2008)	1 :50 000
3. Central West Catchment Management Authority	DEC (2006a)	1 : 250 000
4. Cobar Penepplain	-	1 : 100000 ²
5. Lachlan Catchment Management Authority	DEC (2006b)	1 : 250 000
6. Murrumbidgee Catchment Management Authority	DECC (2007)	1 : 100 000 ³
7. Riverina	Eardley (1999)	1 :250 000
8. Ardlethan-Narrandera	DECCW (2009)f	1 : 6 000 – 1:7 000
9. Cootamundra Junee	DECCW (2009)f	1 : 6 000 – 1:7 000
10. Urana Lockhart	DECCW (2009)f	1 : 6 000 – 1:7 000
11. Murray Catchment Management Authority	DECCW (2009f) unpublished data	1 :100 000
12. State forests (202 in total)	Binns (2009) unpublished data	-

² Assumed scale as no metadata available.

³ Some at 1:50 000

Table A11.2: Area (hectare) of white cypress forest and associated woodland across the central and western divisions

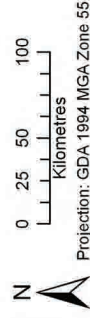
Tenure	Vegetation	Central division	Western division	Total
NRC's composite mapping	White cypress forest	97,570	72,430	170,000
	Associated woodland	1,215,300	1,318,960	2,534,260
	Cypress sub-total	1,312,870	1,391,390	2,704,260
	Other vegetation	14,370,330	6,552,100	20,922,430
	Vegetation total	15,683,200	7,943,490	23,626,690
South-western cypress state forest (n=197)	White cypress forest	79,620	1,350	80,970
	Associated woodland	40,190	13,590	53,780
	Cypress sub-total	119,810	14,940	134,750
	Other vegetation	29,020	7,260	36,280
	Incomplete mapping	23,760	0	24,720
	Vegetation total	173,550	22,200	195,750
Reserve system	White cypress forest	2,490	3,940	6,430
	Associated woodland	111,450	112,520	223,970
	Cypress sub-total	113,940	116,460	230,400
	Other vegetation	714,390	200,500	914,890
	Sub-total	828,330	316,960	1,145,290
Crown lease land (includes Western Land Leases)	White cypress forest	2,660	65,830	68,490
	Associated woodland	269,370	1,164,360	1,433,730
	Cypress sub-total	272,030	1,230,190	1,502,220
	Other vegetation	1,283,600	5,967,470	7,251,070
	Sub-total	1,555,630	7,197,660	8,753,290
Travelling stock reserves	White cypress forest	1,260	700	1,960
	Associated woodland	31,370	8,940	40,310
	Cypress sub-total	32,630	9,640	42,270
	Other vegetation	229,040	34,990	264,030
	Sub-total	261,670	44,630	306,300
Private land	White cypress forest	11,540	610	12,150
	Associated woodland	762,920	19,550	782,470
	Cypress sub-total	774,460	20,160	794,620
	Other vegetation	12,114,280	341,880	12,456,160
	Sub-total	12,888,740	362,040	13,250,780

Legend

Major rivers

Vegetation datasets

1. North-west Slopes - Moree/Walgett
 2. Namoi CMA
 3. Central West CMA
 4. Cobar Penepalin
 5. Lachlan CMA
 6. Murrumbidgee CMA
 7. Riverina
 8. Ardlethan-Narranderra
 9. Cootamundra Junee
 10. Urana Lockhart
 11. Murray CMA
 12. State forests
- Data Gap



Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

24/05/2010
Information Sources:
Department of the Environment, Water, Heritage and the Arts
Department of Land and Property Management Authority
NSW Department of Environment, Climate Change & Water
NSW Department of Primary Industries

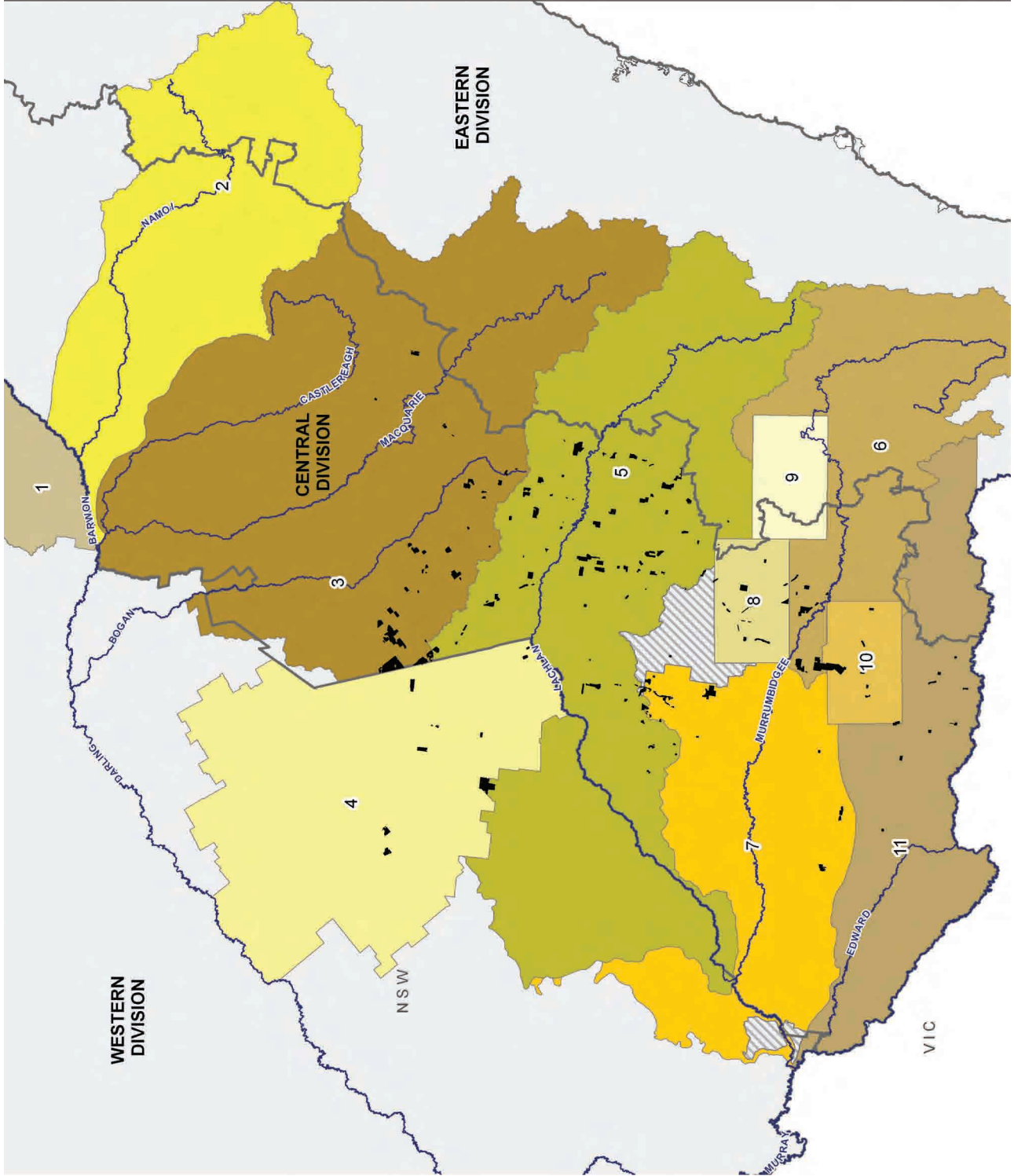


Figure A11.1: Distribution of vegetation datasets used to develop composite map for current extent of white cypress

Appendix 12

Listed endangered ecological communities and species

Table A12.1: Listed endangered ecological communities

Ecological community	EPBC Act	TSC Act	<i>Callitris</i> type	Mapped in state forest (Binns, 2009)	Associated NSWCA types
1. <i>Acacia melvillei</i> shrubland in the Riverina and Murray Darling Depression bioregions	-	E	-	-	23
2. Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	E	-	-	-	20
3. Box-Gum Woodland (<i>EPBC name</i> = White Box – Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland)	CE	E	•	•	227, 266, 267, 276, 279, 274, 275, 278, 281, 282, 286, 312, 347, 435
4. Brigalow Community (<i>EPBC name</i> = Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant))	E	E	-	-	35, 629
5. Brigalow-gidgee Woodland/shrubland	-	E	-	-	29
6. Carbeen Open Forest community in the Darling Riverine Plains and Brigalow Belt South bioregions	-	E	•	-	71, 628
7. Coolibah – Black Box woodland of the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South bioregions	-	E	-	-	37, 39, 40
8. Fuzzy Box on alluvials of South West Slopes; Darling Riverine Plains and Brigalow Belt South	-	E	-	•	201
9. <i>Halosarcia lylei</i> low open-shrubland	-	E	-	-	65
10. Inland Grey Box Woodland (<i>EPBC name</i> = Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia)	E	E	-	•	76, 80, 82, 110, 237
11. Myall Woodland in the Darling Riverine Plains; Brigalow Belt (<i>EPBC name</i> = Weeping Myall Woodlands)	E	E	-	-	26, 27, 28
12. Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	CE	-	-	-	52
13. Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	E	-	-	-	45, 320
14. <i>Nelia</i> Shrublands	-	E	-	-	128
15. Sandhill pine woodland in the Riverina, Murray-Darling Depression and NSW South western Slopes bioregions	-	E	-	•	19, 21, 48

Note: Semi-evergreen vine thicket (equivalent to NSWCA 388) is listed as endangered under the EPBC and TSC Acts. However, it is not included here as it is associated exclusively with the Brigalow Belt South and Nandewar bioregions.

Table A12.2: Threatened flora

Scientific name	Common name	TSC status	EPBC status
1. <i>Acacia ausfeldii</i>	Ausfeld's Wattle	V	-
2. <i>Acacia curranii</i>	Curly-bark Wattle	V	V
3. <i>Amphibromus pithogastrus</i>	Plump Swamp Wallaby-grass	Not listed, presumed extinct in region	-
4. <i>Austrostipa metatoris</i>	-	V	V
5. <i>Austrostipa wakoolica</i>	-	E1	E
6. <i>Brachyscome muelleroides</i>	Claypan Daisy	V	V
7. <i>Brachyscome papillosa</i>	Mossgiel Daisy	V	V
8. <i>Brasenia schreberi</i>	Water shield	Not listed, presumed extinct in region	-
9. <i>Caladenia arenaria</i>	Sand-hill Spider Orchid	E4	E
10. <i>Caladenia rosella</i>	Rosella Spider Orchid	E4	E
11. <i>Callitriche cyclocarpa</i>	Western Water-starwort	V	V
12. <i>Calotis glandulosa</i>	Mauve Burr-daisy	V	V
13. <i>Distichlis distichophylla</i>	Australian Saltgrass	E1	-
14. <i>Diuris pedunculata</i>	Small Snake Orchid	E1	E
15. <i>Diuris</i> sp. (Oaklands, D.L.Jones 5380)	Oaklands Diuris	E1	-
16. <i>Diuris tricolor</i>	Pine Donkey Orchid	V	-
17. <i>Dodonaea sinuolata</i> subsp. <i>acrodentata</i>	-	E1	-
18. <i>Eucalyptus alligatrix</i> subsp. <i>miscella</i>	-	V	V
19. <i>Eucalyptus cannonii</i>	Capertee Stringybark	V	-
20. <i>Euphrasia arguta</i>	An annual herb	E4 (extinct)	E4 (extinct)
21. <i>Euphrasia collina</i> ssp. <i>muelleri</i>	Purple Eyebright	E1; presumed extinct in region	-
22. <i>Homoranthus darwinioides</i>	-	V	-
23. <i>Indigofera efoliata</i>	Leafless Indigo	E1	E
24. <i>Kippistia suaedifolia</i>	Fleshy Minuria	E1	-
25. <i>Leionema sympetalum</i>	Rylstone Bell	V	V
26. <i>Lepidium aschersonii</i>	Spiny Peppercross	V	V
27. <i>Lepidium monolocoides</i>	Winged Peppercross	E1	E
28. <i>Lepidium pseudopapillosum</i>	Erect Peppercross	E1; presumed extinct in region	V
29. <i>Leptorhynchos orientalis</i>	Lanky Buttons	E1	-
30. <i>Monotaxis macrophylla</i>	Large-leafed Monotaxis	E1	-
31. <i>Osteocarpum pentapterum</i>	-	E4	-
32. <i>Philothea angustifolia</i> subsp. <i>angustifolia</i>	-	E4	-

Scientific name	Common name	TSC status	EPBC status
33. <i>Pilularia novae-hollandiae</i>	Austral Pillwort	E1	-
34. <i>Prostanthera cryptandroides</i> ssp <i>cryptandroides</i>	-	V; presumed extinct in region	-
35. <i>Psoralea parva</i> (syn. <i>Cullen parvum</i>)	-	E1; presumed extinct in region	-
36. <i>Pterostylis cobarensis</i>	Greenhood Orchid	V	V
38. <i>Ptilotus extenuatus</i>	-	E4	-
39. <i>Pultenaea</i> sp. <i>Olinda</i>	-	E1	-
40. <i>Rhaponticum australe</i> (syn. <i>Stemmacantha australis</i>)	Austral Cornflower	E4	V
41. <i>Rulingia procumbens</i>	-	V	V
42. <i>Sclerolaena napiformis</i>	Turnip Copperburr	E1	E
43. <i>Senecio garlandii</i>	Woolly Ragwort	V	V
44. <i>Senecio georgianus</i>	Grey Groundsel	E4	E4 (extinct)
45. <i>Swainsona murrayana</i>	Slender Darling Pea	V	V
46. <i>Swainsona plagiotropis</i>	Red Darling Pea	V	V
47. <i>Swainsona recta</i>	Mountain Swainson-pea	E1	E
48. <i>Swainsona sericea</i>	Silky Swainson-pea	V	-
49. <i>Taraxacum aristum</i>	Austral Dandelion	Not listed, presumed extinct in region	-
50. <i>Thesium australe</i>	Austral Toadflax	V; presumed extinct in region	V
51. <i>Threlkeldia inchoata</i>	Tall Bonefruit	E1	-

Table A12.3: Listed threatened fauna

Scientific name	Common name	TSC status	EPBC status
Birds			
1. <i>Amytornis striatus</i>	Striated Grasswren	V	-
2. <i>Anseranas semipalmata</i>	Magpie Goose	V	-
3. <i>Ardeotis australis</i>	Australian Bustard	E1	-
4. <i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-
5. <i>Burhinus grallarius</i>	Bush Stone-curlew	E1	-
6. <i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-
7. <i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-
8. <i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-
9. <i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo, Riverina population	E2	-
10. <i>Certhionyx variegatus</i>	Pied Honeyeater	V	-
11. <i>Cinlosoma castanotus</i>	Chestnut Quail-thrush	V	-
12. <i>Circus assimilis</i>	Spotted Harrier	V	-
13. <i>Climacteris affinis</i>	White-browed Treecreeper population in Carrathool local government area south of the Lachlan River and Griffith local government area	E2	-
14. <i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-
15. <i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-
16. <i>Drymodes brunneopygia</i>	Southern Scrub-robin	V	-
17. <i>Falco hypoleucos</i>	Grey Falcon	V	-
18. <i>Glossopsitta pusilla</i>	Little Lorikeet	V	-
19. <i>Grantiella picta</i>	Painted Honeyeater	V	-
20. <i>Grus rubicunda</i>	Brolga	V	-
21. <i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V	-
22. <i>Hieraetus morphnoides</i>	Little Eagle	V	-
23. <i>Hylacola cauta</i>	Shy Heathwren	V	-
24. <i>Lathamus discolor</i>	Swift Parrot	E1	E
25. <i>Leipoa ocellata</i>	Malleefowl	E1	V
26. <i>Limosa limosa</i>	Black-tailed Godwit	V	-
27. <i>Lophoictinia isura</i>	Square-tailed Kite	V	-
28. <i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-
29. <i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-
30. <i>Neochmia ruficauda ruficauda</i>	Star Finch	Presumed extinct	E

Scientific name	Common name	TSC status	EPBC status
31. <i>Neophema pulchella</i>	Turquoise Parrot	V	-
32. <i>Ninox connivens</i>	Barking Owl	V	-
33. <i>Ninox strenua</i>	Powerful Owl	V	-
34. <i>Oxyura australis</i>	Blue-billed Duck	V	-
35. <i>Pachycephala inornata</i>	Gilbert's Whistler	V	-
36. <i>Pachycephala rufogularis</i>	Red-lored Whistler	E4A	V
37. <i>Pedionomus torquatus</i>	Plains-wanderer	E1	V
38. <i>Petroica boodang</i>	Scarlet Robin	V	-
39. <i>Petroica phoenicea</i>	Flame Robin	V	-
40. <i>Pezoporus occidentalis</i>	Night Parrot	Presumed Extinct	E
41. <i>Phaethon rubricauda</i>	Red-tailed Tropicbird	V	-
42. <i>Polytelis swainsonii</i>	Superb Parrot	V	V
43. <i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	-
44. <i>Psephotus pulcherrimus</i>	Paradise Parrot	Presumed Extinct	Extinct
45. <i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V	-
46. <i>Rostratula benghalensis australis</i>	Painted Snipe (Australian subspecies)	E1	-
47. <i>Stagonopleura guttata</i>	Diamond Firetail	V	-
48. <i>Stictonetta naevosa</i>	Freckled Duck	V	-
49. <i>Tyto novaehollandiae</i>	Masked Owl	V	-
50. <i>Xanthomyza phrygia</i>	Regent Honeyeater	E1	E
Mammals			
51. <i>Antechinomys laniger</i>	Kultarr	E1	-
52. <i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-
53. <i>Chalinolobus picatus</i>	Little Pied Bat	V	-
54. <i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	-
55. <i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-
56. <i>Macrotis lagotis</i>	Bilby	E4	V
57. <i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-
58. <i>Myotis macropus</i>	Southern Myotis	V	-
59. <i>Ningauai yvonneae</i>	Southern Ningauai	V	-
60. <i>Nyctophilus timoriensis</i> (South-eastern form)	Greater Long-eared Bat	V	-
61. <i>Petaurus norfolcensis</i>	Squirrel Glider	V	-
62. <i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V
63. <i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-

Scientific name	Common name	TSC status	EPBC status
64. <i>Phascolarctos cinereus</i>	Koala	V	-
65. <i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
66. <i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-
67. <i>Vespadelus baverstocki</i>	Inland Forest Bat	V	-
Reptiles and Amphibians			
69. <i>Aprasia inaurita</i>	Mallee Worm-lizard	E1	-
70. <i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V
71. <i>Crinia sloanei</i>	Sloane's Froglet	V	-
72. <i>Delma australis</i>	Marble-faced Delma	E1	-
73. <i>Litoria raniformis</i>	Southern Bell Frog	E1	V
74. <i>Oxyuranus microlepidotus</i>	Fierce Snake	Presumed extinct	-
75. <i>Suta flagellum</i>	Little Whip Snake	V	-
76. <i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	V	-

^{CE} Critically endangered

^{E1} Endangered

^{E4A} Critically Endangered

^{E4} Presumed Extinct

^{E2} Endangered Population

^V Vulnerable

Appendix 13

Threat status of white cypress vegetation types

Table A13.1: Threat status of white cypress vegetation types

NSW VCA database	Area estimate (ha)				
	Mapped in state forest?	Pre-European	Current	Reserved	Threat status
VCA 279: Blakelys Red Gum – White Cypress Pine woodland on footslopes of hills in central part of the NSW South-western Slopes bioregion	•	12,000	4,000	684	Vulnerable
VCA 356: Blakelys Red Gum x Dirty Gum – White Cypress Pine tall woodland lining sandy watercourses in the NSW South-western Slopes bioregion	-	1,000	400	0	Vulnerable
VCA 54: Buloke – White Cypress Pine woodland in the NSW South-western Slopes bioregion	-	20,000	4,000	600	Endangered
VCA 71: Carbeen – White Cypress Pine – River Red Gum – Bloodwood tall woodland on sandy loam alluvial and aeolian soils in the northern BBS and DRP bioregions	-	20,000	4,500	227	Endangered
VCA 19: Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains	•	1,000	300	8	Endangered
# VCA 229: Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain bioregion	-	1,000	200,000	9935	Least concern
VCA 206: Dirty Gum – White Cypress Pine tall woodland of alluvial sandy lenses (sand monkeys) mainly of the Darling Riverine Plain bioregion	-	30,000	15,000	1084	Vulnerable
# VCA 184: Dwyers Red Gum – White Cypress Pine – Currawang low shrub-grass woodland of the Cobar Peneplain bioregion	-	100,000	80,000	2386	Least concern
VCA 185: Dwyers Red Gum – White Cypress Pine – Currawang shrubby woodland of the NSW South-western Slopes bioregion	-	50,000	40,000	1295	Least concern
* VCA 201: Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South-western Slopes bioregion	•	100,000	6,000	170	Critically Endangered
# VCA 176: Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain bioregion	-	75,000	60,000	7075	Least concern
# VCA 180: Grey Mallee – White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain bioregion	-	40,000	33,000	3523	Least concern
VCA 258: Gum Coolabah – Mugga Ironbark – White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain bioregion and central NSW SWS bioregion	-	32,000	20,000	5	Near threatened
# VCA 104: Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain bioregion	•	1,000,000	750,000	13412	Least concern

NSW VCA database	Area estimate (ha)				
	Mapped in state forest?	Pre-European	Current	Reserved	Threat status
* VCA 110: Inland Grey Box - Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes and Riverina bioregions	•	40,000	10,000	288	Vulnerable
VCA 82: Inland Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain bioregion	-	400,000	100,000	297	Endangered
VCA 80: Inland Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South-western Slopes and Riverina bioregions	•	800,000	140,000	182	Endangered
* VCA 76: Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina bioregions	•	500,000	40,000	30	Critically Endangered
# VCA 134: Ironwood woodland of the semi-arid plains	-	600,000	500,000	30350	Least concern
VCA 255: Mugga Ironbark – Buloke – Pilliga Box – White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South bioregion	-	10,000	5,000	0	Vulnerable
VCA 243: Mugga Ironbark – White Cypress Pine woodland on low rises mainly in the Cobar Peneplain Bioregion	-	40,000	25,000	0	Near threatened
VCA 88: Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South bioregion	•	40,000	25,000	15868	Least concern
# VCA 245: Pine – Belah low open woodland of the western Cobar Peneplain and northern Murray-Darling Depression bioregions	-	155,000	140,000	11800	Least concern
# VCA 246: Pine shrubland of the western Cobar Peneplain bioregion	-	180,000	172,000	0	Least concern
* VCA 56: Poplar Box – Belah woodland on clay-loam soils on alluvial plains of north-central NSW	•	450,000	100,000	299	Vulnerable
# VCA 103: Poplar Box – Gum Coolabah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain bioregion	•	800,000	400,000	12980	Near threatened
* VCA 244: Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	•	1,500,000	400,000	316	Endangered
# VCA 105: Poplar Box grassy woodland on flats mainly in the Cobar Peneplain and Murray-Darling Depression bioregions	•	900,000	500,000	8905	Near threatened
# VCA 98: Poplar Box – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains and BBS bioregions	-	500,000	300,000	11830	Near threatened
VCA 227: Silver-leaved Ironbark – White Cypress Pine on alluvial sandy loam soils in central-north NSW	-	8,000	1,500	0	Endangered

NSW VCA database	Area estimate (ha)				
	Mapped in state forest?	Pre-European	Current	Reserved	Threat status
VCA 319: Tumbledown Gum – White Cypress Pine hill woodland in the southern part of the NSW South-western Slopes bioregion	-	20,000	8,000	0	Vulnerable
VCA 346: White Box – Blakelys Red Gum – White Cypress Pine shrubby woodland on metamorphic hills in the Wagga Wagga region of the NSW South-western Slopes bioregion	-	5,000	2,000	0	Vulnerable
VCA 435: White Box – White Cypress Pine shrub grass hills woodland in the BBS and Nandewar bioregions	-	150,000	50,000	1392	Vulnerable
VCA 267: White Box – White Cypress Pine – Inland Grey Box shrub/grass/forb woodland in the NSW South-western Slopes bioregion	•	70,000	8,000	10	Endangered
VCA 48: White Cypress Pine – Drooping Sheoak grassy open woodland of the Riverine Plain	-	5,000	500	0	Critically Endangered
# VCA 106: White Cypress Pine – Mulga low woodland on siliceous rocky ranges mainly of the Cobar Peneplain	-	150,000	120,000	5200	Least concern
# VCA 69: White Cypress Pine – Mulga shrubland on plains and sandplains in the arid and semi-arid (hot summer) climate zones	-	300,000	120,000	0	Near threatened
# VCA 72: White Cypress Pine – Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain bioregion	•	200,000	120,000	13077	Near threatened
VCA 28: White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	•	300,000	80,000	3928	Vulnerable
VCA 70: White Cypress Pine woodland on sandy loams in central NSW wheatbelt	•	200,000	70,000	40	Vulnerable
VCA 75: Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South-western Slopes bioregions	•	100,000	8,000	357	Endangered

Note: Average error associated with pre-European and current extent estimates is about $\pm 35\%$.

Types associated with the semi-arid rangelands

• Non-*Callitris* type in state forest

Appendix 14

Listed endangered ecological communities and threatened species in south-western cypress state forests

Table A14.1: Listed endangered ecological communities in the south-western cypress state forests

Endangered ecological community	EPBC Act	TSC Act	<i>Callitris</i> potentially present	Area (ha)*
1. <i>Acacia melvillei</i> shrubland in the Riverina and Murray Darling Depression bioregions	-	E	-	90
2. Box-Gum Woodland (EPBC name = White Box – Yellow Box – Blakelys Red Gum Grassy Woodland and Derived Native Grassland)	CE	E	•	4,900
3. Coolibah – Black Box woodland of the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South bioregions	-	E	-	50
4. Fuzzy Box on alluvials of South West Slopes; Darling Riverine Plains and the Brigalow Belt South	-	E	-	10
5. Inland Grey Box Woodland	-	E	•	25,250
6. Myall Woodland in the Darling Riverine Plains; Brigalow Belt (EPBC name = Weeping Myall Woodlands)	E	E	-	150
7. Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South-western Slopes bioregions	-	E	•	-

E Endangered

CE Critically endangered

* Aerial extent estimates are based on similar mapped vegetation types and may underestimate or overestimate the extent of EECs

Table A14.2: Listed threatened flora species recorded in the south-western cypress state forests

Scientific name	Common name	TSC Status	EPBC Status	State Forest(s)
<i>Acacia curranii</i>	Curly-bark Wattle	V	V	Yelkin
<i>Austrostipa metatoris</i>	-	V	V	Denny
<i>Austrostipa wakoolica</i>	-	E	E	Back Yamma, Boxalls, Bulbodney, Bygalore, Carawandool, Clear Ridge, Corringale, Euglo South, Hiawatha, Jingerangle, Lake View, Mairjimmy, Manna, Murda, Wyrra
<i>Brachyscome muelleroides</i>	Claypan Daisy	V	V	Buckingbong
<i>Caladenia arenaria</i>	Sand-hill Spider Orchid	E	E	Buckingbong, Lonesome Pine, Yarranjerry
<i>Diuris pedunculata</i>	Small Snake Orchid	E	E	1 record, not specified
<i>Diuris tricolor</i>	Pine Donkey Orchid	V	-	Blow Clear West, Ganmain, Gillenbah, Jindalee, Moonbooldool, Nandgeryone, Strahorn
<i>Kippistia suaedifolia</i>	Fleshy Minuria	E	-	Weelah
<i>Leionema sympetalum</i>	Rylstone Bell	V	V	Weddin
<i>Pilularia novae-hollandiae</i>	Austral Pillwort	E	-	Kentucky
<i>Pterostylis cobarensis</i>	Greenhood Orchid	V	V	Canbelego
<i>Swainsona murrayana</i>	Slender Darling Pea	V	V	Wahgunyah

E Endangered

V Vulnerable

Table A14.3: Listed threatened fauna species recorded in the south-western cypress state forests

Scientific name	Common Name	TSC status	EPBC Status
Birds			
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo, Riverina population	E2	-
<i>Certhionyx variegatus</i>	Pied Honeyeater	V	-
<i>Cinlosoma castanotus</i>	Chestnut Quail-thrush	V	-
<i>Circus assimilis</i>	Spotted Harrier	V	-
<i>Climacteris affinis</i>	White-browed Treecreeper population in Carrathool local government area south of the Lachlan River and Griffith local government area	E2	-
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-
<i>Drymodes brunneopygia</i>	Southern Scrub-robin	V	-
<i>Falco hypoleucos</i>	Grey Falcon	V	-
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-
<i>Grantiella picta</i>	Painted Honeyeater	V	-
<i>Grus rubicunda</i>	Brolga	V	-
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-
<i>Hylacola cauta</i>	Shy Heathwren	V	-
<i>Lathamus discolor</i>	Swift Parrot	E	E
<i>Leipoa ocellata</i>	Malleefowl	E	V
<i>Limosa limosa</i>	Black-tailed Godwit	V	-
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-
<i>Neophema pulchella</i>	Turquoise Parrot	V	-
<i>Ninox connivens</i>	Barking Owl	V	-
<i>Pachycephala inornata</i>	Gilbert's Whistler	V	-
<i>Petroica boodang</i>	Scarlet Robin	V	-
<i>Petroica phoenicea</i>	Flame Robin	V	-
<i>Polytelis swainsonii</i>	Superb Parrot	V	V
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	-

Scientific name	Common Name	TSC status	EPBC Status
<i>Pyrrholaemus saggitatus</i>	Speckled Warbler	V	-
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E
Mammals			
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-
<i>Chalinolobus picatus</i>	Little Pied Bat	V	-
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	-
<i>Myotis macropus</i>	Southern Myotis	V	-
<i>Nyctophilus timoriensis</i> (South-eastern form)	Greater Long-eared Bat	V	-
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-
<i>Phascolarctos cinereus</i>	Koala	V	-
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-
Reptiles and Amphibians			
<i>Crinia sloanei</i>	Sloane's Froglet	V	-
<i>Litoria raniformis</i>	Southern Bell Frog	E	V

E Endangered

E2 Endangered population

V Vulnerable

Appendix 15

Supporting information for the social and economic assessment

A15.1 Town Resource Cluster analysis

The objective of Town Resource Cluster (TRC) analysis in the current assessment was to establish a relationship between the south-western cypress state forests and specific towns or communities. TRC analysis provides a meaningful unit on which to base development of a Community Sensitivity Index (see **Section A15.3.1**), as well as the collection of other relevant social and economic data. TRC analysis was developed by Fenton, Coakes and Marshall (2003).

Figure A15.1 summarises the conceptual linkage between a relevant natural resource management unit and a socially defined TRC. It illustrates how social and community criteria derived from social assessment processes within a TRC can be used concurrently with environmental and ecological criteria to better identify and inform the management of natural resources.

The TRC methodology in this assessment indicates communities that have direct or indirect links to the resources within the south-western cypress state forests, based on a series of criteria (see **Chapter 4**). However, it does not quantify the probability or extent to which a community may be affected if the use of this resource changed.

For this reason, if significant changes to resource access were to be considered, more thorough consultation would need to be undertaken (for example, community workshops) and the data required to complete a more quantitative assessment would need to be obtained to fully assess the likely socio-economic impacts.

A15.2 Community profiles

This section provides background information on the two communities that have a strong association with the south-western cypress state forests, Condobolin and Narrandera.

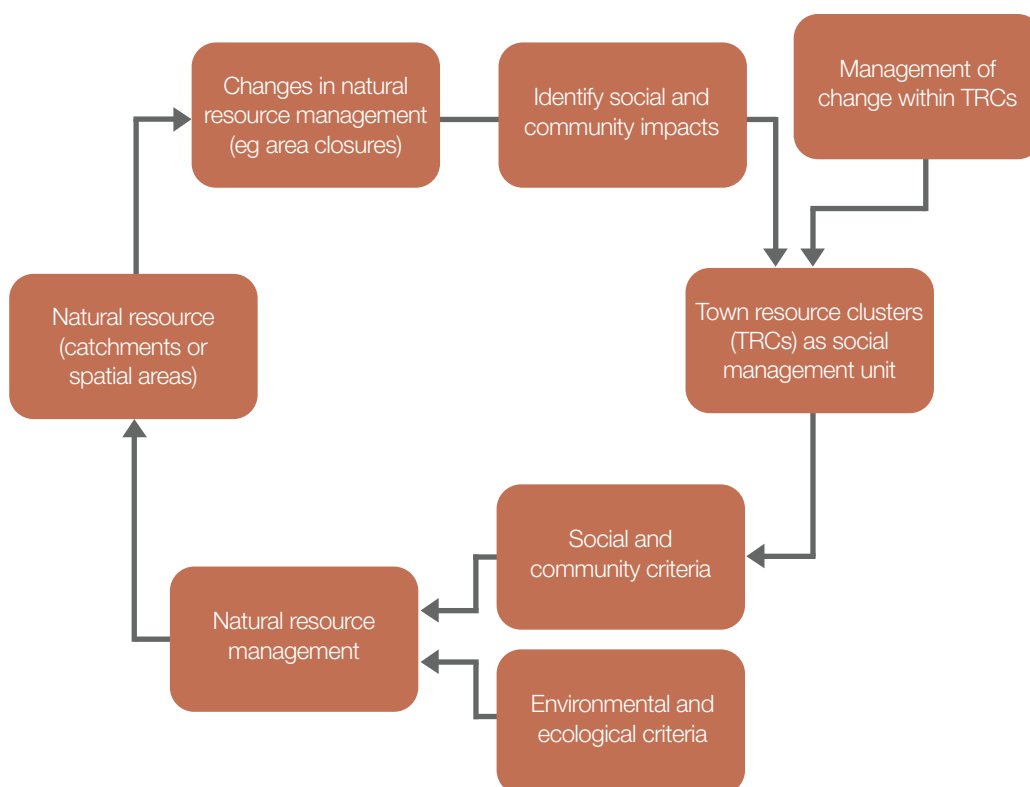
A15.2.1 Condobolin

Condobolin is located in the central west region of NSW, within the Lachlan Shire. The town is located at the junction of the Lachlan River and Goobang Creek, and is eight kilometres south of Mount Tilga, a local landmark.

Condobolin is the main hub of the Lachlan Shire. With an estimated population of 2,847 people, Condobolin is home to approximately 36 per cent of the shire's total population (ABS, 2006). Other major towns in Lachlan Shire include Lake Cargelligo and Tottenham.

Condobolin has an aerodrome, although domestic flights only operate from nearby regional centres such as West Wyalong (100 kilometres), Parkes (100 kilometres) or Griffith (230 kilometres). Countrylink offers coach or bus services into Condobolin, and rail services between Sydney and Adelaide pass through Condobolin once a week.

Figure A15.1: A model for the integration of social and ecological systems



Condobolin is a prime agricultural area. This red-soil plains district has been dominated by grain, sheep and cattle production since the town's historical beginnings in the 19th century. Notably, in 2000, the silos at Condobolin received the largest volume of grain recorded across the eastern states – 216,000 tonnes (Western Plains Regional Development, 2010). Condobolin is also a retail and service hub for the region's farming and agricultural community.

As shown in **Figure A15.2**, the agricultural and retail trade sectors have remained key employers over the last two census periods, each employing around 13 per cent of Condobolin's local workforce. Condobolin's workforce tends to have trade-based expertise and skills. A large proportion of the town's residents have completed their schooling to year 12 level, and pursued further education in the form of vocational or diploma training (ABS, 2001; 2006).

Since 2000, agricultural production in the region has been affected by drought. This has had a flow-on effect to most industries, leading to decreased economic activity across most sectors in Condobolin. In turn, unemployment has increased and some Condobolin residents are migrating to other regional centres in search of work (Lachlan Shire Council, 2010).

Since the 2001 census, Condobolin has experienced a 5.7 per cent population decline. This trend is mirrored in the decline in Lachlan Shire's population, which fell by more than 10 per cent between 1996 and 2006. Specifically, Lachlan Shire Council has identified young people are leaving Condobolin to gain employment or further education.

In contrast, the Indigenous population in Condobolin is increasing. In the 2006 census, the Indigenous community made up 21.5 per cent of Condobolin's total population. By comparison, Indigenous people comprise only 14.8 per cent of Lachlan Shire's total population, and only around 2 per cent of NSW's population (Lachlan Shire Council, 2010; ABS, 2006).

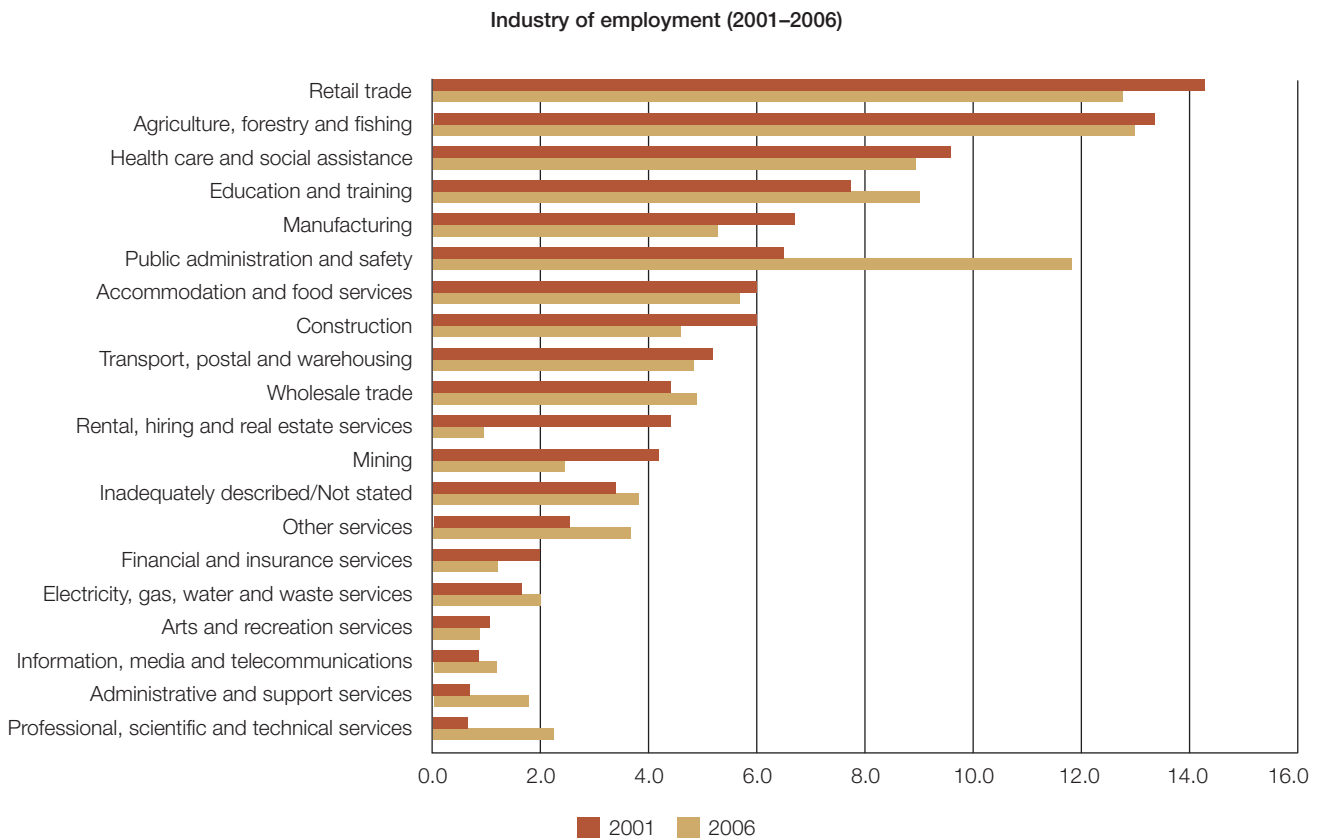
There have been some areas of the economy that have remained stable, or experienced growth, in recent years. Lachlan Shire Council (2010) regards the cypress timber industry as one of the few industries in the region that is relatively unaffected by the drought. Also, the public administration and safety sector has undergone a significant 5.4 per cent growth following the 2001 census period (ABS, 2001; 2006).

Condobolin is currently the central office for the Lachlan Shire Council. In addition to benefiting from public administration employment, Condobolin also hosts a variety of community events, which include the Don Brown Merino Sheep competition, art and craft exhibitions and annual shows.

Table A15.1 provides an overview of Condobolin's access to other key social services and infrastructure.

Despite being in a remote area, Condobolin has access to key health services, including child and adolescent mental health, alcohol and drugs counselling, as well as physiotherapy and occupational therapy. Condobolin also has dedicated Indigenous health services, which support the town's large Indigenous community.

Figure A15.2: Condobolin industry of employment



Source: ABS (2001, 2006)

Table A15.1: Social infrastructure and community services – Condobolin

Education / Training	Health / Support services	Recreation / Youth and general community	Information accessibility
<ul style="list-style-type: none"> • Pre-school kindergarten specialising in early childhood development • Public high school and primary school • Faith based schools, including Catholic primary school and Bretheren high school • A TAFE campus for further education, although tertiary course selection is limited so students tend to travel to larger urban centres for further tertiary education 	<ul style="list-style-type: none"> • 33–bed acute care including maternity ward and paediatric services • Services include basic medical care, regular specialist visits, sexual and environmental health programs, alcohol and drugs counselling, mental health care, as well as allied health care, such as physiotherapy and occupational therapy • Aged care services, which include aged accommodation, home and community care services, as well as Meals on Wheels 	<ul style="list-style-type: none"> • Community centre which holds regular arts and crafts and historical events • Recreational water facilities at Gum Bend Lake • A variety of sporting clubs, which include golf courses, bowling clubs, an Olympic-sized heated swimming pool, as well as tennis courts and cricket grounds • Family day care services licensed through the State Department of Community Services, as well as a mobile child care service 	<ul style="list-style-type: none"> • Public library with facilities that include computers for public use, as well as internet access and printing services • Access to an online library via the Lachlan Shire Council's website

As a community, Condobolin recorded an overall voluntary participation rate of 25.9 per cent (ABS, 2006). While this rate is lower than the Lachlan Shire's average of 32.1 per cent, it is notably higher than the NSW State average of 17.1 per cent. An example of Condobolin's community and social capital is the Lachlan Aged and Community Service organisation, which assists people who are aged or have a disability through social support and Meals on Wheels services. This organisation relies heavily on volunteers.

Tourism and recreation in Condobolin is often centred on recreational water activities, such as fishing, water skiing, swimming and boating. The Lachlan River and Gum Bend Lake are popular attractions for both tourists and locals, and there are camping facilities located along the edge of Gum Bend Lake. Recent droughts have had impacts on the area's popular waterways.

A15.2.2 Narrandera

The town of Narrandera falls within the Shire of Narrandera in southern NSW. Narrandera is situated on the Murrumbidgee River and lies on the junction of both the Newell and Sturt Highways. Other regional centres nearby are Leeton (35 kilometres), Griffith (85 kilometres) and Wagga Wagga (95 kilometres).

Narrandera is one of the more accessible regional towns in southern NSW, given its location on the junction of major highways. Narrandera is serviced by a local airport, with domestic flights into Sydney. Narrandera also has express bus services with routes to Melbourne, Adelaide, Sydney and Brisbane. Daily bus services also provide connections to rail services to Sydney or Melbourne.

Narrandera has a population of 3,961 people, comprising 65 per cent of the shire's total population (ABS, 2006). Since the 2001 census, Narrandera has experienced a 3.8 per cent decline in population. A significant number of males have moved away from the area seeking employment or education. In 1996 the number of males per 100 females was 98.9; however, by 2006 this figure had decreased to 91.6 (DPI, 2009). Also, the elderly dependency ratio has increased over this period and the average age of residents is 42 years, compared with 37 years nationally (DPI, 2009; Narrandera Shire Council, 2010). These figures indicate it is primarily young people who are leaving the town (DPI, 2009).

On the other hand, the region's Indigenous population has increased over the last two census periods, marking an average 1.6 per cent growth. The Indigenous community made up 9.3 per cent of Condobolin's total population. This is less than the Shire's proportion of Indigenous population (12.5 per cent), but more than NSW's Indigenous population (ABS, 2006).

Narrandera is in a highly fertile region with diverse agricultural activities taking place around the town. To the east is an expansive dryland area dedicated to the cultivation of cereal crops, sheep and wool production. To the west is the Murrumbidgee Irrigation Area, which is fed by water from the Burrinjuck Dam. The Irrigation Canal, which carries water to the Murrumbidgee Irrigation Area, flows through the town.

The Murrumbidgee Irrigation Area is central to the wider region's agricultural industry, where irrigation has enabled the production and commercial enterprise of a range of agricultural produce ranging from rice and cereal through to citrus, wine, grapes and potatoes.

Narrandera’s local workforce, however, is employed in a diverse range of sectors. For instance, the construction, education and training, retail trade, and, arts and recreation sectors are all more significant employers within the town than the agriculture, forestry and fishing sectors. A breakdown of employment by industry is provided in **Figure A15.3**.

The education and training sector has undergone a 2 per cent growth in employment rate over the last two census periods. Also noteworthy is growth in the wholesale trade sector which is currently employs up to 6.5 per cent more of Narrandera’s local workforce compared with the 2001 census. The cypress forestry industry within Narrandera is also identified as a growing sector, and recognised as one of the few industries not impacted by the severe drought across the region (Narrandera Shire Council, 2010a). Investment in this industry by mills and the NSW Government has led to growth and increased employment in the region in recent years (DPI, 2009).

Overall, however, unemployment in Narrandera is rising despite a declining population (DPI, 2009). Since 2001, the most significant employment decline has been in the agricultural sector, along with a notable decrease in the construction industry. The agricultural sector has been affected by a downturn in the rice industry following the prolonged drought and subsequent water shortages (DPI, 2009). Another major agricultural employer, Rockdale Feedlot, has also halved its workforce and productivity as a result of the drought (Narrandera Shire Council, 2010a).

Narrandera Shire Council sees significant challenges for the community’s future growth, given its ageing population and

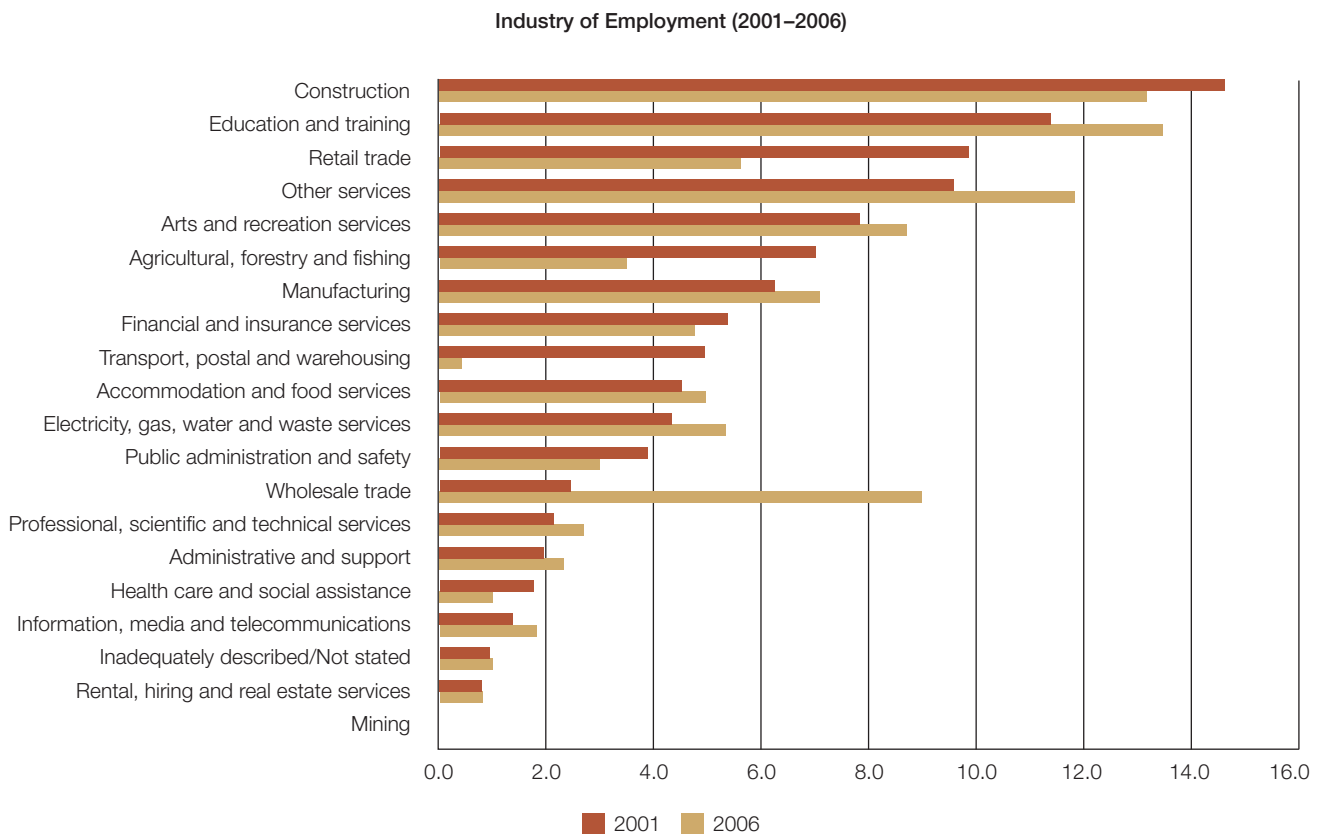
declining opportunities for employment (Narrandera Shire Council, pers. comm., 5 March 2010). In addition to pressure on the agricultural sector due to drought, Narrandera has also lost significant government employers, including Telstra and State Rail (Narrandera Shire Council, 2010a). These businesses have either downsized or relocated, contributing to the loss of skilled employment opportunities within the town.

Narrandera’s workforce is characterised by a dominant proportion of labourers and technicians or trades workers, relative to managers and professionals. Narrandera’s residents are more likely to have completed Year 10 in pursuit of vocational or diploma training, as opposed to completing their schooling at Year 12 in anticipation of enrolment in university courses (ABS, 2001, 2006). Narrandera Shire Council (2010) have raised concerns that the demographics and age of the workforce within Narrandera mean that many workers may face long term unemployment if there were further job losses in the agriculture, forestry and fishing sectors.

The Narrandera Shire is being proactive in developing its social capital. For instance, as part of the shire’s five-year Strategic Plan (2006–2011), the shire has embraced a ‘Community Achievement’ initiative. This involves building the capacity of local communities to engage in volunteerism and to support cultural activities and asset conservation. **Table A15.2** provides an overview of Narrandera’s access to key social services and infrastructure

While Narrandera Shire may have a significant proportion of elderly dependents (DPI, 2009), the shire has in place a number of aged care and respite facilities to support its ageing

Figure A15.3: Narrandera industry of employment



Source: ABS (2001, 2006)

Table A15.2: Social infrastructure and community services – Narrandera

Education / Training	Health / Support services	Recreation / Youth and general community	Information accessibility
<ul style="list-style-type: none"> • Early Learning Centre and Pre-School located in the town, as well as a Playgroup • Three primary schools, which include the Narrandera East Infants School, Narrandera Primary, as well as the Catholic St Joseph's School • One high school (Narrandera High) • A TAFE (Riverina TAFE campus) for further education 	<ul style="list-style-type: none"> • Narrandera District Hospital – 34-bed providing acute and community health care services, including emergency, medical, surgical, high dependency, obstetric and paediatric care. Regional referral hospital is at Wagga, an hour's drive away • Other allied health care services include the aged activity centre, asthma and diabetes education programs, mental health counselling, as well as drug and alcohol education • Cancer support groups, indigenous health and support networks • Aged care and Respite services, which include the Teloca House, a 45-bed low care Aged facility, as well as the Narrandera Shire Council Home and Community Care / Support Services network 	<ul style="list-style-type: none"> • Recreational water complex at Lake Talbot • Narrandera Sport Stadium which accommodates indoor sporting activities; stadium also serves the purpose of a community hall, hosting community functions, such as travel shows, craft fairs and exhibitions • Narrandera Sports Ground has a capacity of 15,000 for sporting matches, and a capacity of 25,000 for musical events and concerts • A large variety of sporting and recreational clubs, which include tennis, bowling, water-skiing, flying and dancing, as well as pony riding 	<ul style="list-style-type: none"> • Public library with facilities that include computers for public use, as well as internet access and printing services • Mobile library service which services house-bound community residents, visiting the Teloca House and other aged-care homes in the town • Access to an online library via the Narrandera Shire Council's website

population. In addition, there are also recreational and social groups tailored specifically for Narrandera's elderly. As part of the Narrandera Shire Council's 2008 – 2011 Management Plan, aged care support services in Narrandera are currently being reviewed to ensure adequate support and resources are accessible to the local community.

According to the 2006 census, Narrandera recorded an overall voluntary participation rate of 23.1 per cent, which is greater than the NSW average of 17.1 per cent. Local initiatives include the Narrandera Social Support Service, providing social contact or companionship to help people participate in community life, and the Narrandera Home Modification and Maintenance Service, which provides modification and some maintenance work for people who are aged or disabled. These initiatives allow people to live more independently and be a part of the broader community.

The Narrandera Shire also hosts a number of different community events each year. Through these events, it is expected that the community's social fabric would be strengthened. A key event includes the John O'Brien Bush Festival, which takes place across a number of different venues in Narrandera. This festival celebrates the Australian bush culture and heritage. Other community events held in Narrandera include the Easter Hot-rod Rally and the Camellia Show.

Finally, recreation for both tourists and the Narrandera community centres on local watercourses. The eastern end of Lake Talbot is a popular spot for locals and visitors to pursue recreational water sports such as water-skiing. Towards the west of the Lake is a wetlands conservation area and walking track, home to native water plants, ground trees and water birds. The Narrandera area also supports recreational fishing, particularly on the Murrumbidgee River and the back area of Lake Talbot where the Murray cod, yellowbelly and redfin are known to be abundant.

A15.3 Community sensitivity analysis

Community sensitivity, and conversely adaptive capacity, can be assessed by examining the state of a community's assets. Community Sensitivity Analysis provides an assessment of the strength of these communities' natural, economic, human, social and physical capitals. The Community Sensitivity Analysis framework was developed by Coakes and Sadler (in preparation) and is shown in **Figure A15.4**.

Figure A15.4: Community capitals framework



Source: Adapted from Coakes Consulting

The conceptual framework for the analysis was based on the assumption that a community’s capacity to adapt to change is dependent on the status of its economic, physical, human and social capitals. Central to the framework is the interrelationship between capitals. Where one capital is depleted, other community capitals are also likely to become compromised. For example, the depletion of human capital through deterioration of education levels or community health is likely to impact on social and economic capitals.

Assessing the status of a community’s key capital areas should provide a sound indication of that community’s overall sensitivity to changes in industry activities.

A15.3.1 The Community Sensitivity Index

A Community Sensitivity Index (CSI) is used within a community sensitivity analysis to provide a relative assessment of the strength of these communities’ natural, economic, human, social and physical capitals, and their respective capacity to adapt to change (Coakes and Sadler, in preparation). The CSI indicates a community’s sensitivity relative to other communities included in the analysis, with a high score indicating higher sensitivity and a low score reflecting greater adaptive capacity.

A15.3.2 Application of Community Sensitivity Analysis to the current assessment

For the current assessment, a CSI was developed for each of those communities identified in **Sections 4.6.1** and **4.6.2** as having a direct or indirect linkage to the south-western cypress state forest resources (with the exception of indirectly linked coastal NSW and interstate communities).

The CSI was developed using readily available ABS data and other relevant social and economic indicator sources to identify the relative sensitivity or vulnerability of directly linked communities. The CSI comprises a number of specific sub-indices that are weighted to form an additive index that provides a relative measure of the communities’ sensitivity or vulnerability to change. The indicators selected for the current assessment are summarised in **Table A15.3**.

The main instrument used within the Community Sensitivity Analysis is the CSI. As it has been developed for the current assessment, this CSI provides an indication of a community’s capacity to respond and adapt to change in general terms. It is a relative index, meaning it measures the sensitivity of communities relative to each other. However, it is assumed that any change applied to the communities will have an equally significant impact on each of those communities. As a result, the CSI does not take into account the nature and extent of the change. Furthermore, although an indicator related to the cypress industry was included in the index, it should be recognised that the index is not strongly geared towards measuring sensitivity to change occurring specifically in the cypress industry.

As the CSI is a relative measure, it should also be recognised that the communities that returned low scores on the index do not necessarily have high adaptive capacity, only that they are potentially more able to adapt than the communities that returned low scores. Therefore, as the index only allows for an understanding of which of these communities are more or less vulnerable, it may be the case that all communities included in the analysis are particularly vulnerable to change.

Finally, some compromises were made during the selection of indicators depending on what data were readily available through secondary sources. Therefore, natural capital was not assessed, and the physical and social capital indicators were less comprehensive and diverse than the human and economic indicators.

When interpreting the findings of the analysis, it is also important to understand that the overall CSI, the capital vulnerability sub-indices that constitute it, and the individual indicators from which those sub-indices were derived, are designed only to indicate sensitivity and/or adaptive capacity. For instance, the presence or absence of a library is used to indicate physical capital vulnerability, because a community that does not have a library is very likely to be lacking in many other areas of built capital. It is not necessarily the case, however, that having a library causes a community to have more capacity to adapt to change.

The CSI is best used as a tool to stimulate discussion, and to identify areas in which to undertake more detailed social and economic assessment and higher levels of consultation with stakeholders.

Table A15.3: Summary of Community Sensitivity Index indicators and data source

Indicator	Variable(s)	Analysis / Measurement Procedure	Data Source
Economic Capital	Government housing	% of renters who are renting from Government or community organisations	2006 census (ABS, 2006)
	Income levels	% of households with an income less than \$500 per week	2006 census (ABS, 2006)
	Employment status	% of total persons in the labour force who are unemployed	2006 census (ABS, 2006)
	Child dependency	Number of dependent-aged children as a proportion of employed persons	2006 census (ABS, 2006)
	Family structure	Per cent of total number of families that are one-parent families with dependent children	2006 census (ABS, 2006)
	Economic diversity	Herfindahl Index, which squares the market-share of commercial and industry activities, and then sums those squares. A high score on the index reflects lower industry diversity of employment.	ABS ANZSIC Industry of Employment data, 2006
Commercial economic activities	Employment in areas relating to white cypress	Per cent of employed persons over the age of 15 years employed by sawmills processing cypress or Forests NSW (to manage cypress forests).	Stakeholder consultation (Grants Holdings and Forests NSW)
Service accessibility	Index of remoteness	ARIA+, which is the standard ABS-endorsed measure of remoteness, derived from measures of road distance between populated localities and service centres. It has score values ranging 0 – 15, where the higher the score, the more remote the locality.	GISCA Applications (http://www.gisca.adelaide.edu.au/web_aria/aria/aria.htm)
Physical Capital	Internet access	Per cent of total population who do not have access to the internet	2006 census (ABS, 2006)
	Information accessibility	Accessibility to public library services	http://www.sl.nsw.gov.au/services/public_libraries/docs/public-libraries-nsw.pdf
Human Capital	Post-school qualifications	Per cent of persons aged 15 years or over without post-school qualifications	2006 census (ABS, 2006)
	School completion	Per cent of persons aged 15 years or over who left school before Year 10	2006 census (ABS, 2006)
	School attendance	Per cent of persons aged 15 years or over who never attended school	2006 census (ABS, 2006)
	Low skilled occupations	Per cent of employed persons over the aged of 15 years who are employed as labourers or community and personal service workers	2006 census (ABS, 2006)
At-risk groups	Minority / vulnerability groups	Per cent of total population who do speak English well or at all Per cent of total population who are disabled and require care Per cent of people aged 65 years or above as proportion of total population Per cent of people aged over 15 years who provide unpaid care or assistance to people with disabilities	2006 census (ABS, 2006)
	Mobility	Per cent of total population with a different address five years ago	2006 census (ABS, 2006)
Social Capital	Cultural diversity	Per cent of total population who were not born in Australia and who do not speak English well or at all	2006 census (ABS, 2006)
	Rate of migration influx	Per cent of total population who were not born in Australia	2006 census (ABS, 2006)
	Participation in not-for-profit voluntary organisations	Per cent of total population who do not provide voluntary services to not-for-profit organisations	2006 census (ABS, 2006)

Table A15.4: Summary of indicator values for directly and indirectly linked communities

Economic capital	Cootamundra										Average					
	Baradine	Trundle	Condobolin	Narrandera	Griffith	Eugowra	Forbes	Leeton	Tumut	Wagga Wagga		Grong Grong	Dubbo	Young	Parkees	
Proportion of renters renting from Government or community organisations	21%	26%	38%	21%	21%	25%	26%	23%	29%	23%	0%	23%	19%	34%	26%	24%
Proportion of households with weekly household income less than \$500	38%	46%	29%	30%	22%	38%	31%	26%	29%	21%	19%	21%	30%	33%	30%	30%
Unemployment rate – proportion of total adult population who are unemployed	11%	9%	10%	7%	5%	7%	8%	6%	8%	6%	3%	6%	7%	9%	9%	7%
Childhood burden – number of dependent-aged children as a proportion of employed persons	53%	45%	58%	53%	52%	36%	57%	56%	53%	46%	44%	54%	56%	52%	57%	51%
Proportion of one-parent families with dependent children	6%	16%	14%	15%	10%	7%	14%	12%	11%	12%	7%	14%	14%	11%	12%	12%
Industrial Diversity Index	0.0347	0.0374	0.0204	0.0177	0.0151	0.0274	0.0122	0.0181	0.0133	0.0118	0.0783	0.0115	0.0133	0.0156	0.0129	0.0226
Proportion of employment in cypress jobs (mills, FNSW employees)	1.15%	0.00%	1.31%	2.50%	0%	0%	0%	0%	0%	0%	1.11%	0%	0%	0%	0%	0%
Human capital																
Proportion of total adult population with no post-school qualification	93%	90%	90%	91%	87%	94%	89%	87%	88%	81%	88%	85%	89%	89%	89%	89%
Proportion of total adult population who left school before Year 10	33%	26%	25%	27%	21%	30%	24%	21%	25%	16%	20%	19%	25%	25%	23%	24%
Proportion who never attended school	0.82%	0.00%	1.21%	0.32%	1.72%	1.29%	0.40%	0.67%	0.32%	0.27%	0.00%	0.51%	0.57%	0.38%	0.34%	1%
Proportion employed as labourers or related workers	17%	15%	14%	19%	19%	20%	14%	19%	18%	12%	9%	13%	19%	17%	12%	16%
Proportion employed as community and personal service workers	12%	13%	12%	11%	8%	14%	10%	7%	9%	10%	7%	10%	9%	11%	10%	10%
Core activity need for assistance	8%	10%	6%	8%	5%	8%	6%	5%	5%	4%	4%	5%	6%	7%	5%	6%

Table A15.4: Summary of indicator values for directly and indirectly linked communities cont.

	Baradine	Trundle	Condobolin	Narrandera	Griffith	Eugowra	Forbes	Leeton	Tumut	Wagga Wagga	Grong Grong	Dubbo	Young	Cootamundra	Parkes	Average
Proportion of retirees aged 65 years and over	24%	24%	19%	21%	15%	27%	19%	16%	17%	13%	13%	13%	20%	22%	17%	19%
Proportion who provide unpaid assistance to people with disabilities	14%	16%	13%	11%	10%	14%	10%	11%	10%	10%	11%	10%	11%	13%	12%	12%
Physical Capital																
ARIA+ remoteness Index	6.1	4.81	5.03	2.48	3.3	3.23	2.62	2.58	1.36	1.03	2.48	1.95	1.99	1.67	2.46	2.87
No access to the internet	63%	60%	59%	58%	47%	52%	53%	51%	49%	40%	43%	44%	54%	54%	50%	52%
Access to a public library	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	-
Social Capital																
Population mobility – proportion with a different address five years ago	10%	14%	15%	14%	17%	8%	16%	14%	15%	20%	7%	18%	20%	13%	17%	14%
Cultural diversity (% of immigrants who do not speak English)	0%	0%	0%	3%	22%	0%	6%	12%	2%	4%	0%	6%	7%	4%	5%	5%
Rate of migration influx (% of population not born in Australia)	5%	6%	3%	4%	18%	7%	4%	7%	7%	7%	4%	5%	5%	5%	5%	6%
Proportion who do not volunteer	66%	63%	66%	67%	71%	62%	67%	66%	67%	72%	56%	70%	71%	65%	70%	67%

¹ Calculations based on Coakes Consulting survey and ABS (2006)

Appendix 16

Profiles for south-western cypress state forests

Table 1: Explanation of forest profile parameters

Number	Parameter	Explanation
1	State forest	Name of the state forest
2	Area	Gross area in hectares
3-5	Composition of the forest area where vegetation data is available	<p>White cypress – means white cypress dominates the forest</p> <p>Associated woodland – means white cypress is found in association with other species (mainly with <i>Eucalyptus spp.</i>)</p> <p>Other vegetation - means other vegetation which is not considered to represent cypress-dominant or cypress-associated woodland.</p>
6	Percentage of forest where vegetation data is not available	Self-explanatory
7-10	Forest Management Zones	<p>Forest Management Zones within the state forest:</p> <p>Zone 1 – Special Protection</p> <p>Zone 3A – Harvesting Exclusions</p> <p>Zone 3B – Special Prescription</p> <p>Zone 4 – General Management</p> <p>Zone 6 – Softwood Plantations</p> <p>Zone 7 – Non Forestry Use</p> <p>Zone 8 – Areas for further assessment</p>
11-12	Proportion of forest which may contain threatened vegetation communities	<ul style="list-style-type: none"> Vegetation communities listed under the <i>Threatened Species Conservation Act 1995</i> (TSC Act) and/or <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) Vegetation communities assessed under the New South Wales Vegetation Classification and Assessment (Benson 2006, 2008; Benson et al. 2006; Benson et al. in preparation) as threatened according to the guidelines of the International Union for Conservation of Nature (IUCN)
13-14	Listed threatened species	<p>Threatened species and their listing status under the TSC Act and EPBC Act:</p> <ul style="list-style-type: none"> fauna species recorded within 10 kilometres of the State Forest flora species recorded in the state forest.

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Albert	1062	94%	6%	0%	0%	0%	2%	1%	97%	6%	94%	8(2)	0(0)
Ardlethan	184	99%	0%	0%	0%	0%	32%	0%	68%	0%	100%	9(1)	0(0)
Back Creek	1008	61%	18%	0%	21%	0%	6%	2%	91%	16%	61%	11(1)	0(0)
Back Yamma	4416	88%	10%	1%	0%	0%	2%	5%	91%	9%	89%	21(3)	1(1)
Bald Hill	152	0%	68%	0%	32%	0%	1%	0%	99%	0%	0%	6(1)	0(0)
Balgay	1102	0%	77%	0%	23%	0%	2%	11%	86%	27%	50%	7(0)	0(0)
Balowra	2063	62%	36%	2%	0%	83%	0%	0%	17%	0%	95%	1(0)	0(0)
Banandra	762	0%	57%	43%	0%	0%	0%	4%	96%	0%	33%	12(4)	0(0)
Barbingal	272	91%	0%	0%	9%	0%	2%	0%	98%	0%	91%	1(1)	0(0)
Barrow	1226	0%	66%	34%	0%	0%	2%	20%	79%	0%	100%	2(1)	0(0)
Beckom	137	89%	4%	1%	5%	0%	31%	0%	69%	0%	90%	6(1)	0(0)
Bedooba	1665	0%	85%	15%	0%	0%	10%	0%	88%	0%	15%	0(0)	0(0)
Bendick Murrell	1862	0%	0%	0%	100%	0%	100%	0%	0%	0%	0%	17(3)	0(0)
Berewombenia	186	7%	92%	0%	0%	0%	1%	0%	99%	92%	7%	1(0)	0(0)
Berida	68	0%	90%	6%	5%	0%	9%	0%	91%	1%	95%	7(1)	0(0)
Berrigan	286	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	4(2)	0(0)
Berry Jerry	1337	0%	5%	95%	1%	0%	9%	4%	87%	5%	95%	15(2)	0(0)
Bimbi	2575	92%	1%	1%	6%	0%	2%	3%	95%	3%	92%	20(4)	0(0)
Binya	4174	93%	4%	0%	2%	0%	4%	7%	88%	0%	94%	30(5)	0(0)
Blow Clear	126	100%	0%	0%	0%	0%	0%	100%	0%	0%	100%	4(0)	0(0)
Blow Clear West	1912	0%	1%	92%	6%	0%	3%	1%	96%	94%	0%	9(2)	0(0)
Blue Mallee	283	0%	0%	100%	0%	23%	1%	0%	75%	0%	100%	27(6)	0(0)
Bobadah	106	0%	100%	0%	0%	0%	1%	0%	99%	0%	100%	8(0)	0(0)
Bogalong	113	0%	40%	0%	60%	0%	4%	0%	96%	40%	0%	19(5)	0(0)
Booberoi	834	0%	78%	22%	0%	0%	0%	0%	100%	1%	99%	2(1)	0(0)
Boona	1185	0%	23%	77%	0%	0%	0%	21%	78%	8%	10%	10(2)	0(0)
Booorooban	1441	14%	5%	36%	45%	0%	100%	0%	0%	18%	0%	5(2)	0(0)
Bourbah	623	0%	99%	0%	1%	0%	0%	0%	100%	0%	99%	12(1)	0(0)
Boxalls	402	78%	19%	3%	0%	0%	0%	0%	100%	19%	81%	12(1)	1(1)
Bretts	735	0%	29%	71%	0%	0%	0%	0%	100%	4%	15%	10(2)	0(0)

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Broken Range	410	0%	98%	2%	0%	0%	3%	0%	97%	1%	99%	0(0)	0(0)
Brookong	333	100%	0%	0%	0%	0%	1%	0%	98%	0%	100%	6(0)	0(0)
Buckingbong	11672	93%	1%	1%	4%	1%	0%	2%	96%	2%	94%	16(3)	5(5)
Buddigower	641	0%	0%	5%	95%	0%	7%	5%	88%	0%	5%	26(6)	0(0)
Buggajool	390	60%	37%	3%	0%	0%	100%	0%	0%	0%	63%	8(1)	0(0)
Bulbodney	2390	0%	98%	0%	2%	0%	2%	2%	96%	96%	2%	5(1)	1(1)
Bunganbil	460	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	10(0)	0(0)
Bygalore	257	0%	0%	99%	1%	0%	2%	0%	98%	0%	99%	2(1)	1(1)
Cadow	58	0%	0%	98%	2%	0%	8%	12%	62%	0%	98%	1(0)	0(0)
Calleen	17	0%	100%	0%	0%	0%	8%	0%	92%	100%	0%	1(0)	0(0)
Canbelego	1494	0%	100%	0%	0%	0%	7%	0%	93%	0%	100%	5(2)	1(1)
Caragabal	409	89%	0%	10%	1%	0%	0%	5%	95%	0%	99%	3(1)	0(0)
Carawandool	1321	26%	44%	0%	31%	0%	1%	13%	86%	44%	26%	4(0)	1(1)
Cargelligo	583	6%	94%	0%	0%	0%	5%	12%	83%	74%	6%	11(1)	0(0)
Carolina	479	32%	68%	0%	0%	0%	0%	11%	89%	8%	92%	12(0)	0(0)
Carrabear	174	0%	100%	0%	0%	0%	0%	0%	100%	0%	100%	13(1)	0(0)
Carrobbolin	140	0%	0%	2%	98%	0%	0%	0%	100%	0%	2%	4(0)	0(0)
Clear Ridge	304	4%	96%	0%	0%	0%	16%	0%	84%	0%	4%	4(1)	1(1)
Combaning	766	0%	0%	0%	100%	0%	3%	97%	0%	0%	0%	15(3)	0(0)
Conapaira East	1027	95%	0%	4%	0%	0%	0%	15%	85%	0%	100%	10(2)	0(0)
Conapaira South	1892	51%	19%	0%	29%	0%	19%	0%	72%	0%	51%	23(3)	0(0)
Condobolin	<1	0%	0%	4%	96%	0%	0%	0%	0%	0%	4%	5(0)	0(0)
Cookamidgera	530	0%	2%	0%	98%	0%	5%	11%	84%	2%	0%	13(2)	0(0)
Cope	1507	0%	0%	92%	8%	0%	7%	0%	93%	2%	0%	19(2)	0(0)
Coradgery	784	37%	46%	0%	17%	0%	4%	4%	92%	29%	37%	6(1)	0(0)
Coreen	374	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	8(0)	0(0)
Corringle	726	100%	0%	0%	0%	0%	0%	0%	100%	0%	85%	5(1)	1(1)
Cowal	504	84%	14%	0%	2%	0%	0%	0%	100%	0%	98%	6(1)	0(0)
Cullivel	165	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	3(0)	0(0)
Cumbijowa	250	0%	0%	99%	1%	0%	2%	15%	83%	1%	98%	4(0)	0(0)

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cumbine	10752	75%	15%	0%	10%	0%	3%	3%	93%	0%	90%	9(0)	0(0)
Curra	274	0%	0%	98%	2%	0%	0%	0%	100%	98%	0%	6(1)	0(0)
Curraurrama	531	5%	0%	76%	18%	0%	0%	3%	97%	76%	5%	0(0)	0(0)
Currajong	233	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	16(2)	0(0)
Currawananna	237	36%	0%	1%	62%	0%	9%	6%	51%	0%	38%	16(3)	0(0)
Denny	134	0%	54%	0%	46%	0%	0%	0%	100%	0%	2%	8(0)	1(1)
Derriwong	61	16%	21%	0%	63%	0%	4%	0%	96%	21%	16%	4(1)	0(0)
Dubbo	2	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	23(6)	0(0)
Dungeree	801	0%	0%	99%	1%	0%	3%	2%	12%	0%	39%	6(2)	0(0)
East Cookeys Plains	2393	21%	10%	53%	16%	0%	3%	5%	91%	63%	21%	6(1)	0(0)
Edgar	637	51%	0%	27%	22%	0%	100%	0%	0%	78%	0%	3(2)	0(0)
Edols	166	0%	34%	0%	66%	0%	4%	0%	96%	34%	0%	4(0)	0(0)
Eringaneirin	58	87%	5%	6%	1%	0%	9%	0%	91%	1%	98%	9(1)	0(0)
Euchabil	212	0%	0%	74%	26%	0%	1%	0%	99%	74%	0%	6(1)	0(0)
Euglo South	1592	91%	9%	0%	0%	0%	0%	1%	99%	0%	100%	5(0)	1(1)
Eurabba	753	2%	0%	47%	51%	0%	0%	3%	97%	47%	2%	4(1)	0(0)
Fifield	108	72%	0%	0%	28%	0%	11%	0%	89%	0%	72%	4(1)	0(0)
Forbes	2	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	14(3)	0(0)
Ganmain	979	85%	14%	0%	1%	0%	0%	13%	87%	0%	99%	8(1)	1(1)
Gap Dam	260	0%	38%	0%	62%	0%	58%	42%	0%	13%	0%	22(3)	0(0)
Gilgandra	190	93%	5%	0%	2%	0%	0%	0%	100%	1%	97%	4(1)	0(0)
Gilgunnia	865	0%	39%	61%	0%	0%	4%	0%	96%	0%	100%	1(0)	0(0)
Gillenbath	3128	100%	0%	0%	0%	0%	0%	5%	95%	0%	100%	21(3)	1(1)
Gilwarry	3498	3%	94%	1%	2%	0%	0%	7%	93%	0%	98%	0(0)	0(0)
Gin Gin	39	0%	1%	99%	0%	0%	97%	0%	0%	0%	100%	3(0)	0(0)
Girilambone	972	0%	93%	7%	1%	0%	1%	0%	99%	5%	94%	1(0)	0(0)
Goolgowi	101	0%	100%	0%	0%	0%	0%	0%	100%	100%	0%	7(1)	0(0)
Grahway	8404	7%	25%	62%	6%	0%	1%	1%	97%	2%	92%	2(0)	0(0)
Grayfogg	485	96%	1%	0%	4%	0%	9%	0%	91%	0%	96%	6(1)	0(0)
Gunning Gap	266	0%	7%	0%	93%	0%	13%	0%	87%	7%	0%	5(0)	0(0)

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Gunningbland	1099	71%	28%	0%	1%	0%	1%	2%	97%	28%	71%	6(0)	0(0)
Hiawatha	777	0%	0%	100%	0%	0%	2%	98%	0%	0%	100%	7(2)	1(1)
Holyoak	125	0%	0%	100%	0%	0%	24%	0%	74%	0%	100%	3(0)	0(0)
Jerilderie	23	0%	0%	100%	0%	0%	0%	99%	0%	0%	100%	8(2)	0(0)
Jimberoo	3107	3%	35%	0%	62%	0%	22%	10%	68%	7%	3%	10(2)	0(0)
Jindalee	1061	0%	0%	96%	4%	0%	7%	93%	0%	0%	96%	18(3)	1(1)
Jingerangle	269	0%	0%	90%	10%	0%	0%	23%	77%	0%	90%	3(1)	1(1)
Kentucky	165	100%	0%	0%	0%	0%	0%	0%	99%	0%	100%	15(1)	1(0)
Kiacatoo	142	0%	0%	97%	3%	0%	0%	0%	100%	5%	92%	2(0)	0(0)
Killibbutta	1520	0%	0%	0%	100%	0%	2%	15%	83%	0%	0%	3(1)	0(0)
Kindra	518	100%	0%	0%	0%	0%	8%	11%	80%	0%	100%	7(0)	0(0)
Kookbitoo	243	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	10(2)	0(0)
Koklibertoo	193	75%	0%	0%	25%	0%	0%	0%	100%	0%	75%	9(1)	0(0)
Kulki	170	0%	0%	100%	0%	0%	0%	0%	100%	0%	100%	7(2)	0(0)
Lachlan Range	3157	29%	6%	0%	65%	0%	10%	0%	90%	1%	29%	8(2)	0(0)
Lake Urana	213	89%	0%	11%	0%	0%	0%	0%	100%	100%	0%	6(1)	0(0)
Lake View	236	100%	0%	0%	0%	0%	2%	0%	98%	0%	100%	6(0)	1(1)
Lester	755	100%	0%	0%	0%	0%	3%	0%	97%	0%	100%	9(1)	0(0)
Limestone	62	0%	0%	100%	0%	0%	0%	0%	100%	0%	100%	9(1)	0(0)
Little Blow Clear	57	100%	0%	0%	0%	0%	3%	97%	0%	0%	100%	4(0)	0(0)
Little Caragabal	150	0%	0%	98%	2%	0%	21%	0%	79%	0%	98%	4(1)	0(0)
Lonesome Pine	299	100%	0%	0%	0%	0%	0%	7%	93%	0%	100%	7(0)	1(1)
Mairijimmy	454	0%	100%	0%	0%	0%	0%	100%	0%	100%	0%	3(0)	1(1)
Mandagery	1492	0%	100%	0%	0%	0%	8%	51%	37%	0%	100%	3(1)	0(0)
Mandamah	252	98%	0%	0%	2%	0%	7%	0%	93%	0%	98%	7(1)	0(0)
Manna	3016	67%	32%	1%	0%	0%	0%	5%	95%	3%	68%	6(0)	1(1)
Matong	3170	94%	0%	0%	6%	0%	0%	4%	96%	0%	94%	10(2)	0(0)
Maudry	207	0%	98%	0%	2%	0%	2%	0%	98%	0%	98%	2(2)	0(0)
Mejum	921	100%	0%	0%	0%	0%	1%	0%	99%	0%	100%	16(2)	0(0)
Melbergen	278	0%	95%	4%	0%	0%	0%	0%	100%	95%	3%	5(1)	0(0)

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mellerstain	194	0%	0%	100%	0%	0%	0%	0%	100%	0%	100%	1(1)	0(0)
Melougel	261	4%	2%	94%	0%	0%	0%	0%	100%	2%	98%	2(1)	0(0)
Meriwagga	166	0%	94%	0%	6%	0%	0%	0%	100%	94%	0%	3(0)	0(0)
Merri Merri	191	0%	98%	0%	2%	0%	0%	0%	100%	0%	98%	12(1)	0(0)
Merrinele	536	88%	0%	12%	0%	0%	0%	0%	100%	1%	97%	6(0)	0(0)
Meryula	561	74%	26%	0%	0%	0%	13%	2%	84%	4%	96%	1(1)	0(0)
Miandetta	738	0%	9%	91%	0%	0%	0%	2%	98%	0%	100%	6(1)	0(0)
Milbrulong	381	95%	0%	0%	5%	0%	1%	0%	99%	0%	95%	22(2)	0(0)
Minter	42	0%	0%	100%	0%	0%	0%	0%	100%	100%	0%	2(1)	0(0)
Momo	548	41%	21%	0%	38%	0%	9%	0%	91%	8%	50%	10(1)	0(0)
Monumea Gap	386	0%	28%	0%	72%	0%	5%	0%	95%	28%	0%	11(1)	0(0)
Moomboodool	94	79%	0%	21%	0%	0%	0%	0%	100%	0%	100%	3(1)	0(0)
Mount Nobby	1535	87%	0%	7%	6%	0%	0%	3%	97%	0%	94%	15(2)	0(0)
Mount Tiga	663	90%	8%	2%	0%	0%	0%	3%	97%	8%	92%	7(1)	0(0)
Mulyandry	761	84%	0%	0%	16%	0%	0%	0%	100%	0%	84%	10(1)	0(0)
Murda	1390	81%	19%	0%	0%	0%	0%	3%	97%	0%	87%	5(0)	1(1)
Nangerybone	6018	37%	37%	9%	18%	0%	5%	0%	94%	0%	71%	8(0)	1(1)
Naradhan	165	4%	0%	96%	0%	0%	0%	0%	100%	0%	100%	5(1)	0(0)
Narraburra	59	86%	0%	14%	0%	0%	0%	0%	100%	14%	0%	8(2)	0(0)
Narraway	881	0%	86%	6%	9%	0%	0%	0%	100%	0%	91%	13(1)	0(0)
Nabea	361	0%	7%	92%	1%	0%	0%	0%	100%	0%	99%	3(0)	0(0)
Nerang Cowal	1060	73%	12%	1%	14%	0%	0%	5%	95%	12%	75%	5(0)	0(0)
Paddington	6969	1%	18%	81%	0%	0%	2%	5%	91%	0%	50%	8(1)	0(0)
Palmer	724	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	2(1)	0(0)
Pangee	1104	0%	97%	2%	1%	0%	3%	0%	97%	0%	99%	1(0)	0(0)
Peisley	1265	0%	0%	100%	0%	0%	5%	2%	92%	0%	100%	2(0)	0(0)
Pridde	210	0%	34%	28%	38%	0%	13%	0%	87%	62%	0%	13(4)	0(0)
Puckawidgee	427	3%	0%	53%	44%	0%	100%	0%	0%	55%	0%	2(1)	0(0)
Pullabooka	1527	99%	0%	0%	1%	0%	2%	2%	95%	0%	99%	2(1)	0(0)
Reefton	314	0%	0%	1%	99%	0%	1%	99%	0%	0%	1%	15(2)	0(0)

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ringwood Tank	231	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	7(1)	0(0)
Sandgate	780	1%	97%	1%	2%	2%	0%	0%	98%	0%	98%	12(1)	0(0)
Stackpoole	755	25%	20%	0%	55%	0%	50%	50%	0%	0%	0%	6(1)	0(0)
Steam Plains	327	44%	0%	33%	23%	0%	100%	0%	0%	77%	0%	3(2)	0(0)
Strahorn	2260	76%	17%	0%	7%	3%	2%	5%	90%	9%	84%	6(2)	0(0)
Tabbita	127	0%	0%	97%	3%	0%	0%	0%	100%	0%	97%	19(2)	0(0)
Tabratong	463	22%	70%	0%	8%	0%	0%	0%	100%	64%	29%	7(1)	0(0)
Tailby	911	0%	97%	0%	3%	0%	0%	0%	100%	0%	97%	7(1)	0(0)
Talgong	667	0%	95%	1%	4%	0%	4%	0%	93%	0%	96%	5(0)	0(0)
Tallegar	1797	0%	98%	0%	2%	0%	0%	1%	99%	0%	98%	13(1)	0(0)
Taratta	955	95%	5%	0%	0%	0%	0%	0%	100%	0%	100%	13(2)	0(0)
Tenandra	490	45%	54%	0%	1%	0%	0%	0%	96%	0%	99%	5(2)	0(0)
Therabung	193	100%	0%	0%	0%	0%	3%	0%	97%	0%	100%	4(0)	0(0)
Thomdale	1751	99%	0%	0%	1%	0%	0%	2%	98%	0%	99%	6(1)	0(0)
Tomanbil	364	39%	0%	0%	61%	0%	0%	0%	100%	0%	39%	9(1)	0(0)
Tottenham	1374	73%	17%	0%	10%	0%	0%	3%	97%	0%	90%	12(1)	0(0)
Towyal	142	0%	0%	21%	79%	0%	0%	2%	97%	21%	0%	2(0)	0(0)
Trundle	440	0%	84%	0%	16%	0%	1%	0%	99%	84%	0%	3(2)	0(0)
Tuckland	860	0%	34%	65%	1%	0%	3%	0%	97%	30%	15%	4(0)	0(0)
Tullamore	124	73%	27%	0%	0%	0%	5%	0%	95%	4%	96%	6(1)	0(0)
Ugobit	221	0%	78%	22%	0%	0%	0%	0%	100%	1%	9%	11(2)	0(0)
Ungare	211	98%	0%	2%	0%	0%	3%	0%	97%	0%	100%	1(0)	0(0)
Vermont Hill	426	25%	71%	0%	4%	0%	1%	0%	99%	0%	96%	3(0)	0(0)
Wahgunyah	326	100%	0%	0%	0%	0%	21%	0%	79%	0%	100%	15(3)	1(1)
Wallerobie	273	54%	46%	0%	0%	0%	1%	0%	99%	46%	54%	5(1)	0(0)
Warraderry	2860	41%	0%	0%	59%	0%	4%	2%	94%	0%	41%	12(3)	0(0)
Warregal	176	0%	0%	87%	13%	0%	10%	0%	90%	87%	0%	8(2)	0(0)
Warrie	295	1%	99%	0%	0%	0%	0%	0%	100%	0%	100%	4(1)	0(0)
Weddin	2367	0%	15%	8%	77%	0%	4%	5%	91%	21%	2%	20(4)	1(1)
Weelah	1499	4%	83%	0%	13%	0%	0%	2%	98%	83%	4%	3(0)	1(0)

State forest	Area (ha)	Composition of forest area where vegetation data is available			% of forest where vegetation data is not available	Proportion of Forest Management Zones				Proportion of forest with vegetation communities listed under		Threatened species listed under TSC Act (EPBC Act)	
		White cypress	Associated woodland	Other vegetation		Zone 1 – Special Protection	Zone 3A – Harvesting Exclusions	Zone 3B – Special Prescription	Zone 4 – General Mgmt	TSC Act and/or EPBC Act	IUCN	Fauna	Flora
1	2	3	4	5	6	7	8	9	10	11	12	13	14
West Cookkeys Plains	640	0%	34%	66%	1%	0%	4%	0%	96%	0%	99%	5(1)	0(0)
Wharfdale	599	10%	86%	4%	0%	0%	10%	0%	89%	86%	14%	1(1)	0(0)
Widgiewa	204	0%	0%	100%	0%	0%	0%	0%	100%	0%	100%	4(1)	0(0)
Wilberroy	1565	29%	71%	0%	0%	8%	0%	0%	92%	56%	44%	2(0)	0(0)
Wilga	282	0%	0%	100%	0%	0%	0%	0%	100%	0%	100%	0(0)	0(0)
Willows	71	0%	6%	69%	25%	0%	34%	0%	65%	0%	0%	13(1)	0(0)
Wingadee	296	0%	97%	1%	2%	0%	0%	0%	100%	1%	97%	0(0)	0(0)
Wombin	405	32%	0%	63%	5%	0%	5%	0%	95%	10%	85%	10(1)	0(0)
Wyalong	179	0%	0%	67%	33%	0%	1%	99%	0%	0%	67%	23(4)	0(0)
Wyrra	1271	87%	4%	0%	8%	0%	0%	2%	97%	0%	88%	13(2)	1(1)
Yambira	42	0%	14%	85%	1%	0%	4%	0%	96%	0%	99%	19(4)	0(0)
Yarragong	75	0%	0%	6%	94%	0%	0%	0%	100%	6%	0%	9(1)	0(0)
Yarranjerry	1873	100%	0%	0%	0%	0%	7%	1%	93%	0%	100%	13(2)	1(1)
Yathong	7898	0%	92%	8%	0%	0%	5%	11%	84%	1%	94%	24(4)	0(0)
Yelkin	1851	0%	0%	100%	0%	0%	1%	5%	94%	0%	100%	14(1)	3(3)
Yeo Yeo	187	0%	0%	100%	0%	0%	2%	98%	0%	29%	71%	18(3)	0(0)
Young	492	0%	2%	97%	1%	0%	4%	96%	0%	0%	99%	5(3)	0(0)

Appendix 17

Comparison of silvicultural operations for cypress on private and public land

Table A17.1: Comparison of silvicultural operations for cypress forests on private land and state forests

Area	Management practice on private land	Management practice in state forests
Non-commercial thinning	<ul style="list-style-type: none"> Thin regrowth that is usually 4–6 metres tall. Thin stands to a spacing of about 6 x 6 metres (280 stems per hectare). 	<ul style="list-style-type: none"> Selectable stems should be at least 5 metres tall. Thin stands to a spacing of 5.5–6 metres (280–330 stems per hectare)
Commercial thinning	<ul style="list-style-type: none"> Thin when trees spaced 6 metres apart have reached a commercial size. Residual basal area should be about 6–8 square metres per hectare. 	<ul style="list-style-type: none"> Thin where cypress is at least 80 per cent of total stand basal area and bring the cypress basal area to 6–8 square metres per hectare. Thin where cypress is less than 80 per cent of total stand basal area and maintain the stand basal area at least 8 square metres per hectare and the cypress basal area at least 1.5 square metres per hectare. In steep country (12–250), all merchantable trees >18 centimetres dbhob should be harvested to minimum basal area of 4 square metres.
Commercial harvesting	<ul style="list-style-type: none"> Thin when there is a regenerating age class about 4–6 metres high beneath the overstorey. Remove all trees in the older age class not required for habitat retention. 	<ul style="list-style-type: none"> Release the regeneration from overstorey competition by taking the commercially mature cypress trees. Stands should have preferably 1500 stems per hectare and at least 1.5 metres tall. Minimum 600 stems per hectare (preferably >5 metres tall). Stands should be at least five years since release logging. Remove merchantable trees appearing to be close to death (likely to die within 15 years), except for those required for recruitment. In steep country (12–250), all merchantable trees >20 centimetres dbhob should be harvested to minimum basal area of 4 square metres.
Regeneration	<ul style="list-style-type: none"> Landowner must ensure that minimum stand stocking has been reached within 36 months of a regeneration event. 	<ul style="list-style-type: none"> The above prescriptions preclude commercial harvesting from areas lacking sufficient established regeneration.
Logging frequency/timing	<ul style="list-style-type: none"> Stocking levels must reach 80 per cent of stocked plot before harvesting in a previously harvested area. 	

Table A17.1: Comparison of silvicultural operations for cypress forests on private land and state forests – continued

Area	Management practice on private land	Management practice in state forests
Protection of habitat and biodiversity	<ul style="list-style-type: none"> • All old grey and two hollow-bearing eucalypt trees per hectare, where available, must be retained. • One recruitment tree of the same species from the next cohort must be retained for every old grey and hollow-bearing tree retained. • Where the total old grey and cypress recruitment trees are less than 5 trees per hectare, additional recruitment trees must be retained to bring the number up to 5 trees per hectare. • Where total hollow-bearing eucalypt and eucalypt recruitment trees are less than 4 trees per hectare, additional recruitment trees must be retained to bring the number up to 4 trees per hectare. • All roost, nest or food resource trees must be retained. 	<ul style="list-style-type: none"> • Retain all old grey trees. • Retain at least 6 other healthy mature cypress trees per hectare (from the 1890s age class) that have the potential to grow into old grey trees. • In mixed stands, retain 4–6 healthy eucalypt recruitment trees per hectare with 40–50 centimetres dbhob with good crown development. • Various no-harvest zone prescriptions for threatened species, dependent on species. • Retain all standing dead trees with hollows or fissures. • Retain all V-notch trees.
Riparian zone	<ul style="list-style-type: none"> • No forestry operations in riparian exclusion zones. • Where a tree cannot be felled into the area outside the riparian exclusion zone, not more than 6 trees within any distance of 200 metres along the boundary of the zone enter the riparian exclusion zone. 	<ul style="list-style-type: none"> • No harvesting within 5 metres of the bank of a gazetted stream, watercourse or drainage depression (with channelised flow). • Within 5–20 metres zone of a gazetted stream, up to 50 per cent of the canopy may be removed.
Wetlands	<ul style="list-style-type: none"> • Forest operations must not occur in any wetland or within 20 metres of any wetland, except that existing roads may be maintained. 	<ul style="list-style-type: none"> • Depending on wetland size, up to 40 metres exclusion zone.
Rocky outcrops and heathlands	<ul style="list-style-type: none"> • No forestry operations within 20 metres, except for maintaining existing tracks. 	<ul style="list-style-type: none"> • Rocky outcrops/cliffs: 30-metre no-harvest zone. • Heath/scrub from 0.2 hectare, 50-metre wide no harvest zone; 30 metres around broom brush area.
Cliffs, caves and tunnels	<ul style="list-style-type: none"> • No forestry operations within 10 metres, except for maintaining existing tracks. 	<ul style="list-style-type: none"> • As above.
Old growth forest	<ul style="list-style-type: none"> • No forestry operations permitted. 	<ul style="list-style-type: none"> • No prescription due to the absence of known old growth forest in cypress areas.

Appendix 18

Maps of proposed management and tenure arrangements for south-western cypress state forests¹

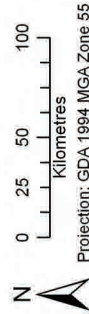
¹ As described in **Section 6.6.3**

**NRC south-western cypress
state forests assessment
management and associated
tenure**

Overview of proposed
management and associated
tenure

Legend

- Major rivers
- Potential corridors
- Forests NSW
- NPWS estate
- Travelling stock routes
- NSW land divisions
- Proposed management and associated tenure**
 - Manage as state forest for production and environmental values
 - Manage for conservation and other values



Projection: GDA 1994 MGA Zone 55

Note: Full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

25/05/2010
Information Sources:
Department of the Environment, Water, Heritage and the Arts
Geoscience Australia
Land and Property Management Authority
NSW Department of Environment, Climate Change & Water
NSW Department of Primary Industries

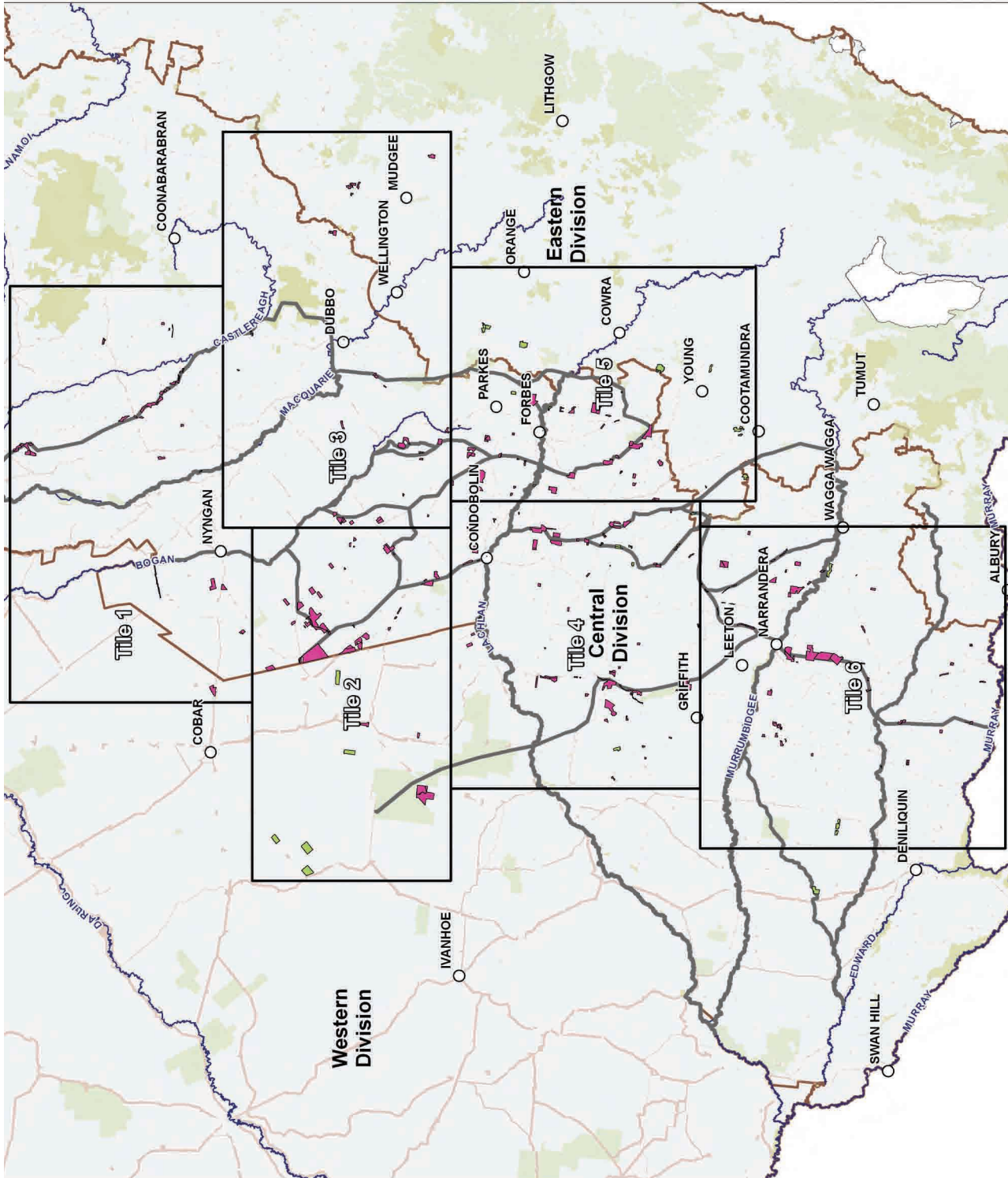
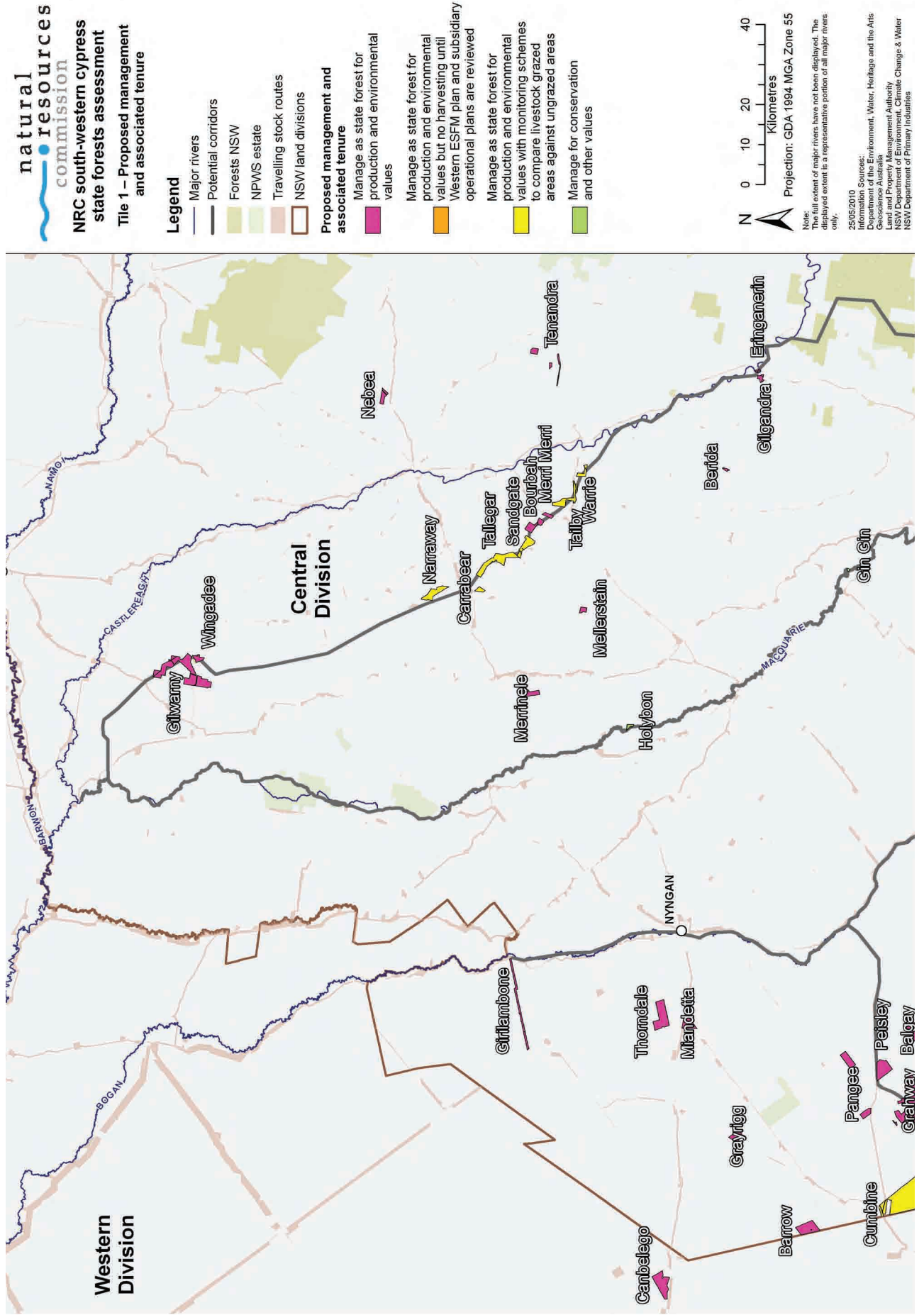


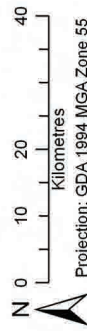
Figure A18.1: Overview of management and proposed tenure arrangements for south-western cypress state forests

Figure A18.2: Tile 1 – proposed management and tenure arrangements for south-western cypress state forests



Legend

- Major rivers
- Potential corridors
- Forests NSW
- NPWS estate
- Travelling stock routes
- NSW land divisions
- Proposed management and associated tenure
 - Manage as state forest for production and environmental values
 - Manage as state forest for production and environmental values but no harvesting until Western ESFM plan and subsidiary operational plans are reviewed
 - Manage as state forest for production and environmental values with monitoring schemes to compare livestock grazed areas against ungrazed areas
 - Manage for conservation and other values



Projection: GDA 1984 MGA Zone 55
 Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

25/05/2010
 Information Sources: Environment, Water, Heritage and the Arts
 Geoscience Australia
 Land and Property Management Authority
 NSW Department of Environment, Climate Change & Water
 NSW Department of Primary Industries

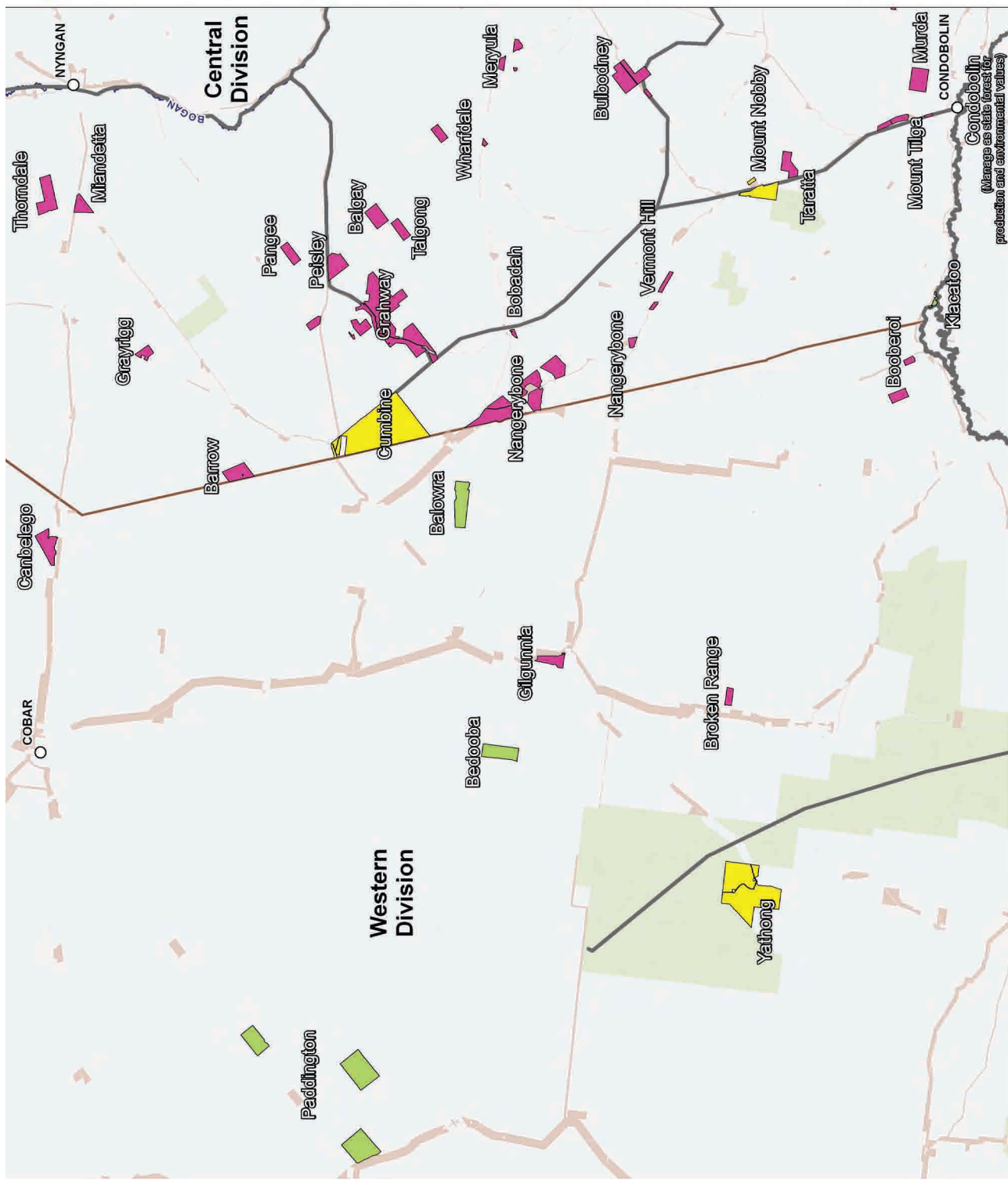
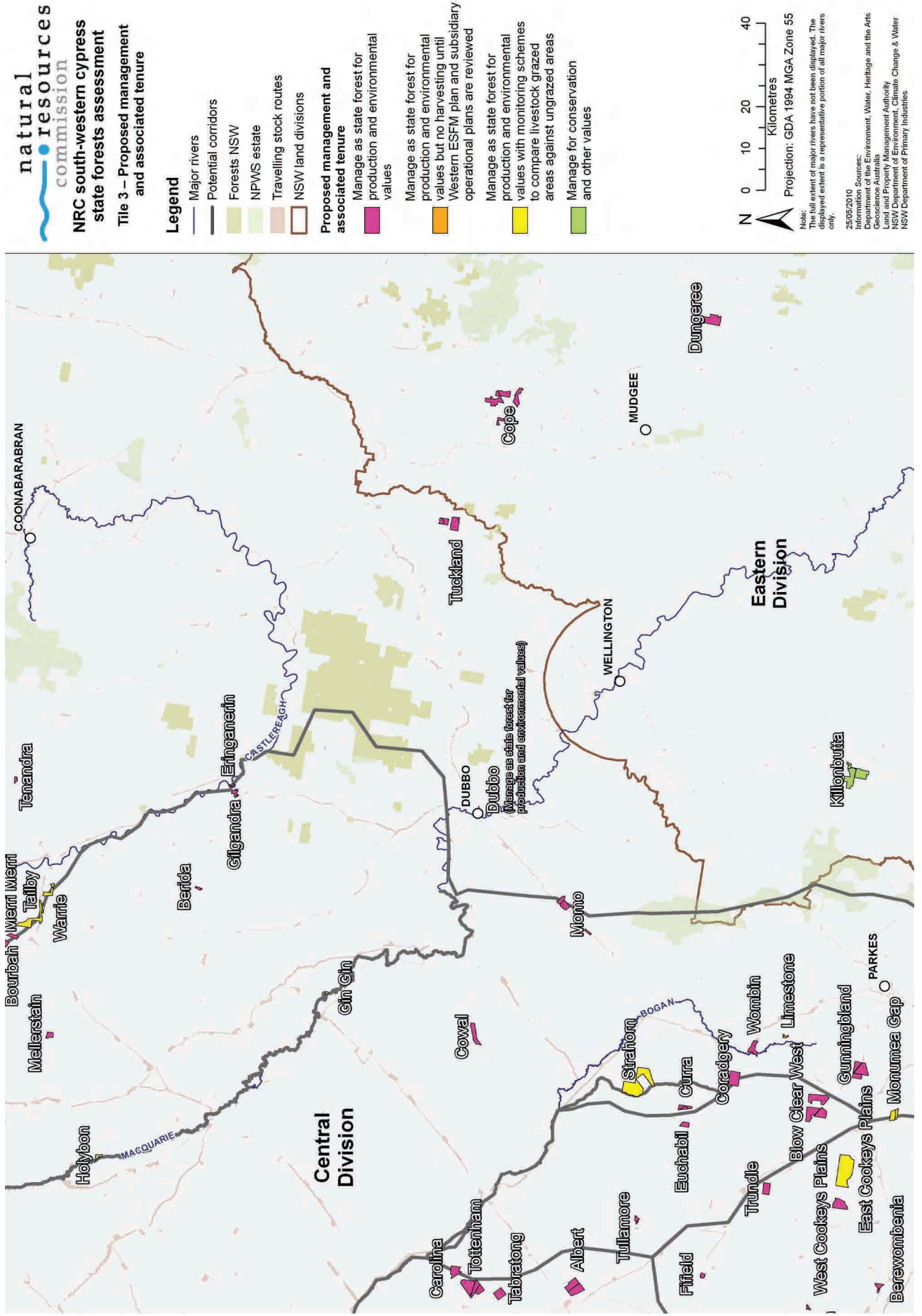


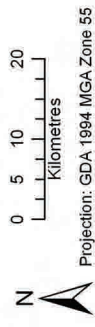
Figure A18.3: Title 2 – proposed management and tenure arrangements for south-western cypress state forests

Figure A18.4: Tile 3 – proposed management and tenure arrangements for south-western cypress state forests



natural resources commission
NRC south-western cypress state forests assessment
Title 4 – Proposed management and associated tenure

- Legend**
- Major rivers
 - Potential corridors
 - Forests NSW
 - NPWS estate
 - Travelling stock routes
 - NSW land divisions
 - Proposed management and associated tenure**
 - Manage as state forest for production and environmental values
 - Manage as state forest for production and environmental values but no harvesting until Western ESM plan and subsidiary operational plans are reviewed
 - Manage as state forest for production and environmental values with monitoring schemes to compare livestock grazed areas against ungrazed areas
 - Manage for conservation and other values



Projection: GDA 1984 MGA Zone 55
 Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

25/05/2010
 Information Sources:
 Department of the Environment, Water, Heritage and the Arts
 Land and Property Management Authority
 NSW Department of Environment, Climate Change & Water
 NSW Department of Primary Industries

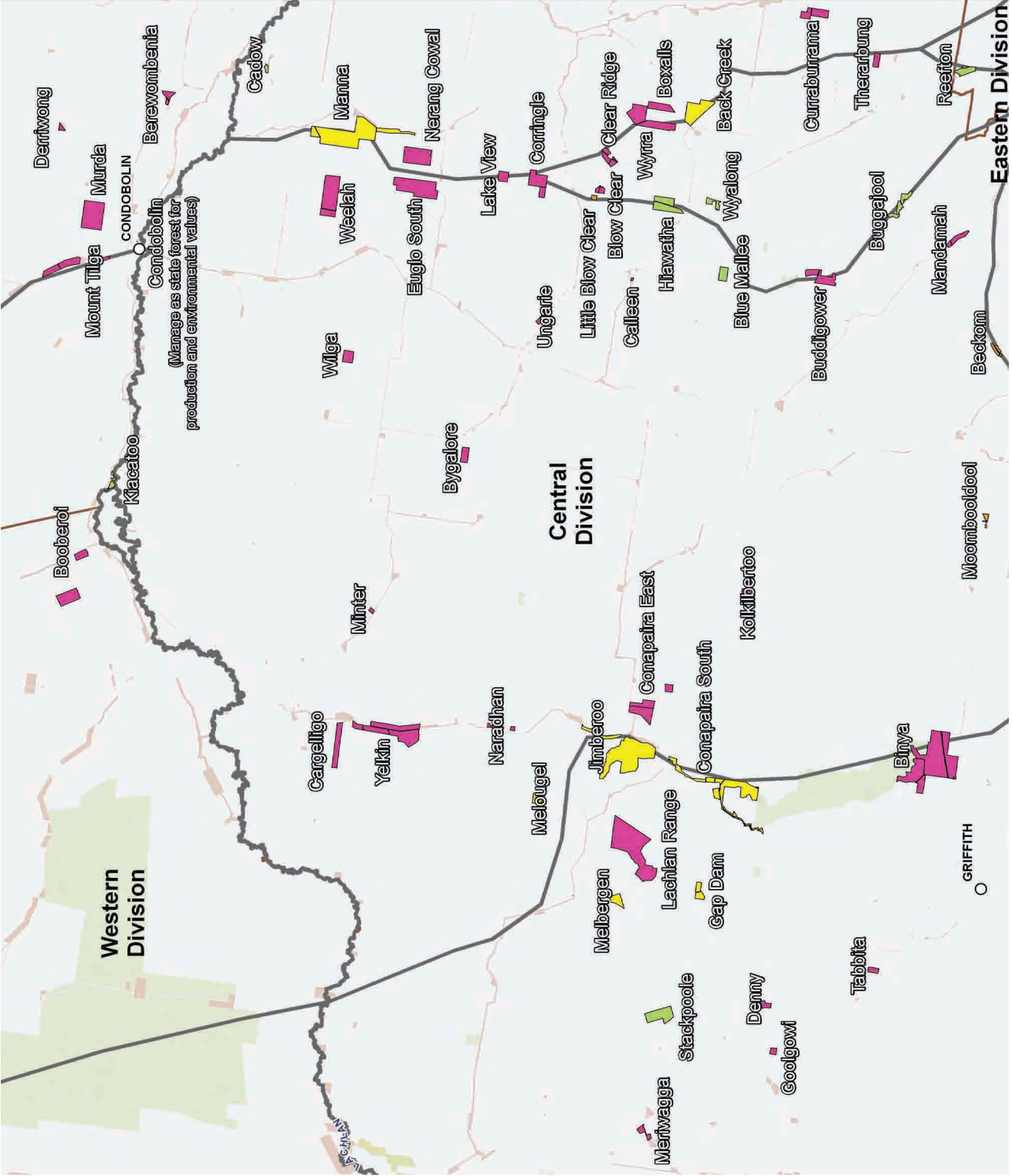
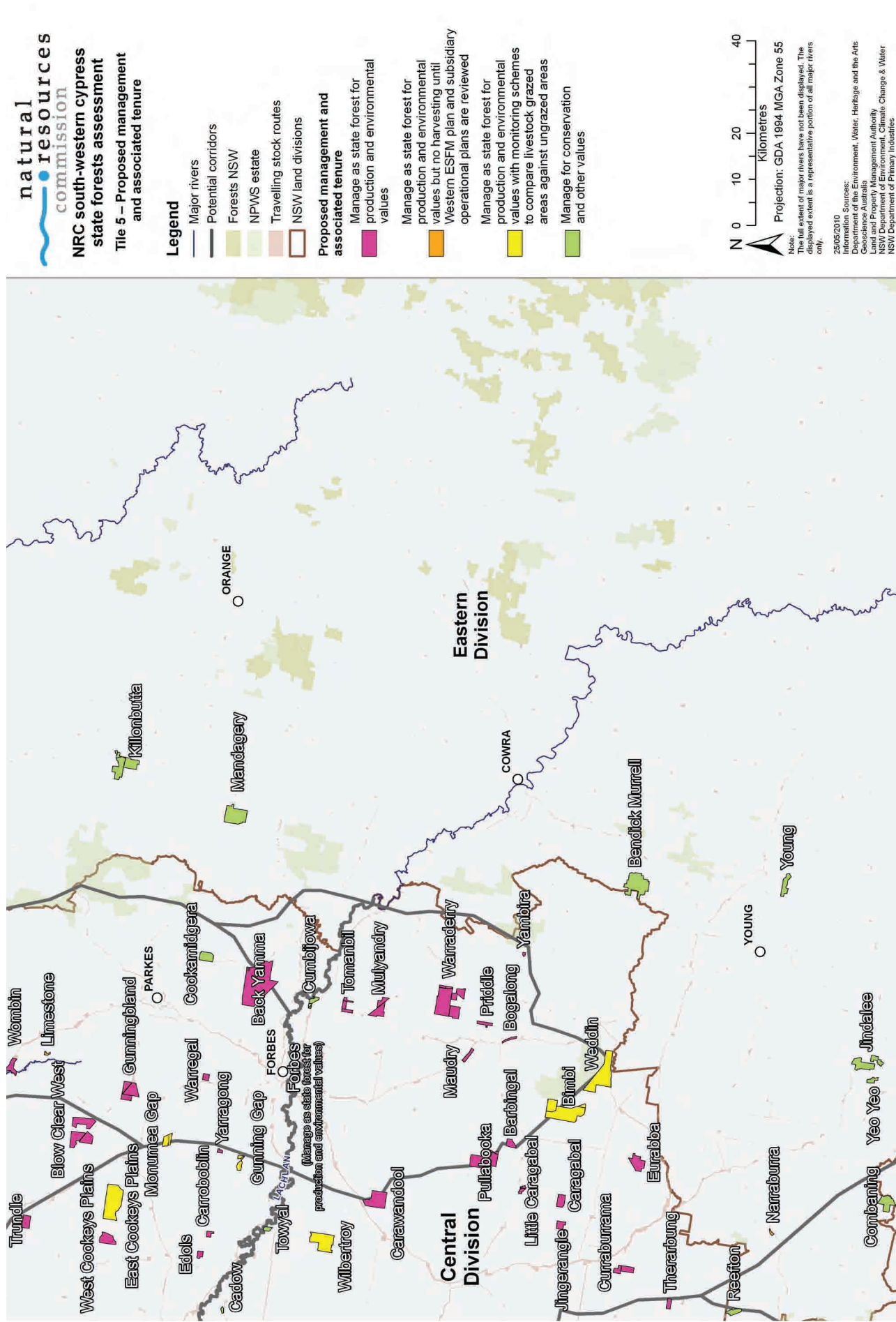


Figure A18.5: Title 4 – proposed management and tenure arrangements for south-western cypress state forests

Figure A18.6: Tile 5 – proposed management and tenure arrangements for south-western cypress state forests

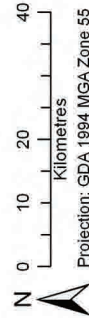


NRC south-western cypress state forests assessment

Title 6 – Proposed management and associated tenure

Legend

- Major rivers
- Potential corridors
- Forests NSW
- NPWS estate
- Travelling stock routes
- NSW land divisions
- Proposed management and associated tenure**
- Manage as state forest for production and environmental values
- Manage as state forest for production and environmental values but no harvesting until Western ESFM plan and subsidiary operational plans are reviewed
- Manage as state forest for production and environmental values with monitoring schemes to compare livestock grazed areas against ungrazed areas
- Manage for conservation and other values



Projection: GDA 1994 MGA Zone 55

Note: The full extent of major rivers have not been displayed. The displayed extent is a representative portion of all major rivers only.

25/05/2010
Information Sources: Environment, Water, Heritage and the Arts
Geoscience Australia
Land and Property Management Authority
NSW Department of Environment, Climate Change & Water
NSW Department of Primary Industries

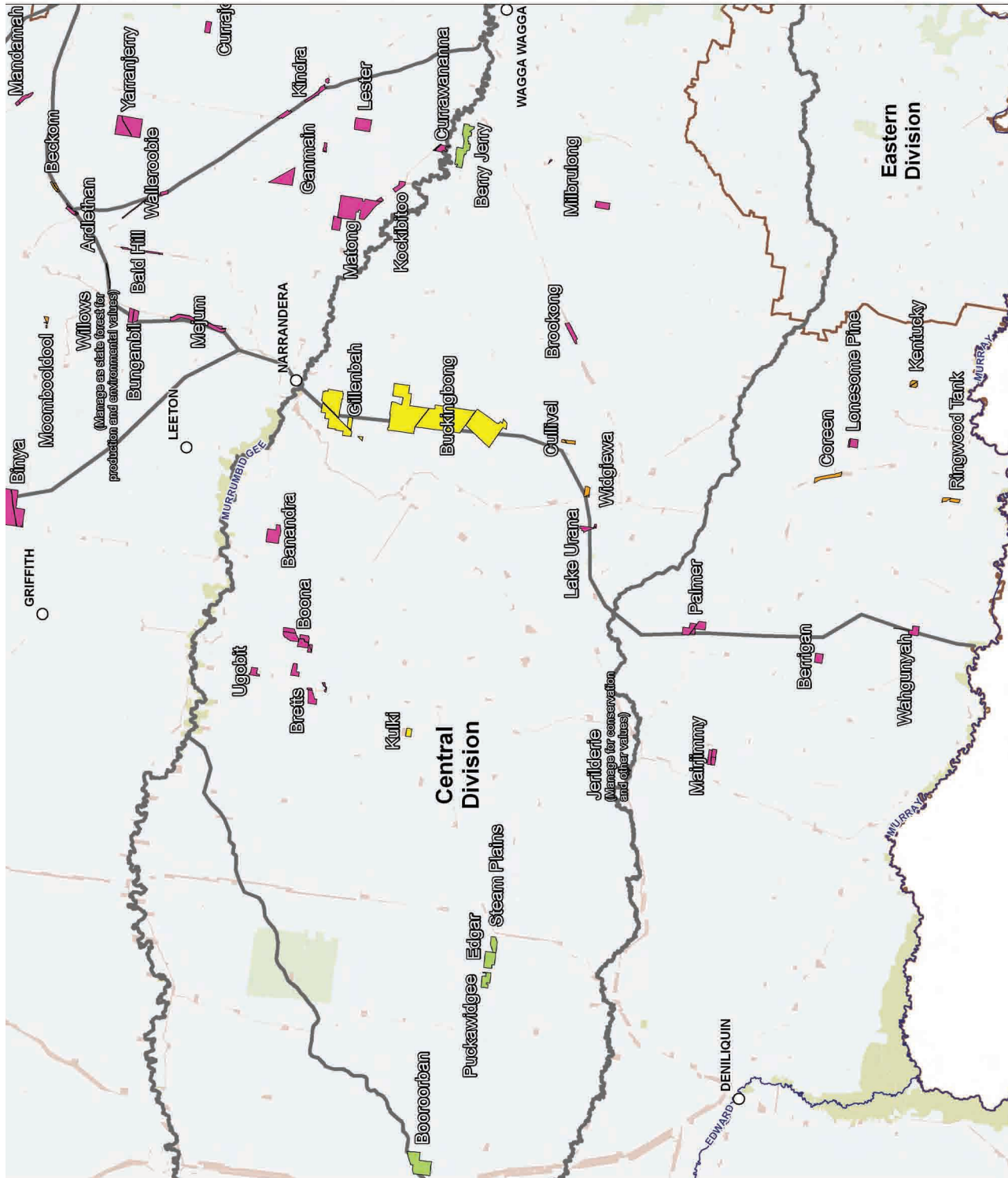


Figure A18.7: Tile 6 – proposed management and tenure arrangements for south-western cypress state forests

Appendix 19

The Brigalow decision

A19.1 Brigalow decision context and outcomes

In 1999, the NSW Government initiated regional assessments of the Brigalow Belt South and Nandewar bioregions – areas in northern NSW with significant cypress resources. The government intended that these assessments would inform future planning and conservation strategies within the bioregions. The NSW Resource and Conservation Assessment Council coordinated and completed the assessment process between 1999 and 2002 for the Brigalow Belt South bioregion and 2002 and 2004 for the Nandewar bioregion.

In May 2005, the NSW Government announced a suite of proposals (the Brigalow decision) for the Brigalow Belt South and Nandewar bioregions, including:

- changes in land tenure (shown in **Table A19.1**)
- a regional wood supply commitment of 57,000 cubic metres per year for mills in the Brigalow Belt South and Nandewar bioregions
- new 20-year wood supply agreements between Forests NSW, the NSW Government and timber mills (which also included mills outside the region)
- funding assistance packages for the cypress timber industry (which also included mills outside the region) and conservation outcomes (shown in **Table A19.2**).

Table A19.1: Changes in land tenure as a result of the Brigalow decision

Tenure	Management objective	Relevant legislation	Area (ha)	
			Pre-2005	Post-2005
CCA – Zone 1 (National Park)	Conservation and recreation	<i>National Parks and Wildlife Act 1974</i>	-	120,000
CCA – Zone 2 (Aboriginal Area)	Conservation and Indigenous culture	<i>National Parks and Wildlife Act 1974</i>	-	22,000
CCA – Zone 3 (State Conservation Area)	Conservation, recreation and mineral extraction	<i>National Parks and Wildlife Act 1974</i>	-	185,000
CCA – Zone 4 (State Forest)	Forestry, recreation and mineral extraction	<i>Forestry and National Park Estate Act 1998 and Forestry Act 1916</i>	-	273,000
State Forest	Forestry and multiple uses	<i>Forestry and National Park Estate Act 1998 and Forestry Act 1916</i>	620,000	-
Reserve system	Conservation, recreation and mineral extraction	<i>National Parks and Wildlife Act 1974</i>	208,000	240,000 ^a

^a Includes Crown leases vested in DECCW (~18,000 hectares) and other formal reserves (~222,000 hectares).

Table A19.2: NSW Government timber industry assistance funding (the Brigalow Assistance Fund) announced as part of the Brigalow decision

Fund	Purpose	Value
Timber Industry Development	<ul style="list-style-type: none"> • Five-year funding program for investment in value adding, new timber export products and markets, and plant and equipment upgrades. • Support for a long-term investment plan for the cypress industry. 	\$15 million
Business Exit	<ul style="list-style-type: none"> • Business exit payments for mills ceasing timber harvesting and production. • Redundancy payments for timber workers wishing to permanently exit the timber industry. • Retraining and relocation expenses for timber workers wishing to pursue a new career. 	\$14 million
Timber Industry Job Creation	<ul style="list-style-type: none"> • Five-year funding program to employ up to 50 workers in cypress thinning programs • Dedicated positions for Indigenous community members and timber workers affected by the Brigalow decision. 	\$12 million
Total		\$41 million

Source: NSW Government (2005).

A19.1.1 Impact on resource volume and sustainable yield within state forests in the Brigalow Belt South and Nandewar bioregions

As a result of the Brigalow decision, the total area of forest in the Brigalow Belt South and Nandewar bioregions managed for timber production decreased by over 50 per cent. **Table A19.3** shows the impact of the Brigalow decision on the cypress resource area and sustainable yield estimates.

Subsequent to the Brigalow decision, Forests NSW calculated an interim sustainable yield estimate for cypress from the new Community Conservation Area Zone 4 forests of 40,000 cubic metres per year. As **Table A19.3** shows, this was a significant reduction from the previous supply drawn from the Brigalow Belt South and Nandewar bioregions' forests (Forests NSW, 2008a).

A19.1.2 Impact on management of cypress wood supply areas

In 2005, the government directed Forests NSW to make available 57,000 cubic metres of cypress resource per year to mills harvesting timber from the Brigalow Belt South and Nandewar state forests.

The 40,000 cubic metres per year interim sustainable yield estimate for Zone 4 forests in the new Community Conservation Area (see **Table A19.3**) did not provide Forests NSW with sufficient timber resource to meet a 57,000 cubic metres per year supply commitment from these forests. To manage this potential supply deficit, and because a number of Forests NSW's former Management Areas had limited resources following the government decision, Forests NSW created a single wood supply area by combining the Brigalow Belt South

and Nandewar and south-western cypress state forest supply areas. This single wood supply area is known as the Western Region Supply Area and is shown in **Figure A19.1**. The industry adjustment initiatives in the Brigalow decision were expanded to cover the whole of the cypress industry in the single wood supply area.

A19.1.3 Cypress timber industry consolidation

The NSW Government's Brigalow Assistance Fund provided financial assistance to mill owners (and affected employees) who chose to leave the cypress timber industry or cease harvesting from state forests. Alternatively, mill owners choosing to enter into new 20-year wood supply agreements could apply for funding assistance to invest in value adding, market development and plant and equipment upgrades. Mill owners (and employees) within the south-western cypress state forests were included within the Brigalow Assistance Fund following the creation of the Western Region Supply Area.

Table A19.4 shows actual amounts paid under the Brigalow Assistance Fund.

The Brigalow Assistance Fund supported an industry restructure across the entire Western Region Supply Area, including the south-western cypress state forests' timber industry. A significant proportion of the Fund has been spent assisting mill owners and employees exiting the cypress timber industry. This indicates a major phase of contraction and consolidation within the NSW cypress timber industry. Over \$6 million has also been invested in developing and modernising the consolidated cypress timber industry, including the cypress timber industry associated with the south-western cypress state forests.

Table A19.3: Brigalow Belt South and Nandewar state forests cypress resource, yields and supply commitments pre-Brigalow and potential post-Brigalow decision impacts

Brigalow Belt South and Nandewar state forests	Pre-2005	Post-Brigalow decision impacts	% Decrease
Area supporting cypress timber production (ha) ^a	620,000	273,000	56
Sustainable yield estimates (cubic metres per year) ^b	>70,000	~40,000 (interim sustainable yield)	43

^a Forests NSW (2008a) ^b DPI (2009).

Table A19.4: Amounts paid under the Brigalow Assistance Fund

Program name	Amount paid 1 July 2005 to 30 June 2008 ^a
Brigalow Timber Workers Assistance Fund	\$10,671,000
Brigalow Timber Industry Exit Assistance Fund	\$18,085,300
Brigalow Timber Industry Hardwood (Small Operators) Exit Assistance Fund	\$903,000
Brigalow Timber Industry Development Assistance Fund	\$5,471,500
Brigalow Timber Industry Log Haulage & Harvesting Equipment Floating Assistance	\$572,000
Brigalow Assistance Fund Allocation Reduction	\$740,000
Other associated program costs	\$882,000
Total	\$37,324,800

^a DECCW (2009c)

Figure A19.1: Western Region Supply Area

Source: Coakes Consulting

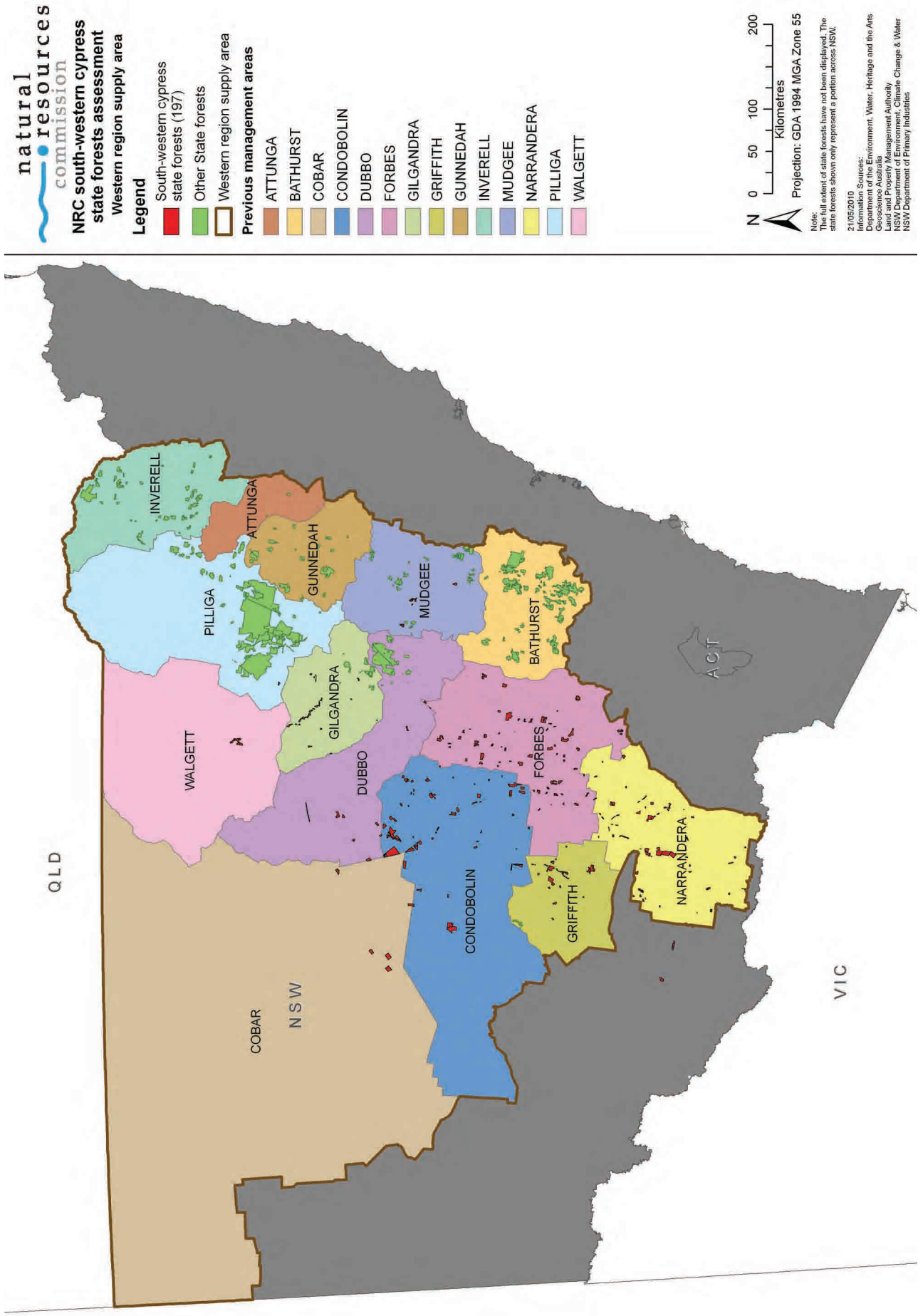


Figure A19.2 shows the extent of consolidation across the NSW cypress industry, particularly with reference to mills sourcing cypress directly from state forests.

Following the Brigalow decision and provision of exit assistance funding, several mills chose to cease timber harvesting and milling operations. Grants Holdings is the primary remaining harvester and miller sourcing sawlogs from the south-western cypress state forests. Grants Holdings operates two mills, located in Condobolin and Narrandera.

Some of the south-western timber companies, including RJ & JR Stephenson in Trundle and E & RJ Hay & Co in Eugowra and Parkes, chose to move away from harvesting and milling operations and instead have increased their value-adding operations.

Baradine Sawmilling Company sources some wood supply from the south-western cypress state forests, however is geographically located in the Brigalow Belt South and Nandewar area.

Further details of the current industry are set out in **Chapter 5**.

A19.1.4 Wood supply agreements

In 2006, Forests NSW and the NSW Government entered into 20-year wood supply agreements with a number of timber harvesting and milling companies across the entire Western Region Supply Area, including mill operations in the south-western cypress state forests. The 20-year wood supply agreements specify a total supply of 59,590 cubic metres per year of cypress from the Western Region Supply Area (DPI, 2009). Forests NSW and the NSW Government signed 20-year wood supply agreements with:

- Grants Holdings for the supply of cypress timber to their Narrandera and Condobolin operations
- Baradine Sawmilling Company
- Gunnedah Timbers
- Gulargambone Sawmilling
- R Austin Pty Ltd (Montreal Process Implementation Group for Australia, 2008b).

These companies are guaranteed an agreed annual wood supply volume until December 2025.

In 2008, Gulargambone Sawmilling operations divided and traded their wood supply agreements to remaining sawmill operations within the Western Region Supply Area. Grants Holdings purchased a share of the Gulargambone cypress resource.

A19.1.5 Investment outcomes

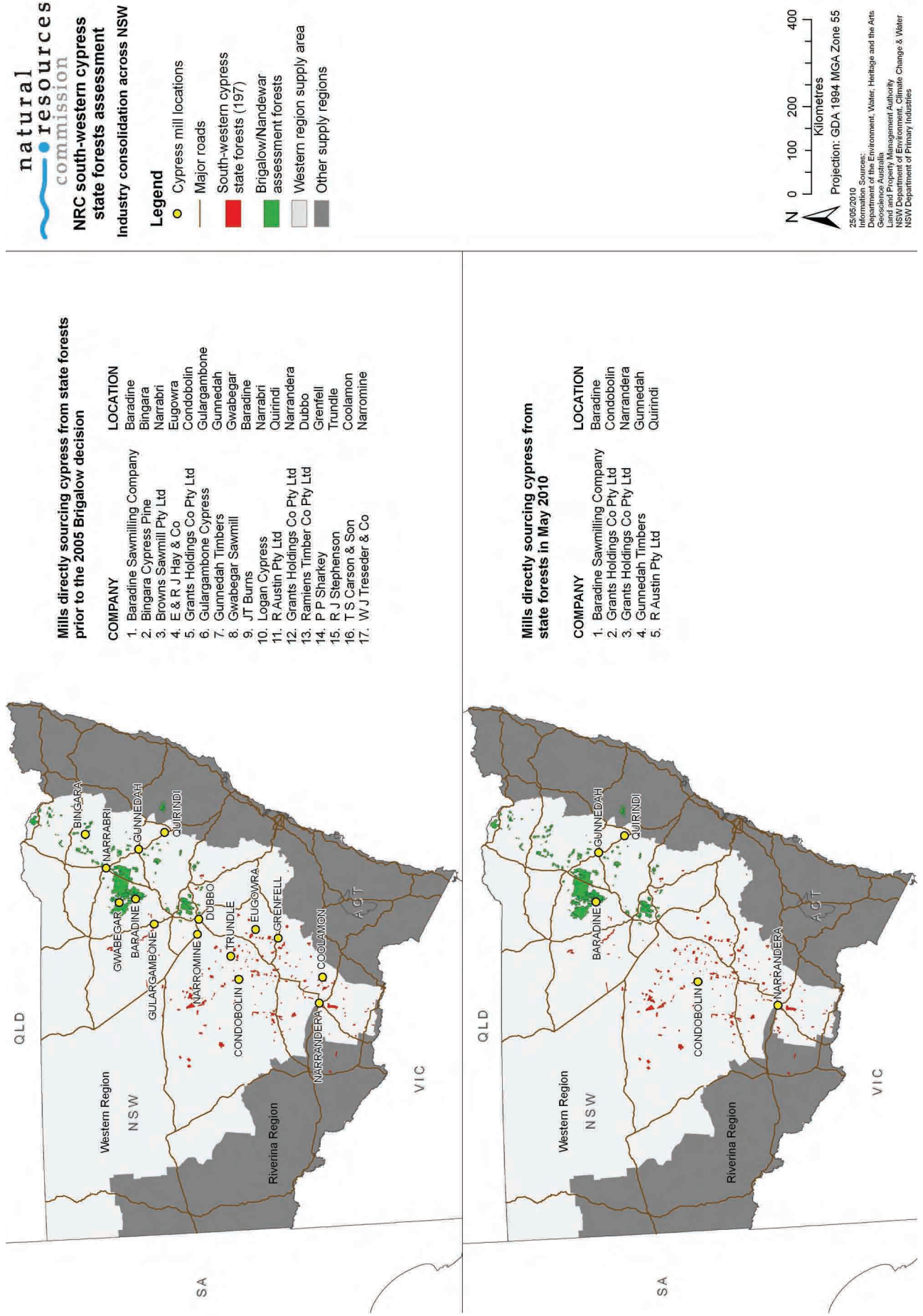
Mills were able to invest in value-adding and plant upgrades because of the certainty of 20-year agreements and assistance from the Brigalow Assistance Fund. Both timber companies currently sourcing timber from the south-western cypress state forests, Grants Holdings and Baradine Sawmilling Company, received funding assistance and also invested their own funds.

By the end of 2007, Grants Holdings had received over \$1 million in government funding from the Brigalow Assistance Fund (NSW Parliament, 2007) and self-invested \$3 million (Grants Holdings, personal communication, 19 April 2010). Grants Holdings has used this period of investment to gain accreditation and upgrade its processing facilities for building-material exports to Japan. This is a new market opportunity for the cypress timber industry, with an estimated worth of up to \$5 million per year (Chester, 2009).

Submissions received from Baradine Sawmilling Company indicate that the company used the Brigalow Assistance Fund to invest in equipment, plant and facilities upgrades.

Figure A19.2: Industry consolidation across NSW

Source: Cypress Industry Strategic Plan Group (2003)



Appendix 20

EPBC Act and FNPE Act requirements

Table A20.1: *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) requirements considered in this assessment*

EPBC Act requirements	Issues considered	Section of report	Page number
Matters of National Environmental Significance	EPBC-listed endangered ecological communities	3.3.1	42
	EPBC-listed flora species	3.3.2	42 – 43
	EPBC-listed fauna species	3.3.3	43
Environmental values such as biodiversity	Range of vegetation types, flora and fauna, and habitats associated with the south-western cypress state forests	3.2	38 – 42
Activities occurring in the south-western cypress state forests	Social and economic values and uses of south-western cypress state forests	4.5	62 – 69
	Managing cypress in the south-western cypress state forests	6.2	88 – 92
Ways to avoid, reduce or control impacts below the level of significance	Sustainable yields and current commitments	5.2.4	77 – 78
	Management principles for white cypress and associated woodlands	6.5.2	101 – 104
Residual significant impacts which can then be addressed through specific measures under the EPBC Act	The NRC considers that current protocols and principles applying to the silviculture management of cypress stands in south-western cypress state forests will be sufficient to maintain environmental values when the recommendations in this report are implemented	6.5.2	101

Table A20.2: Forestry and National Parks Estate Act 1998 (FNPE Act) requirements considered in this assessment

FNPE Act (S 15) requirements	Issues considered	Section of report	Page number
Environmental values	Range of vegetation types, flora and fauna, and habitats associated with the south-western cypress state forests	3.2	38 – 42
	TSC-listed endangered ecological communities	3.3.1	42
	TSC-listed flora species	3.3.2	42 – 43
	TSC-listed fauna species	3.3.3	43
Heritage values (including Indigenous heritage)	Indigenous cultural and heritage values	4.3	57 – 60
	Non-Indigenous cultural and heritage values	4.4	60 – 62
Economic values	Timber industry economic value and contribution to local and regional economies	5.4.4	84 – 85
	Markets for south-western cypress timber	5.5	86
	Broom bush harvesting	4.5.2	63
	Firewood, craft wood and other forest products	4.5.3	63
	Livestock grazing	4.5.4	64
	Apiary	4.5.5	64 – 66
	Non-timber forest materials, mining and other extractive industries	4.5.6	66
Social values	Recreation and tourism	4.5.7	66
	Nature-based activities	4.5.8	66 – 68
	Hunting	4.5.9	68
	Education and training	4.5.10	68
	Communities with links to south-western cypress state forests	4.6, 4.7	70 – 74
Ecologically sustainable forest management	Management principles for white cypress and associated woodlands	6.5.2	101 – 104
Timber resources	Sustainable yields from the cypress state forests	5.2.4	77 – 78
	Cypress resource on other Crown timber land and private land	5.3	81 – 82

Appendix 21

Cypress state forests' contribution to public land in Local Aboriginal Land Councils

Table A21.1: Cypress state forests' contribution to public land in Local Aboriginal Land Councils

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Albury and district	Kentucky	165	0.3
	Lonesome Pine	299	0.6
	Ringwood Tank	231	0.4
	Total		1.3
Cobar	Canbelego	1,492	3.3
	Total		3.3
Condobolin	Balgay	1,100	1.2
	Balowra	2,059	2.3
	Berewombenia	186	0.2
	Blow Clear West	1,908	2.1
	Bobadah	106	0.1
	Bulbodney	2,385	2.6
	Cadow	58	0.1
	Carawandool	1,318	1.5
	Carolina	473	0.5
	Carroboblin	139	0.2
	Condobolin ¹	<1	<0.1
	Cumbine	10,477	11.6
	Derriwong	61	0.1
	East Cookeys Plains	2,389	2.6
	Edols	165	0.2
	Fifield	108	0.1
	Grahway	8,389	9.3
	Gunning Gap	266	0.3
	Kiacatoo	142	0.2
	Meryula	560	0.6
	Monumea Gap	<1	<0.1
	Mount Nobby	1,532	1.7
	Mount Tilga	662	0.7
	Murda	1,387	1.5
	Nangerybone	6,007	6.7
	Peisley	1,263	1.4
Tabratong	462	0.5	

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Condobolin (cont)	Talgong	666	0.7
	Taratta	953	1.1
	Tottenham	1,204	1.3
	Towyal	142	0.2
	Trundle	439	0.5
	Vermont Hill	425	0.5
	West Cookeys Plains	639	0.7
	Wharfdale	598	0.7
	Wilbertroy	1,562	1.7
	Yarragong	75	0.1
	Total		55.8
Coonamble	Bourbah	622	1.4
	Carrabear	173	0.4
	Gilwarny	295	0.7
	Mellerstain	194	0.4
	Merri Merri	190	0.4
	Narraway	880	2.0
	Nebea	361	0.8
	Sandgate	779	1.8
	Tailby	460	1.0
	Tallegar	1,795	4.1
	Tenandra	489	1.1
	Wingadee	<1	<0.1
	Total		14.1
Cowra	Barbingal	272	0.4
	Bendick Murrell	1,859	3.1
	Bimbi	2,034	3.3
	Bogalong	113	0.2
	Caragabal	406	0.7
	Cumbijowa	<1	<0.1
	Little Caragabal	150	0.2
	Mandagery	444	0.7
	Maudry	206	0.3
	Mulyandry	759	1.2
	Priddle	209	0.3
	Pullabooka	1,524	2.5
	Tomanbil	363	0.6
	Warraderry	2,854	4.7
	Weddin	839	1.4
	Yambira	42	0.1
Total		19.7	

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Cummeragunja	Berrigan	286	0.5
	Coreen	374	0.7
	Jerilderie	23	<0.1
	Mairjimmy	454	0.8
	Palmer	724	1.3
	Wahgunyah	326	0.6
	Total		3.9
Deniliquin	Boooroban	1,439	3.1
	Total		3.1
Dubbo	Dubbo ²	2	<0.1
	Tuckland	857	1.2
	Total		1.2
Gilgandra	Berida	68	0.2
	Eringanerin	58	0.2
	Gilgandra	190	0.6
	Total		1.0
Griffith	Banandra	404	0.3
	Binya	4,167	3.0
	Boona	1,183	0.8
	Bretts	734	0.5
	Conapaira East	<1	<0.1
	Conapaira South	1,888	1.3
	Denny	133	0.1
	Edgar	637	0.5
	Gap Dam	259	0.2
	Goolgowi	101	0.1
	Jimberoo	1,938	1.4
	Kolkilbertoo	193	0.1
	Kulki	170	0.1
	Lachlan Range	3,151	2.3
	Melbergen	277	0.2
	Meriwagga	165	0.1
	Stackpoole	754	0.5
	Steam Plains	327	0.2
	Tabbita	127	0.1
	Ugobit	221	0.2
Total		12.0	
Ivanhoe	Paddington	5,465	4.4
	Total		4.4

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Leeton and district	Banandra	357	3.8
	Moombooldool	93	1.0
	Willows	71	0.8
	Total		5.6
Mudgee	Cope	1,502	3.2
	Dungeree	799	1.7
	Total		4.9
Murrin Bridge	Booberoi	833	1.4
	Cargelligo	582	1.0
	Conapaira East	1,025	1.7
	Jimberoo	1,163	1.9
	Melougel	261	0.4
	Minter	42	0.1
	Naradhan	165	0.3
	Yelkin	1,848	3.0
	Total		9.8
Narrandera	Ardlethan	184	0.5
	Bald Hill	152	0.4
	Beckom	137	0.4
	Buckingbong	11,663	34.0
	Buggajool	108	0.3
	Bunganbil	460	1.3
	Currajong	232	0.7
	Ganmain	978	2.9
	Gillenbah	3,125	9.1
	Kindra	3	<0.1
	Lake Urana	2	<0.1
	Mandamah	251	0.7
	Matong	3,162	9.2
	Mejum	920	2.7
	Wallerobie	272	0.8
	Willows	<1	<0.1
	Yarranjerry	1,871	5.5
	Total		68.5
	Narromine	Cowal	503
Momo		473	17.6
Total			36.3
Nyngan	Barrow	1,224	0.6
	Canbelego	<1	<0.1
	Cumbine	256	25.5
	Girilambone	971	2.3

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Nyngan cont.	Grayrigg	484	1.1
	Miandetta	737	1.7
	Pangee	1,102	2.6
	Thorndale	1,749	4.1
	Total		15.3
Orange	Killonbutta	1,283	5.0
	Mandagery	1,045	4.1
	Total		9.1
Peak Hill	Albert	1,060	1.7
	Back Yamma	4,406	7.1
	Carolina	5	<0.1
	Cookamidgera	529	0.9
	Coradgery	782	1.3
	Cumbijowa	249	0.4
	Curra	274	0.4
	Euchabil	211	0.3
	Forbes ³	2	<0.1
	Gunningbland	1,096	1.8
	Limestone	62	0.1
	Momo	74	0.1
	Monumea Gap	385	0.6
	Strahorn	2,255	3.6
	Tottenham	167	0.3
	Tullamore	123	0.2
	Warregal	176	0.3
	Wombin	404	0.7
	Yarragong	<1	<0.1
	Total		19.8
Quambone	Holybon	125	0.3
	Merrinele	536	1.3
	Total		1.6
Trangie	Gin Gin	39	1.7
	Total		1.7
Wagga Wagga	Berry Jerry	1,336	3.6
	Brookong	333	0.9
	Combaning	53	0.1
	Cullivel	165	0.4
	Currawananna	236	0.6
	Kindra	514	1.4
	Kockibitoo	243	0.7
	Lake Urana	212	0.6

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Wagga Wagga cont.	Lester	754	2.1
	Matong	5	<0.1
	Milbrulong	381	1.0
	Widgiewa	204	0.6
	Total		12.0
Walgett	Gilwarny	3,202	3.2
	Wingadee	296	0.3
	Total		3.5
Weilwan	Tailby	450	2.5
	Tenandra	<1	<0.1
	Warrie	294	1.6
	Total		4.2
Wellington	Killonbutta	233	4.1
	Total		4.1
West Wyalong	Back Creek	1,006	4.3
	Blow Clear	126	0.5
	Blue Mallee	283	1.2
	Boxalls	402	1.7
	Buddigower	640	2.8
	Bygalore	256	1.1
	Calleen	17	0.1
	Caragabal	<1	<0.1
	Clear Ridge	304	1.3
	Corringle	724	3.1
	Euglo South	1,589	6.9
	Hiawatha	776	3.3
	Jingerangle	269	1.2
	Lake View	235	1.0
	Little Blow Clear	57	0.2
	Manna	3,010	13.0
	Nerang Cowal	1,058	4.6
	Ungarie	211	0.9
	Weelah	1,496	6.5
	Wilga	281	1.2
	Wyalong	179	0.8
	Wyrra	1,269	5.5
	Total		61.2

Local Aboriginal Land Council (LALC)	State forest name	State forest area (hectares)	Contribution to public land in the LALC (percentage)
Young	Bimbi	536	2.7
	Buggajool	282	1.4
	Caragabal	2	<0.1
	Combaning	712	3.6
	Curraurrama	530	2.7
	Eurabba	752	3.9
	Jindalee	1,059	5.4
	Narraburra	59	0.3
	Reefton	313	1.6
	Therabung	193	1.0
	Weddin	1,523	7.8
	Yeo Yeo	187	1.0
	Young	491	2.5
	Total		

Source DECCW, written communication, 14 April 2010

¹ Condobolin State Forest is the location of a depot shed and cottage.

² Dubbo State Forest is the location of Forests NSW and DII regional offices.

³ Forbes State Forest is the location of a depot shed and retail nursery.

Appendix 22

Methodology for landscape function values and threats

The NRC carried out a desktop analysis to identify the environmental values of the 197 cypress state forests and the potential threats to these values. The results of the NRC's analysis are presented in **Tables A22.1** to **A22.4**. This analysis was used to inform the NRC's recommendations to Government on potential management and tenure arrangements.

The purpose of this appendix is to explain the methodology for the analysis.

A22.1 Determining landscape function value

The NRC developed a landscape function value for each of the 197 cypress state forests; ranging from limited to high. **Table A22.1** shows these landscape function values.

Chapter 3 explained some limitations of the data used for this assessment. For example, the reliability of the NRC's profile mapping for each forest varies because the mapping datasets used to develop the composite map were based on different methods, approaches and constraints. As such, the NRC calibrated other datasets against its own analysis to increase the reliability of the values it generated for landscape function.

The NRC dataset was based on an independent analysis conducted by Eco Logical Australia (EcoAus) on ecological landscape values of each state forest (see **Section A22.4** and **Table A22.5** for further details). The other datasets used were:

- Department of Environment, Climate Change and Water (DECCW) – analysis carried out by DECCW identifying state forests with high ecological values. This list was provided by DECCW to the NRC as part of the assessment (see **Section A22.5**, **Table A22.6**)
- National Parks Association of NSW (NPA) (on behalf of the NPA, Nature Conservation Council of NSW and Colong Foundation for Wilderness) – analysis of priority state forests for reservation based on a range of criteria, contained in a public submission to the NRC (see **Section A22.6**, **Table A22.7**).

The following decision rule was used to identify forests with high landscape function:

• Landscape function value = [all HIGH EcoAus value + any value that scored HIGH in both DECCW and NPA values and also was either LIMITED or MEDIUM in EcoAus] – any HIGH EcoAus value that scored 'NOT LISTED' in both DECCW and NPA values].

¹ Based on an independent analysis conducted by Eco Logical Australia on ecological landscape values of each state forest (refer to **Section A22.4**)

Table A22.1: NRC's list of state forests' landscape function values

State forests with high landscape function value		
Back Creek	Cumbine	Mount Nobby
Back Yamma	East Cookeys Plains	Narraway
Bendick Murrell	Euglo South	Reefton
Berry Jerry	Gap Dam	Sandgate
Bimbi	Gillenbah	Stackpoole
Binya	Gunning Gap	Strahorn
Blow Clear	Hiawatha	Tailby
Blue Mallee	Jimberoo	Tallegar
Boooroban	Jindalee	Tottenham
Bourbah	Kiacatoo	Warraderry
Boxalls	Killonbutta	Warrie
Buckingbong	Lachlan Range	Weddin
Buddigower	Lake Urana	Weelah
Carawandool	Mandagery	Wilbertroy
Cargelligo	Manna	Wyrra
Carolina	Melbergen	Yambira
Carrabear	Melougel	Yathong
Conapaira South	Merri Merri	Yelkin
Coradgery	Monumea Gap	Young
State forests with moderate landscape function value		
Albert	Denny	Mount Tilga
Ardlethan	Derriwong	Mulyandry
Bald Hill	Dungeree	Murda

Table A22.1: NRC's list of landscape function values continued

State forests with moderate landscape function value		
Balgay	Edgar	Nebea
Balowra	Edols	Nerang Cowal
Banandra	Eringanerin	Paddington
Barbingal	Euchabil	Palmer
Barrow	Fifield	Pangee
Beckom	Forbes	Peisley
Bedooba	Ganmain	Priddle
Berewombenia	Gilgandra	Puckawidgee
Berida	Gilgunnia	Pullabooka
Berrigan	Gilwarny	Steam Plains
Blow Clear West	Gin Gin	Tabbita
Bobadah	Girilambone	Tabratong
Bogalong	Goolgowi	Talgong
Booberoi	Grahway	Taratta
Boona	Grayrigg	Tenandra
Bretts	Gunningbland	Therabung
Broken Range	Holybon	Thorndale
Brookong	Jerilderie	Tomanbil
Buggajool	Jingerangle	Towyal
Bulbodney	Kindra	Trundle
Bunganbil	Kockibitoo	Tuckland
Bygalore	Kolkilbertoo	Tullamore
Cadow	Lake View	Ugobit
Calleen	Lester	Ungarie
Canbelego	Little Blow Clear	Vermont Hill
Caragabal	Little Caragabal	Wahgunyah
Carrobooblin	Lonesome Pine	Wallerroobie
Clear Ridge	Mairijimmy	Warregal
Combaning	Mandamah	West Cookeys Plains
Conapaira East	Matong	Wharfdale
Condobolin	Maudry	Widgiewa
Cookamidgera	Mejum	Wilga
Cope	Mellerstain	Willows
Corringle	Meriwagga	Wingadee
Cowal	Merrinele	Wombin
Cullivel	Meryula	Wyalong
Cumbijowa	Miandetta	Yarragong
Curra	Milbrulong	Yarranjerry
Curraburrama	Minter	Yeo Yeo
Currajong	Momo	
Currawananna	Nangerybone	
Eurabba	Naradhan	
State forests with limited landscape function value ¹		
Coreen	Kulki	Narraburra
Dubbo	Limestone	Ringwood Tank
Kentucky	Moombooldool	

Based on this analysis, the NRC identified 57 state forests it regards as of high landscape function value. The remainder were classified as having either moderate or limited value.

A22.2 Identifying cypress state forests at risk from potential threats

The NRC identified a range of potential threats to the landscape functions the cypress state forests provide. The two key potential threats recognised were (i) livestock grazing and (ii) harvesting where it has the potential to diminish spatial variability in forest structure, especially small, isolated forests (see **Chapters 3** and **6** of the NRC's assessment report).

Forests that may be at risk from these potential threats were identified using the NRC's assessment of landscape function values (see **Table A22.1**) and additional datasets from:

- Forests NSW – information on timber values and other uses such as grazing and apiary (see **Table A22.8**)
- Eco Logical Australia – an independent analysis on potential threatening processes for each state forest (197) commissioned by the NRC

The following decision rules were used to identify forests that are particularly vulnerable to these potential threats:

- **Potential grazing threat** = the state forest has one or more grazing permits and has been identified by the NRC as having high landscape function value
- **Disturbance potential from harvesting** = the state forest occurs as a remnant within the central division, is less than 100 hectares in size and white cypress makes up more than 75 per cent of the vegetation in the state forest

Based on this analysis, the NRC identified:

- 25 cypress state forests that may be particularly vulnerable to grazing threats (refer to **Table A22.2**)
- 11 state forests that may be vulnerable to disturbance from harvesting (refer to **Table A22.3**).

A22.3 Management and associated potential tenure changes

The available information allowed the NRC to group the 197 assessed forests into two broad categories based on the range of values they support, which the NRC used to propose future management and associated tenure arrangements.

A number of key datasets were used, including:

- NRC's landscape function values – a derived value as described in **Section A22.1**
- NRC's derived threat values – a derived value as described in **Section A22.2**
- Forests NSW – including information on timber values (refers to commercial or non-commercial values as indicated in **Table A22.8**)
- DECCW analysis – state forests with high ecological priority (**Section A22.5**)

The two categories, and their proposed management and tenure regions, were:

1. Continue to manage most of the state forests for both production and environmental values

These 168 forests were of varying landscape function value. Within this group the NRC identified two sets of forests of particular interest:

- 25 forests that may have grazing threat potential (see **Table A22.2**)
- 11 state forests that may be vulnerable to disturbance from harvesting (see **Table A22.3**).

2. Manage a small number of the state forests primarily for landscape function and other social values

These 29 state forests were mainly of high landscape function value, had high DECCW priority and/or were mostly identified by Forests NSW as having low timber values. **Table A22.4** provides a list of these forests.

Table A22.2: State forests that may be particularly vulnerable to grazing threats

State forest		
Back Creek	Gunning Gap	Sandgate
Bimbi	Jimberoo	Strahorn
Buckingbong	Manna	Tailby
Carrabear	Melbergen	Tallegar
Conapaira South	Melougel	Warrie
Cumbine	Monumea Gap	Weddin
East Cookeys Plains	Mount Nobby	Wilbertroy
Gap Dam	Narraway	Yathong
Gillenbah		

Table A22.3: State forests that may be vulnerable to disturbance from harvesting

State forests	
Beckom	Little Blow Clear
Coreen	Moombooldool
Cullivel	Narraburra
Kentucky	Ringwood Tank
Kulki	Widgiewa
Limestone	

Table A22.4: State forests that should be managed primarily for landscape function and other social values

State forest		
Balowra	Cumbijowa	Paddington
Bedooba	Edgar	Puckawidgee
Bendick Murrell	Gin Gin	Reefton
Berry Jerry	Hiawatha	Stackpoole
Blue Mallee	Holybon	Steam Plains
Booroorban	Jerilderie	Towyal
Buggajool	Jindalee	Wyalong
Cadow	Kiacatoo	Yeo Yeo
Combaning	Killonbutta	Young
Cookamidgera	Mandagery	

A22.4 Eco Logical Australia's methodology and forests list

The landscape function scores assigned to each forest by Eco Logical Australia were calculated as the weighted sum of scores for a suite of important ecological parameters. These parameters, and the weighting assigned them, are presented in **Section A22.4.1**.

A summary of the rationale and methods used for Eco Logical Australia's assessment follows, as well as a list of cypress state forests identified by Eco Logical Australia as having high ecological value scores.

A22.4.1 Ecological values

Multiplier	Parameter
X 1	Presence of an endangered ecological vegetation community (EEC).
X 1	Presence of a vegetation community that is listed by the International Union for Conservation of Nature (IUCN).
X 2	Vegetation mosaics – presence of a diversity of vegetation types within the forest. In this case the diversity within a patch of vegetation provides an indication of the ability to support a more diverse range of species and operate as more complete representative of biodiversity within the region
X 2.6	Habitat patch sizes. Generally, this weighting reflects the premise that the larger and more contiguous the habitat patch, the greater the ability for it to support and maintain biodiversity in the longer term within a landscape.
X 2.6	Remnants and broad land tenure/land use. This weighting reflects the importance of a habitat remnant within a fragmented and developed landscape. Habitat remnants in highly modified environments often operate as important refugia and/or stepping stones for species over a broad area.
X 1.5	Proximity to an identified corridor. Habitat associated with a corridor contributes to the overall landscape biodiversity values by providing a link for species to move through a landscape

A simple grouping of the final weighted ecological significance score is described below, showing potential ecological

significance score ranges and a general description of the characteristics of the grouping.

Rating	Ecological Significance Score	General description
Low	0 to 8	Mainly forests with single dominant community (white cypress), poor representation of habitat patches and poor connectivity in the landscape
Moderate	8.1 to 16	Generally forests where either EECs or IUCN-identified communities occur, with a variation in the occurrence of vegetation mosaics, significance of habitat patches and landscape connectivity
High	16.1 to 24	Generally forests that are associated with significant habitat patches in the landscape, have good connectivity, contain a diverse mosaic of vegetation and have either EECs or IUCN-identified communities

A22.4.2 EEC and IUCN value

This value identifies the proportion of the forest which is covered (in area) by an identified EEC or by an IUCN identified vegetation community. These values reflect the presence

of vegetation communities that are rare or endangered and are valued for conservation in the broader landscape. The criteria developed to score these parameters are defined in the following table.

Score	Criteria
EEC Values	
0	No EEC presence recorded
1	EEC presence recorded
2	EECs make up >75% of the vegetation within the forest
IUCN Values	
0	No IUCN communities recorded
1	IUCN communities recorded
2	IUCN communities make up >75% of the vegetation within the forest

A22.4.3 Vegetation mosaic value

This value identifies the diversity value of the forest. The higher the diversity of species within a forest, the greater the potential for it to provide effective habitat values for a range of fauna species and contribute as a complex remnant of habitat within a broader landscape. In this case, some simple,

available information was used in the assessment of this value to determine the presence of heterogeneity or diversity within the forest. This value was based mainly on the presence and proportion of the forest that was white cypress dominant against other communities (white cypress associated or otherwise). The criteria developed to score these parameters are defined in the following table.

Score	Criteria
0	White cypress dominant vegetation makes up > 75% of the vegetation in the forest
1	White cypress dominant vegetation makes up 50–75% of the vegetation in the forest and other communities present (associated to white cypress or otherwise)
2	White cypress dominant vegetation makes up 25–50% of the vegetation in the forest and other communities present (associated to white cypress or otherwise)
3	White cypress dominant vegetation makes up <25% of the vegetation in the forest and other communities present (associated to white cypress or otherwise)

A22.4.4 Habitat patch value

This value represents contiguity of the overall habitat importance within a landscape. Larger, more contiguous and well connected patches of forest provide an important habitat for a diverse range of species. Usually, forests associated with larger patches of habitat support a key ecological function across this landscape and are able to support a range of

species from those with smaller, more localised needs to those that require a larger more diverse habitat.

A simple proximity analysis was carried out to identify the association of the forest within a contiguous patch of native woody vegetation, regardless of community or species makeup. The criteria developed to score these parameters are defined in the following table.

Score	Criteria
0	Associated vegetation patch <100 hectares
1	Associated vegetation patch between 100 hectares and 1000 hectares
2	Associated vegetation patch >1000 hectares

A22.4.5 Remnant and Land Tenure / Land Use Value

This value represents the operation of the forest as a habitat remnant in a fragmented agricultural landscape. In order to consider the variation in land use as a factor of this parameter, the forests were divided dependant on the primary surrounding land tenure and use.

key ecological function of the patch of forest is to provide a refuge for species in an otherwise developed landscape. To assess this value simply, patches of forest in primarily privately owned and developed lands within the central division that make up the sheep-wheat belt were identified as providing an important ecological function within the fragmented landscape. The criteria developed to score these parameters are defined in the following table.

Fragmented forests tend to occur within a landscape dominated by more intensive land use, such as cropping. In this case, the

Score	Criteria
0	Occurs in or immediately adjacent to the western division
2	Occurs as a remnant within the central division

A22.4.6 Corridor functionality

This value identifies the contribution that the forest makes to landscape connectivity. This was assessed by identifying the spatial relationship of the forest to known broad habitat corridors across the landscape. A forest located within or in

proximity to an identified corridor may have a higher contribution to maintaining functional connectivity for a diversity of species across the landscape. The criteria developed to score these parameters are defined in the following table.

Score	Criteria
0	Greater than 2 kilometres from an identified corridor
1	All or part of the forest occurring within 2 kilometres of an identified corridor
2	All or part of the forest occurring within an identified 1 kilometre wide corridor

A22.4.7 State forests with high ecological value scores based on Eco Logical Australia’s analysis

Table A22.5: State forests with high ecological scores based on Eco Logical Australia’s analysis

Ecological Australia’s high ecological scores		
Back Yamma	Derriwong	Momo
Balgay	Dungeree	Monumea Gap
Barrow	East Cookeys Plains	Narraway
Berewombenia	Euchabil	Pangee
Berry Jerry	Gap Dam	Peisley

Table A22.5: State forests with high ecological scores based on Ecological Australia's analysis cont.

Ecological Australia's high ecological scores		
Bimbi	Gilwarny	Reefton
Blow Clear West	Gin Gin	Sandgate
Blue Mallee	Girilambone	Strahorn
Bobadah	Grahway	Tabratong
Booroorban	Gunning Gap	Tailby
Bourbah	Hiawatha	Talgong
Buckingbong	Holybon	Tallegar
Buddigower	Jerilderie	Tottenham
Bulbodney	Jimberoo	Trundle
Carawandool	Jindalee	Tuckland
Cargelligo	Kiacatoo	Warraderry
Carolina	Killonbutta	Weddin
Carrabear	Lachlan Range	Weelah
Conapaira South	Mandagery	West Cookeys Plains
Cope	Manna	Wharfdale
Coradgery	Maudry	Wingadee
Cumbijowa	Melbergen	Yarragong
Curra	Melougel	Yelkin
Curraburrama	Merri Merri	Young

A22.5 State forests with high ecological value based on DECCW analysis

DECCW has undertaken analysis and provided the NRC with a list of forests of high ecological value, including forests that:

- adjoin already in existing reserves, and in most cases contain different vegetation types than the adjoining reserve
- contribute to corridor linkages in north south corridors, linking existing reserves or priority landscape areas
- are eucalypt hardwood forests/forest-dominated EECs that are considered to have high conservation value and many of the hardwood forest also contain mixed woodland comprising EECs
- have other high ecological values including size and therefore overall contribution in the landscape, high biodiversity values, including providing habitat for a large number of threatened species and some endangered ecological communities.

Table A22.6: Forests with high ecological value based on DECCW analysis

State Forests		
Back Creek	Cumbine	Puckawidgee
Banandra	Edgar	Reefton
Bendick Murrell	Euglo South	Ringwood Tank
Berrigan	Eurabba	Sandgate
Berry Jerry	Gillenbah	Stackpoole
Bimbi	Goolgowi	Steam Plains
Binya	Gunning Gap	Strahorn
Blow Clear	Hiawatha	Tabbita
Blue Mallee	Jimberoo	Tailby
Boona	Jindalee	Tallegar
Booroorban	Kentucky	Taratta
Bourbah	Kiacatoo	Towyal

Table A22.6: Forests with high ecological value based on DECCW analysis cont.

State Forests		
Boxalls	Killonbutta	Ugobit
Bretts	Kockibitoo	Wahgunyah
Buckingbong	Lake Urana	Warraderry
Buddigower	Little Blow Clear	Warrie
Buggajool	Lonesome Pine	Weddin
Cadow	Corringle	Wilbertroy
Carawandool	Mairjimmy	Wyalong
Cargelligo	Mandagery	Wyrra
Carrabear	Manna	Yambira
Clear Ridge	Matong	Yarranjerry
Combaning	Merri Merri	Yathong
Conapaira East	Milbrulong	Yelkin
Conapaira South	Mount Nobby	Yeo Yeo
Cookamidgera	Mount Tilga	Young
Coradgery	Narraway	
Coreen	Palmer	

A22.6 State forests with high ecological value as identified by the National Parks Association of NSW

Table A22.7: State forests with high ecological values identified by National Parks Association of NSW, Nature Conservation Council of NSW and Colong Foundation for Wilderness¹

Recognised high conservation	
Back Creek	Narraway
Back Yamma	Nerang Cowal
Bourbah	Reefton
Boxall	Sandgate
Buckingbong	Strahorn
Carrabear	Tailby
Carrawandool	Tallegar
Cumbine (and associated timber reserves)	Tottenham
Euglo South	Warrie
Gillenbah	Weelah
Gunebang	Wilbertroy
Mandagery	Wyrra
Manna	Yambira
Merri Merri	
Core conservation	
Bimbi	Jimberoo
Binya	Mount Nobby
Conapaira South	Weddin
Lachlan Range	Yathong (and nearby timber reserves)
Lake Urana	

¹ For further information see the National Parks Association's submission on the NRC's website at <http://nrc.nsw.gov.au>.

Table A22.7: State forests with high ecological values identified by National Parks Association of NSW, Nature Conservation Council of NSW and Colong Foundation for Wilderness¹ cont.

Threatened Species and Communities	
Blowclear East	Killanbutta
Blue Mallee	Monumea Gap
Carolina	Mulyandry
Coradgery	Reefton
East Cookeys Plains	Tottenham
Gunningbland	Warraderry
Conectivity	
Warraderry	
Stepping Stones	
Cargelligo	Mejum
Gap Dam	Stackpoole
Melbergen	Yelkin
Melougel	
Naradhan	
Social/Recreational Value	
Bendick Murrell	Binya
Bimbi	Weddin

A22.7 Information provided by Forests NSW regarding commercial timber value and grazing permits in cypress state forests

Table A22.8: Forest NSW's list of forests with commercial timber value and grazing permits

Conectivity	Timber value	Grazing permit
1. Albert	Yes	No
2. Ardlethan	Yes	No
3. Back Creek	Yes	Yes
4. Back Yamma	Yes	No
5. Bald Hill	Yes	No
6. Balgay	Yes	No
7. Balowra	No	No
8. Banandra	Yes	Yes
9. Barbingal	Yes	No
10. Barrow	Yes	No
11. Beckom	Yes	No
12. Bedooba	No	Yes
13. Bendick Murrell	No	No
14. Berewombenia	Yes	Yes
15. Berida	Yes	No
16. Berrigan	Yes	Yes
17. Berry Jerry	No	Yes
18. Bimbi	Yes	Yes
19. Binya	Yes	No

Table A22.8: Forest NSW's list of forests with commercial timber value and grazing permits cont.

Conectivity	Timber value	Grazing permit
20. Blow Clear	Yes	No
21. Blow Clear West	Yes	No
22. Blue Mallee	No	No
23. Bobadah	Yes	No
24. Bogalong	Yes	Yes
25. Booberoi	Yes	Yes
26. Boona	Yes	Yes
27. Booroorban	No	No
28. Bourbah	Yes	No
29. Boxalls	Yes	No
30. Bretts	Yes	Yes
31. Broken Range	Yes	Yes
32. Brookong	Yes	No
33. Buckingbong	Yes	Yes
34. Buddigower	Yes	No
35. Buggajool	No	No
36. Bulbodney	Yes	Yes
37. Bunganbil	Yes	Yes
38. Bygalore	Yes	No
39. Cadow	No	No
40. Calleen	Yes	Yes
41. Canbelego	Yes	Yes
42. Caragabal	Yes	Yes
43. Carawandool	Yes	No
44. Cargelligo	Yes	No
45. Carolina	Yes	No
46. Carrabear	Yes	Yes
47. Carrooblin	Yes	No
48. Clear Ridge	Yes	No
49. Combaning	No	No
50. Conapaira East	Yes	Yes
51. Conapaira South	Yes	Yes
52. Condobolin	Yes	No
53. Cookamidgera	No	No
54. Cope	Yes	Yes
55. Coradgery	Yes	No
56. Coreen	Yes	Yes
57. Corringale	Yes	No
58. Cowal	Yes	Yes
59. Cullivel	Yes	No
60. Cumbijowa	No	Yes
61. Cumbine	Yes	Yes
62. Curra	Yes	No
63. Curraburrama	Yes	Yes
64. Currajong	Yes	No
65. Currawananna	Yes	No

Table A22.8: Forest NSW's list of forests with commercial timber value and grazing permits cont.

Conectivity	Timber value	Grazing permit
66. Denny	Yes	Yes
67. Derriwong	Yes	Yes
68. Dubbo	Yes	No
69. Dungeree	Yes	No
70. East Cookeys Plains	Yes	Yes
71. Edgar	No	Yes
72. Edols	Yes	Yes
73. Eringanerin	Yes	No
74. Euchabil	Yes	No
75. Euglo South	Yes	No
76. Eurabba	Yes	Yes
77. Fifield	Yes	No
78. Forbes	Yes	No
79. Ganmain	Yes	No
80. Gap Dam	Yes	Yes
81. Gilgandra	Yes	Yes
82. Gilgunnia	Yes	No
83. Gillenbah	Yes	Yes
84. Gilwarny	Yes	Yes
85. Gin Gin	No	Yes
86. Girilambone	Yes	Yes
87. Goolgowi	Yes	Yes
88. Grahway	Yes	No
89. Grayrigg	Yes	Yes
90. Gunning Gap	Yes	Yes
91. Gunningbland	Yes	No
92. Hiawatha	No	No
93. Holybon	No	Yes
94. Jerilderie	No	Yes
95. Jimberoo	Yes	Yes
96. Jindalee	No	No
97. Jingerangle	Yes	Yes
98. Kentucky	Yes	Yes
99. Kiacatoo	No	No
100. Killonbutta	No	No
101. Kindra	Yes	Yes
102. Kockibitoo	Yes	No
103. Kolkilbertoo	Yes	No
104. Kulki	Yes	Yes
105. Lachlan Range	Yes	No
106. Lake Urana	Yes	No
107. Lake View	Yes	No
108. Lester	Yes	Yes
109. Limestone	Yes	No
110. Little Blow Clear	Yes	Yes
111. Little Caragabal	Yes	Yes

Table A22.8: Forest NSW's list of forests with commercial timber value and grazing permits cont.

Conectivity	Timber value	Grazing permit
112. Lonesome Pine	Yes	No
113. Mairjimmy	Yes	Yes
114. Mandagery	No	No
115. Mandamah	Yes	Yes
116. Manna	Yes	Yes
117. Matong	Yes	Yes
118. Maudry	Yes	No
119. Mejum	Yes	Yes
120. Melbergen	Yes	Yes
121. Mellerstain	Yes	Yes
122. Melougel	Yes	Yes
123. Meriwagga	Yes	Yes
124. Merri Merri	Yes	No
125. Merrinele	Yes	Yes
126. Meryula	Yes	Yes
127. Miandetta	Yes	No
128. Milbrulong	Yes	No
129. Minter	Yes	No
130. Momo	Yes	No
131. Monumea Gap	Yes	Yes
132. Moombooldool	Yes	Yes
133. Mount Nobby	Yes	Yes
134. Mount Tilga	Yes	Yes
135. Mulyandry	Yes	No
136. Murda	Yes	No
137. Nangerybone	Yes	Yes
138. Naradhan	Yes	Yes
139. Narraburra	Yes	No
140. Narraway	Yes	Yes
141. Nebea	Yes	Yes
142. Nerang Cowal	Yes	No
143. Paddington	No	Yes
144. Palmer	Yes	Yes
145. Pangee	Yes	No
146. Peisley	Yes	No
147. Priddle	Yes	Yes
148. Puckawidgee	No	Yes
149. Pullabooka	Yes	Yes
150. Reefton	No	No
151. Ringwood Tank	Yes	Yes
152. Sandgate	Yes	Yes
153. Stackpoole	No	No
154. Steam Plains	No	Yes
155. Strahorn	Yes	Yes
156. Tabbita	Yes	Yes
157. Tabratong	Yes	Yes

Table A22.8: Forest NSW's list of forests with commercial timber value and grazing permits cont.

Conectivity	Timber value	Grazing permit
158. Tailby	Yes	Yes
159. Talgong	Yes	No
160. Tallegar	Yes	Yes
161. Taratta	Yes	No
162. Tenandra	Yes	Yes
163. Therarbung	Yes	Yes
164. Thorndale	Yes	Yes
165. Tomanbil	Yes	No
166. Tottenham	Yes	No
167. Towyal	No	Yes
168. Trundle	Yes	No
169. Tuckland	Yes	No
170. Tullamore	Yes	Yes
171. Ugobit	Yes	No
172. Ungarie	Yes	No
173. Vermont Hill	Yes	No
174. Wahgunyah	Yes	No
175. Walleroobie	Yes	Yes
176. Warraderry	Yes	No
177. Warregal	Yes	Yes
178. Warrie	Yes	Yes
179. Weddin	Yes	Yes
180. Weelah	Yes	No
181. West Cookeys Plains	Yes	No
182. Wharfdale	Yes	No
183. Widgiewa	Yes	No
184. Wilbertroy	Yes	Yes
185. Wilga	Yes	Yes
186. Willows	Yes	Yes
187. Wingadee	Yes	Yes
188. Wombin	Yes	No
189. Wyalong	No	No
190. Wyrra	Yes	No
191. Yambira	Yes	No
192. Yarragong	Yes	No
193. Yarranjerry	Yes	No
194. Yathong	Yes	Yes
195. Yelkin	Yes	No
196. Yeo Yeo	No	No
197. Young	No	No

Appendix 23

List of the south-western cypress state forests within this assessment

South-western cypress state forests under this assessment					
Albert	Buggajool	Dungeree	Kolkilbertoo	Nangerybone	Ugobit
Ardlethan	Bulbodney	East Cookeys Plains	Kulki	Naradhan	Ungarie
Back Creek	Bunganbil	Edgar	Lachlan Range	Narraburra	Vermont Hill
Back Yamma	Bygalore	Edols	Lake Urana	Narraway	Wahgunyah
Bald Hill	Cadow	Eringanerin	Lake View	Nebea	Wallerobie
Balgay	Calleen	Euchabil	Lester	Nerang Cowal	Warraderry
Balowra	Canbelego	Euglo South	Limestone	Paddington	Warregal
Banandra	Caragabal	Eurabba	Little Blow Clear	Palmer	Warrie
Barbingal	Carawandool	Fifield	Little Caragabal	Pangee	Weddin
Barrow	Cargelligo	Forbes	Lonesome Pine	Peisley	Weelah
Beckom	Carolina	Ganmain	Mairjimmy	Priddle	West Cookeys Plains
Bedooba	Carrabear	Gap Dam	Mandagery	Puckawidgee	Wharfdale
Bendick Murrell	Carroboblin	Gilgandra	Mandamah	Pullabooka	Widgiewa
Berewombenia	Clear Ridge	Gilgunnia	Manna	Reefton	Wilbertroy
Berida	Combaning	Gillenbah	Matong	Ringwood Tank	Wilga
Berrigan	Conapaira East	Gilwarny	Maudry	Sandgate	Willows
Berry Jerry	Conapaira South	Gin Gin	Mejum	Stackpoole	Wingadee
Bimbi	Condobolin	Girilambone	Melbergen	Steam Plains	Wombin
Binya	Cookamidgera	Goolgowi	Mellerstain	Strahorn	Wyalong
Blow Clear	Cope	Grahway	Melougel	Tabbita	Wyrra
Blow Clear West	Coradgery	Grayrigg	Meriwagga	Tabratong	Yambira
Blue Mallee	Coreen	Gunning Gap	Merri Merri	Tailby	Yarragong
Bobadah	Corringle	Gunningbland	Merrinele	Talgong	Yarranjerry
Bogalong	Cowal	Hiawatha	Meryula	Tallegar	Yathong
Booberoi	Cullivel	Holybon	Miandetta	Taratta	Yelkin
Boona	Cumbijowa	Jerilderie	Milbrulong	Tenandra	Yeo Yeo
Booororban	Cumbine	Jimberoo	Minter	Therarbung	Young
Bourbah	Curra	Jindalee	Momo	Thorndale	
Boxalls	Curraburrama	Jingerangle	Monumea Gap	Tomanbil	
Bretts	Currajong	Kentucky	Moombooldool	Tottenham	
Broken Range	Currawananna	Kiacatoo	Mount Nobby	Towyal	
Brookong	Denny	Killonbutta	Mount Tilga	Trundle	
Buckingbong	Derriwong	Kindra	Mulyandry	Tuckland	
Buddigower	Dubbo	Kockibitoo	Murda	Tullamore	

Notes

Notes

Notes

