FEBRUARY 2010

SUMMARY OF AVAILABLE INFORMATION AND CALL FOR SUBMISSIONS

REGIONAL FOREST ASSESSMENT

SOUTH-WESTERN CYPRESS STATE FORESTS

natural resources commission

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Submissions

Submissions in response to this document are due to the NRC by 26 March 2010.

There is no standard format for submissions. Submissions may range from a short letter outlining your views on a particular topic to a more comprehensive document covering a range of issues. Where possible you should provide evidence, such as relevant data and documentation, to support your views. While every submission is welcome, multiple identical submissions do not carry more weight than the merits of an argument in a single submission.

Submissions may be sent by email, fax or mail. An electronic copy would be appreciated either by email or on disk. The electronic version can be either a text document (.doc, .txt) or Adobe Portable Format (.pdf)

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List of acronyms

ABS	Australian Bureau of Statistics
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DECCW	Department of Environment, Climate Change and Water
DII	Department of Industry and Investment NSW
EPBC	Environment Protection and Biodiversity Conservation Act 1999 (C'th)
ESFM	Ecologically Sustainable Forests Management
IBRA	Interim Biogeographic Regionalisation of Australia
IFOA	Integrated Forestry Operations Approval
INS	Invasive Native Scrub
JANIS	Joint ANZECC National Forest Policy Statement Implementation Sub-Committee
NRC	Natural Resources Commission
NRM	Natural Resource Management
NSW	New South Wales
PNF	Private Native Forestry
PVP	Property Vegetation Plan

natural resources commission

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1 Introduction

The NSW Government has asked the Natural Resources Commission (NRC) to assess the cypress state forests in south-western NSW. 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 **Attachment 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; and
4. timber resources.

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 Purpose of this document

The purpose of this document is to seek submissions from stakeholders on any further information and insights that can contribute to the assessment. This is because much of the information relevant to the assessment will be held by stakeholders at the local and regional scale.

The document also explains how the NRC will conduct its assessment, and summarises the key issues and information sources currently available to the NRC to complete the assessment by 30 April 2010.

1.2 What is a NSW forest assessment?

NSW forest agreements are formal agreements between the NSW Ministers for Environment and Forest and Mineral Resources. The agreements set out how forests in particular regions will be managed by Forests NSW as state forests, or by the Department of Environment, Climate Change and Water (DECCW) as part of the NSW reserve system.

NSW forest agreements must contain certain minimum provisions. They are intended to frame an Integrated Forestry Operations Approval (IFOA)[1] under which Forests NSW carries out its

[1] There are currently four IFOAs. The Upper North East, Lower North East, and Eden IFOAs commenced on the 1 January 2000 and another for the Southern Region commenced on the 13 May 2002. An IFOA for the Brigalow and Nandewar Community Conservation Area is currently being finalised.

harvesting operations. An IFOA describes the permitted forestry operations in the area covered and the conditions imposed.[2]

NSW Ministers may only negotiate a forest agreement following a regional forest assessment by the NRC.

The terms of reference also include meeting the assessment requirements of the *Environment Protection and Biodiversity Conservation Act 1999 (C'th)* (EPBC Act). The matters that must be considered to satisfy the Commonwealth legislation are similar in nature to those required of a regional forest assessment.

1.3 Previous assessments of the Brigalow and Nandewar bioregions

Following an extensive assessment of the Brigalow Belt South ('Brigalow') and Nandewar bioregions, the NSW Government announced in May 2005 its decision to create a Community Conservation Area (CCA), managed for both conservation and multiple uses depending on a range of zoning. White cypress sawlog allocations from the CCA were previously 71,260m^3 per annum. The decision made available 57,000 m^3 per annum[3], some of which would be drawn from outside the CCA zones.

The south-western cypress forests lie outside of the Brigalow and Nandewar bioregions and were not assessed prior to the Government's 2005 decision. However, the Government's decision required that south-western cypress forests be included as supplementary resource for mills within the Brigalow and Nandewar bioregions. An industry adjustment package was applied across the whole cypress sawmilling sector including mills outside of the Brigalow and Nandewar bioregions. A number of mills then chose to exit the industry and others entered 20-year wood supply agreements, including some previously supplied from the south-western cypress state forests.

The 20-year wood supply agreement to two cypress mills in the south-west of NSW relies on wood supply from the south-western region. However, the Brigalow and Nandewar bioregional assessments and subsequent IFOAs do not extend to these south-western forests.

1.4 How will NRC conduct this assessment?

The NRC has developed an analytical framework to guide its assessment of the cypress state forests. The analytical framework has five steps, as shown in **Figure 1**.

The central task is to identify and recommend land tenure and management arrangements to promote an appropriate balance between the environmental, social, economic and heritage values that these cypress forests can provide. The NRC's approach to this task will be to:

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2 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 DII – Fisheries.

3 Forests NSW (2009) Environmental Impact Statement - *Harvesting and associated road work operations in South-Western NSW*

- characterise the landscape context, historic management (including silviculture) and current extent and condition of these cypress forests, and describe the values they currently support;
- identify how the forests and associated ecosystems and values may change in the future, including under the projected impacts of climate change (to the extent possible), and describe those values that are likely to be able to be supported into the future; and
- in the light of these values, recommend how the cypress forests and associated ecosystems 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 forest agreement delivering "conservation outcomes and a sustainable future for the forests, the forestry industry and local communities".

This document describes how the NRC plans to complete the first four key steps in the analytical framework. Also described is the context in which the steps must be taken and the key sources of information identified to date.

Contributing to this document is information developed through a forest visit with key stakeholders and input from the NRC's Technical Review Panel (see **Attachment 2**).

1.5 How will the NRC finalise its recommendations?

In completing Steps 1-4 of the analytical framework the NRC proposes to draw together the best available science and knowledge on the current health, uses and values of the forests; and the possible trajectories of change in the forests. This includes, to the extent possible, climate change impacts and their implications for the future health, uses and values of the forests.

The last step in the assessment process will be to test and refine the broad-scale future management and tenure of the cypress forests identified in Step 4 of the NRC's analytical framework. This will be done through late March and early April 2010 as the NRC tours the forests and meets with key stakeholders.

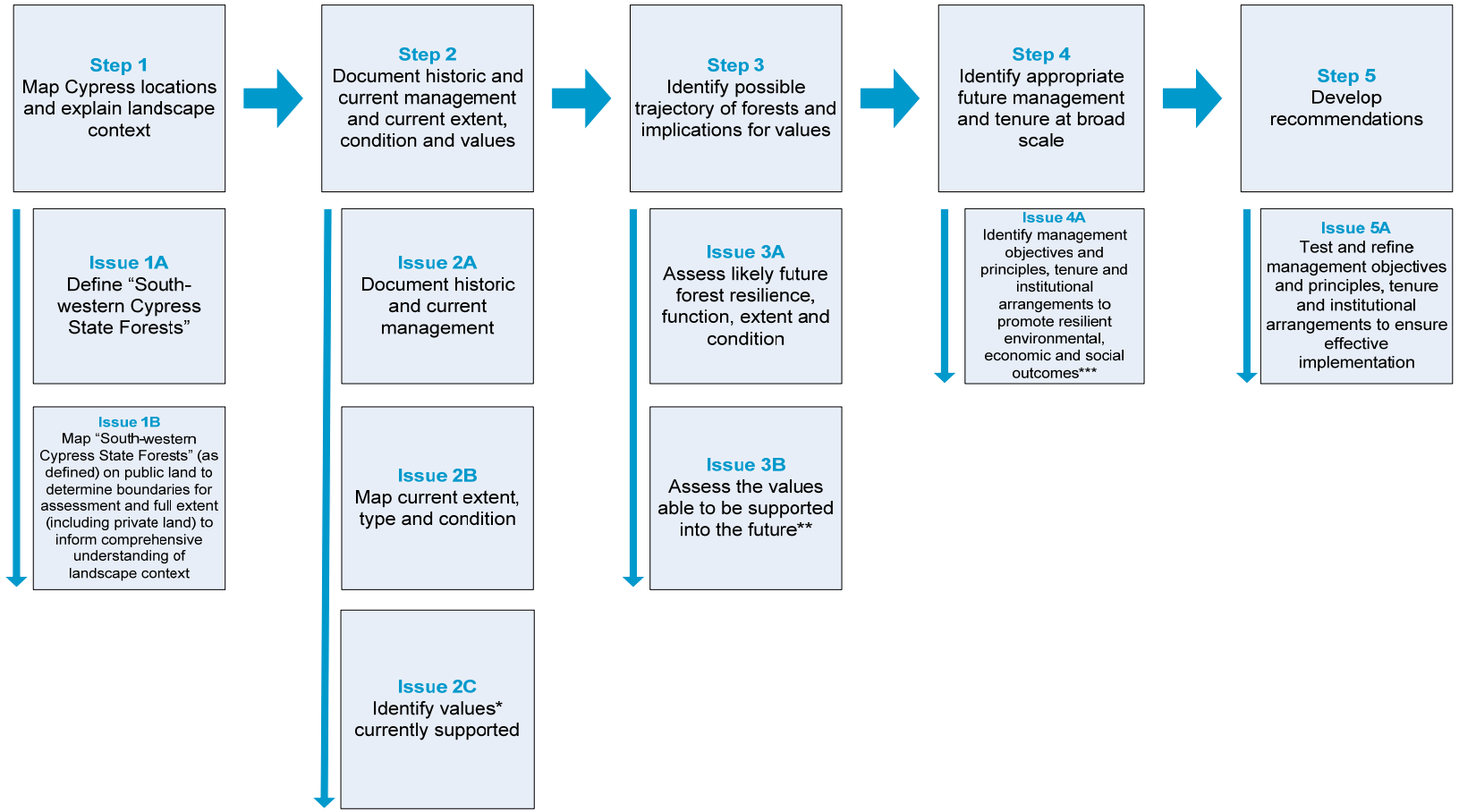
1.6 What are the key dates and how can you have your say?

As part of the assessment, the NRC will visit a cross section of interested parties, call for written submissions, convene discussions with key stakeholders, undertake forest tours and canvass expert views.

The key dates for the assessment and opportunities to provide input are listed in **Table 1** below.

Table 1: Key dates for assessment south-western cypress state forests

Action	Date
Submissions on terms of reference closed	*29 January 2010*
Consultation and forest tours	February - April 2010
Close of public submissions in response to this document	26 March 2010
Final assessment report to Government	30 April 2010



* 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 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 long term productivity and health and to international or intergovernmental obligations, agreements or arrangements

Figure 1: Analytical framework for making recommendations to NSW Government for south-western cypress state forests of NSW

2 Where are the south-western cypress state forests?

2.1 Landscape context

Cypress (*Callitris spp.*) is a native Australian tree and occurs in a wide variety of vegetation communities, and in all Australian states. Based on National Forest Inventory data, the current national extent of cypress forests is some 2.5 million hectares.[4] The majority of cypress forests are found in NSW (1.5 million hectares or 59 per cent of the national total).[5] Around 58 per cent of cypress forests in NSW are found on public land[6], with the remainder found on private land.[7]

Cypress forests '*typically occur in small populations in the drier inland regions*'.[8] However, in some places such as the Pilliga Scrub of central-western NSW, they form extensive tracts. Pure stands of cypress forests are rare and, more commonly, species of *Callitris* are co-dominate '*with Eucalyptus, Casuarina or Acacia species over an herbaceous, sparse, shrubby understory*'.[9] These communities are '*often restricted to undulating or flat land with sandy soils, or in upland rocky areas protected from fire*'.[10]

The NRC's assessment will address some 202 state forests (around 200,000 ha) in NSW's south west. These state forests are fragmented and range from white cypress (*Callitris glaucophylla*) dominated forests to others that contain an assemblage of vegetation communities including various cypress species. The NRC estimates that approximately 171,000 ha of these forests contain cypress.[11]

Many south-west cypress state forests are heavily dominated by white cypress trees, as other co-dominant woody species (especially eucalypts) have been depleted due to a combination of factors, including past management practices such as ring-barking (often before State Forests were declared), lack of burning and silvicultural management. Many of these forests are now embedded in largely cleared agricultural areas.

Figure 2 is an indicative map of where cypress forests may be located in the landscape based on the best available information to date. It is the NRC's 'first-cut' cypress map that uses multiple vegetation layers which contain any reference to *Callitris, White cypress* or cypress pine in any form - dominant, co-dominant or associate (see **Table 2**). The map provides a useful illustration of the relationship between the fragmented state forests under assessment (see **Attachment 3**) and cypress found in the broader landscape.[12] A key task in Step 1 of the NRC's analytical framework is to refine this mapping.

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4 Department of Agriculture, Fisheries and Forestry - Australian Forest Profiles: *Callitris*. Accessed at www.daff.gov.au/brs/publications/series/forest-profiles/australian_forest_profiles_callitris.
5 *Ibid.*
6 Leasehold, multiple-use forests, nature conservation and other crown land.
7 See note 3.
8 See note 4.
9 See note 4.
10 See note 4.
11 Based on best available information to date. This is likely to be refined as the assessment progresses.
12 *Ibid.*

This figure also illustrates that the state forests under assessment span a large geographical range. They can be broadly divided into two sections: the 'western' division, comprising what is commonly referred to as rangelands, and which is managed predominantly under perpetual leasehold (Western Lands leases); and the 'central' division, historically cleared for cropping, sheep meat and wool production, and on predominantly freehold land (see **Figure 3**).

The contrasting landscapes and tenure arrangements of these two divisions may also be reflected in the ecological, social and economic values of the cypress state forests in each.

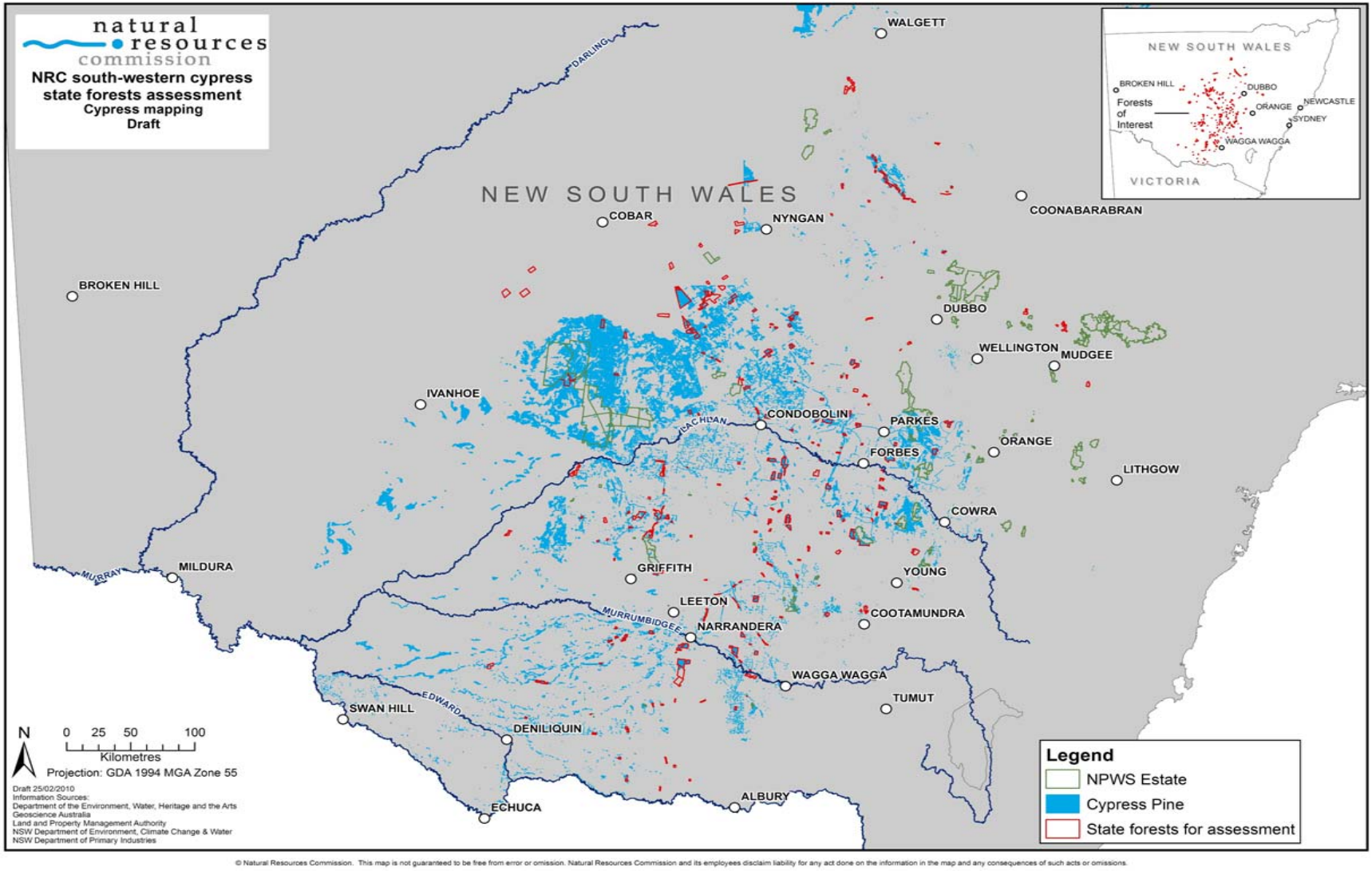

Figure 2: Indicative extent of cypress and state forests under assessment

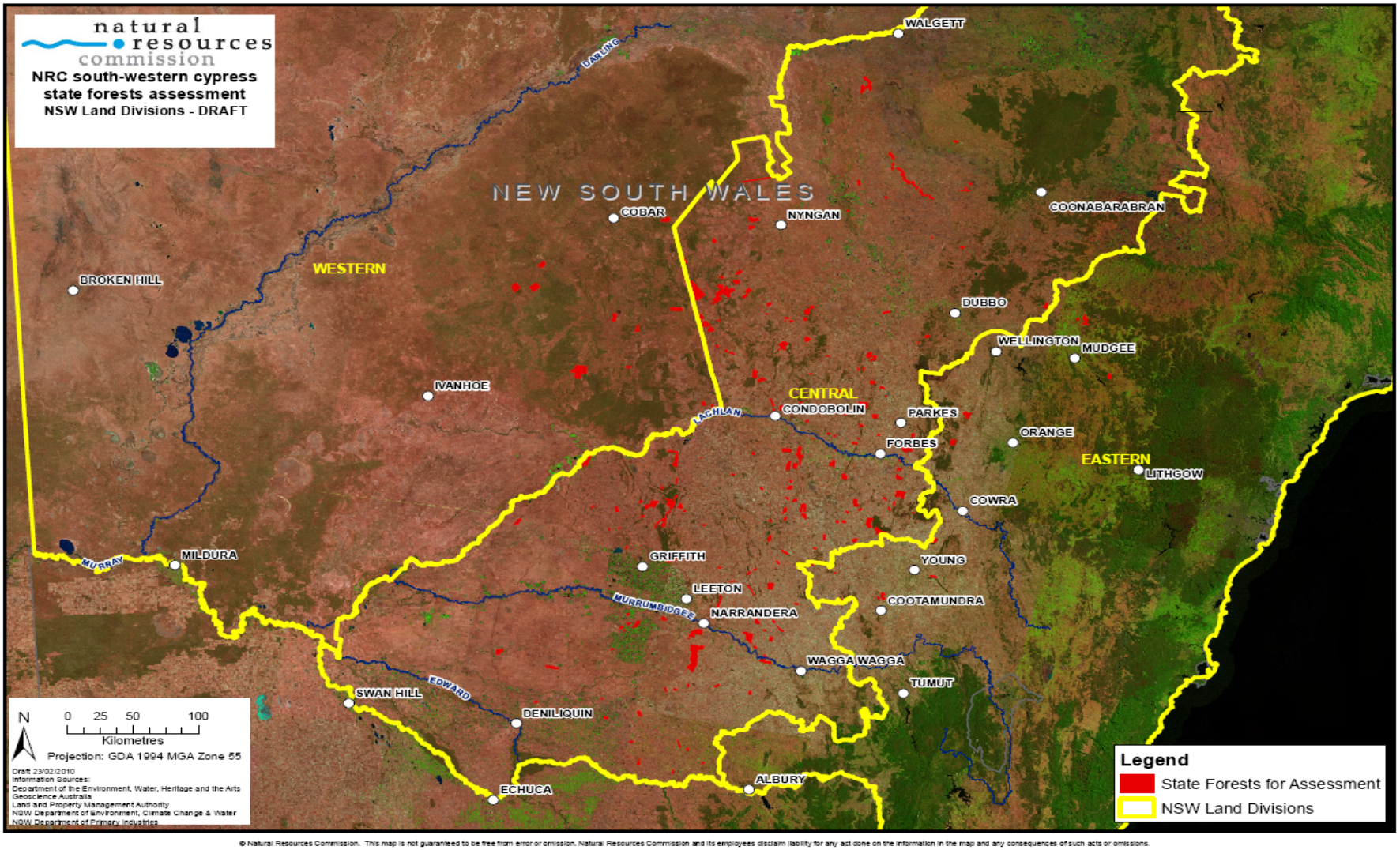

Figure 3: Broad NSW land division and state forests under NRC's assessment

2.2 Defining a south-western cypress state forest

The first step in the NRC's assessment (or Step 1 of the analytical framework) will be to define in more detail the specific cypress forests and provide the context of their occurrence on public, leasehold and private land. This will ensure that ecological linkages and landscape contexts are clear.

The key tasks to be completed in this step of the assessment will include:

- more clearly characterising cypress state forests, cypress vegetation communities and their landscape contexts
- mapping a series of ecological attributes including vegetation on private, leasehold and public land, flora and fauna records, threatened species and ecological communities, and soil landscapes
- analysing and describing landscape function and context such as connectivity and the relationships between soil and water; and
- describing the ecological attributes of cypress forests, within state forests, leasehold and private land.

2.2.1 Key issues for submissions

Key issues on which the NRC seeks submissions include:

1. Defining 'south-western cypress forests' because the vegetation communities and structures within which white cypress occurs is highly variable and definitions will be scale-dependent.
2. Understanding cypress forest dynamics, as the structure of many forests has changed greatly since European settlement owing to changed disturbance regimes and past utilisation and management, including the effects of fire control, grazing by livestock and rabbits, ring-barking and silvicultural management.
3. Defining the relevant landscape contexts to help understand the ecological, economic and social functions that cypress forests, which are often small and isolated, perform in a fragmented landscape.

2.2.2 Summary of available sources of information

The NRC will source further spatial information from Forests NSW, DECCW and Catchment Management Authorities (CMAs) to map the location of cypress forests on public and private land in south-western NSW. This will define the extent and location of the forests at a finer scale and in more detail than **Figure 2**.

There may be other cypress forests that have not been mapped to date, including those on private land not under active management. The NRC is therefore keen to hear about further data sets or information not represented in **Table 2.**

Table 2: Preliminary mapping data available to the NRC

Description	Reference & Source
Forest NSW GIS layer	Forest types
Report, strategy and maps inc. CD, prepared for Mid Lachlan Regional vegetation Management Committee	NSW Dept Land and Water Conservation (2001) Native Vegetation Resource Package for the Mid Lachlan Region
A series of 1:100 000 vegetation maps covering a northern part of the Western Division. Satellite imagery and field checking (Northern Floodplains Planning Committee NFPC 2004)	NFPC (2004), *Vegetation Communities of the Northern Floodplains, Western New South Wales*: Book 1- Western Division of the Walgett Shire; Book 2- Brewarrina Shire; Book 3- eastern part of Bourke Shire. Northern Floodplains Planning Committee, Walgett.
Vegetation mapping for individual DECC reserves (90 individual layers)	Various
Vegetation mapping in the Moree LGA - Extant	White, M (2002), *The reconstructed distribution and extent of indigenous vegetation types in the Moree Plains Shire*, report to NSW National Parks and Wildlife Service, (Ecology Australia Pty. Ltd.: Fairfield, Victoria).
North West Vegetation Mapping - Walgett & Moree Shire East	Peasley, B and Walsh, A (2000), *Mapping Vegetation Landscape of the NSW North West Slopes & Plains*, a project overview, NHT Project NW0339.97.
A series of 1:100 000 vegetation maps covering a northern part of the Western Division. Satellite imagery and field checking (Northern Floodplains Planning Committee 2004)	NFPC (2004) *Vegetation Communities of the Northern Floodplains, Western New South Wales*: Book 1- Western Division of the Walgett Shire; Book 2- Brewarrina Shire; Book 3- eastern part of Bourke Shire. Northern Floodplains Planning Committee, Walgett.
NVMP – Vegetation of the Bellata, Gravesend, Horton and Boggabri 1:100K Map Sheets	Cannon, G, Cannon, M, Harding, W, McCosker, R, Spunner, B, Steenbeeke, G and Watson G (2002), *Native vegetation map report No 3: Bellata, Gravesend, Horton and Boggabri 1:100 000 map sheets*, NSW Department of Infrastructure, Planning and Natural Resources, (submitted to Cunninghamia).
NVMP – Vegetation of the Coonabarabran, Coolah and Tambar Springs 1:100K Map Sheets	Ismay, K, Lewer, S, Deluca, S, McKenzie-Gay, M, Powrie, S, Burns, M, Ryan, C and Chaffey, D., *Native vegetation map report Cobbora, Coolah, Coonabarabran, Mendooran, Tambar Springs 1: 100 000 map sheets*, Department of Infrastructure, Planning and Natural Resources.
Original composite vegetation map of Namoi CMA including non-vegetation polygons including all API coding	Eco Logical Australia (2008), *Vegetation Map for the Namoi Catchment Management Authority, f*inal draft prepared for Namoi CMA, Project No 125-004.
NVMP – Vegetation of the Cobbadah, Manilla and Tamworth 1:100K Map Sheets	Unknown
Composite vegetation map of BRG CMA including non-vegetation polygons.	Eco Logical Australia (2009), *Upgrade of Vegetation Mapping in the Border Rivers-Gwydir Catchment, a product for the High Conservation Value Project,* final draft prepared for Department of Environment and Climate Change, Project No 09 COFGIS-0002.

Description	Reference & Source
Extant distribution of native vegetation in the Central West Catchment	DEC (2006), *Reconstructed and extant distribution of native vegetation in the Central West Catchment*, NSW Department of Environment and Conservation, Dubbo.
Extant distribution of native vegetation in the Lachlan Catchment	DEC (2006), *Reconstructed and extant distribution of native vegetation in the Lachlan Catchment*, NSW Department of Environment and Conservation, Dubbo.
Extant vegetation map of Boorowa Shire	NPWS (2002), *The native vegetation of Boorawa Shire*, NSW National Parks and Wildlife Service, Hurstville.
National Forest Inventory	Department of Agriculture, Fisheries and Forestry - Australian Forest Profiles: *Callitris*. www.daff.gov.au/brs/publications/series/forest-profiles/australian_forest_profiles_callitris.
National Vegetation Information System (NVIS)	http://www.environment.gov.au/erin/nvis/index.html
Combined vegetation maps relevant to the Riverina Bioregion.	Todd, MK and McDonnell, R (2003), *Riverina Biodiversity Assessment Project*. Unpublished report produced by the NSW National Parks and Wildlife Service, Riverina as part of the NSW Biodiversity Strategy.
Vegetation mapping for individual DECC reserves of the South West Slopes	EcoGIS (2004), *Mapping of Vegetation Ecosystems in New and Existing Conservation Reserves South West Slopes Region 2002-2004*, final report prepared for South West Slopes Region, NPWS.
Forest Types	Lindsay, DA (1967), *Forest type mapping of the Pilliga State Forests*, Forestry Commission of NSW, Sydney.
NVMP - Native Vegetation Mapping Program	Centre for Natural Resources (2004), *NSW Native vegetation report - Cobbora, Coolah, Coonabarabran, Mendooran, Tambar Springs 1: 100 000 map sheets*, New South Wales Department of Infrastructure, Planning and Natural Resources, Parramatta.
NVMP - Native Vegetation Mapping Program	DIPNR and DEC. (no date), *Native Vegetation Map Report Series No.4*, version 2.2.
NVMP - Native Vegetation Mapping Program	Centre for Natural Resources (2004), *NSW Native vegetation report - Cobbora, Coolah, Coonabarabran, Mendooran, Tambar Springs 1: 100 000 map sheets*, New South Wales Department of Infrastructure, Planning and Natural Resources, Parramatta.
NVMP - Native Vegetation Mapping Program	Centre for Natural Resources (2002), *Native vegetation map report series: Abridged version No. 2 - Dry Lake, Gunbar, Hay, Moggumbill, One Tree and Oxley 1:100 000 Map Sheets*, New South Wales Department of Land and Water Conservation, Parramatta.
NVMP - Native Vegetation Mapping Program	Centre for Natural Resources (2002), *Native vegetation map report series: Abridged version No.1 Bogan Gate, Boona Mount, Condobolin, Dandaloo, Tottenham and Tullamore1: 100 000 Map Sheets*.
Statewide existing vegetation map, NSW	Keith, DA (2002), *A compilation map of native vegetation for New South Wales*, NSW Biodiversity Strategy, NSW NPWS, Sydney.
Murray_Vegetation_DRAFT2.8 - multi-scale, object based mapping of native vegetation in the Murray catchment	DEC unpublished data
Forest cover of the Central West region of NSW	Goldney, DC and Bowie, IJS (1987), *Scenic and Scientific Survey of the Central Western Region*, a report to the Australian Heritage Commission, Vol. 1, Mitchell College of Advanced Education, Bathurst.

Description	Reference & Source
Extant native vegetation at a 1:250,000 scale within Lachlan CMA	DEC (2006), *Reconstructed and extant distribution of native vegetation in the Lachlan Catchment*, NSW Department of Environment and Conservation, Dubbo.
Ecological survey of the south-eastern Riverina in 1953 by Moore	Moore, CWE (1953), The Vegetation of the South-eastern Riverina, New South Wales, 1. Climax Communities, *Australian Journal of Botany*, Vol. 1(3), p. 1953.
Riverina Bioregion Vegetation Map (NSW component)	Eardley, KA (1999), *A Foundation for Conservation in the Riverina Bioregion*, NSW National Parks and Wildlife Service (unpublished report).
Royal Botanic Gardens: natural vegetation of the 1:250 000 mapsheets in the NSW Riverina	Scott, JA (1992), Natural vegetation of the Balranald - Swan Hill 1:250 000 map sheet, *Cunninghamia* Vol. 2(4), pp. 597-652. and Porteners MF (1993), The natural vegetation of the Hay Plain: Booligal-Hay and Deniliquin-Bendigo 1:250 000 maps, *Cunninghamia* Vol. 3(1), pp. 1-87.
Scotia 1:100,000 mapsheet Full Floristic	Westbrooke, ME, Miller, JD and Kerr, MKC (1998), The vegetation of the Scotia 1:100 000 map sheet, western New South Wales, *Cunninghamia*, Vol. 5(3) pp. 665-684.
Eastern Bushlands Database - Southern Region	Holme, L (1993), *Eastern Bushlands Database Project, Central Region*, NSW NPWS (unpublished report).
The Pre-clearing Natural Vegetation of the Southern Mallee Planning Region	Val, JD (1998), *The Pre-Clearing natural vegetation of the Southern Mallee Planning Region,* report and data prepared for the Southern Mallee Regional Planning Committee, DLWC, Buronga.
Natural Vegetation in the Lower Macquarie River Floodplain 1:50, 000	Steenbeeke (unknown), *Lower Macquarie Floodplain Vegetation.*
Little River Catchment Existing vegetation	Seddon, J, Briggs, S and Doyle, S (2002), *Little River Catchment Biodiversity Assessment*, a report for the TARGET project, NSW National Parks & Wildlife Service, Canberra.
Journal article	Sivertsen, D, Metcalfe, L, (1995), Natural vegetation of the southern wheat-belt (Forbes and Cargelligo 1:250,000 map sheets), *Cunninghamia*, 4, pp. 103–128.
Extant vegetation of the NSW South Western Slopes (NSS) IBRA bioregion within the Murrumbidgee CMA	NSW DECC (2007), *The Native Vegetation of the Southern Wheat-Sheep Belt* (unpublished report).
Extant vegetation of the NSW South Western Slopes (NSS) IBRA bioregion in reservation within the Murrumbidgee CMA	NSW DECC (2007), *The Native Vegetation of the Southern Wheat-Sheep Belt* (unpublished report).
Extant vegetation of the NSW South Western Slopes (NSS) IBRA bioregion within the Murray CMA	NSW DECC (2007), *The Native Vegetation of the Southern Wheat-Sheep Belt* (unpublished report).
Extant vegetation of the NSW South Western Slopes (NSS) IBRA bioregion in reservation within the Murray CMA	NSW DECC (2007), *The Native Vegetation of the Southern Wheat-Sheep Belt* (unpublished report).

3 How are cypress forests currently managed?

In Step 2A of the analytical framework, the NRC will document the historical and current management of the cypress forests. This information will help explain why cypress forests exist in such a wide variety of structures and ecological communities across the landscape, and are used, valued and managed in a similarly wide range of ways.

The NRC will also consider how cypress forests are used and managed on other crown lands such as travelling stock reserves, western land leases, private land, private conservation areas and public reserves.

3.1 Current management arrangements and objectives

Different management arrangements are in place for cypress pine communities depending on land tenure, current management objectives, past management intervention, vegetation composition and structure.

3.1.1 State forests

The NRC estimates there are some 170 individual state forests containing predominantly white cypress forests in south-western NSW.[13] These state forests have been managed and modified over a lengthy period, making them highly dominated by white cypress.

These state forests are of a relatively small size, scattered and fragmented. In the eastern part of their range, in particular, they are located in an otherwise cleared agricultural landscape (see **Figure 3**).

State forests are managed for economic and environmental values in accordance with the *Forestry Act 1916* (NSW), including timber production, preservation of soil resources, water catchment capabilities and conservation of flora and fauna.

Forests NSW uses Ecologically Sustainable Forests Management (ESFM) plans to guide sustainable forest management across its estate.[14] For example, they use Forest Management Zoning as a land classification system which sets out in a spatially explicit form the way in which Forests NSW intends to manage state forests. Through this system, a protected area network that comprises both dedicated and informal reserves can be created and managed.

Forests NSW uses a range of silviculture systems, including single tree selection and thinning, to harvest timber from cypress forests and to ensure long-term sustainable yields. A range of management prescriptions is also employed to protect and promote environmental values such as threatened species.

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13 Based on the best available information to date, the remaining 32 state forests under the NRC's assessment contain other vegetation assemblages on which extent of cypress is to be determined.

14 Most of the state forests in the NRC's assessment fall within the Western Region ESFM.

3.1.2 Conservation reserves

There are some 36 conservation reserves[15], totalling approximately 371,838 ha, located amongst the state forests of interest to the NRC's assessment.[16] These reserves contain a range of vegetation types, including cypress forests.

Some of the major reserves are:

- Yathong Nature Reserve - 109,024 ha of which around 20,000 ha is mixed cypress woodland
- Nombinnie Nature Reserve - 72,289 ha of which around 20,000 ha is mixed cypress woodland
- Goobang National Park - 42,439 ha; and
- Nombinnie State Conservation Area - 46,324 ha.

3.1.3 As an invasive native scrub on private and leasehold land

Cypress forests are also prevalent on private and leasehold land, covering nearly 1.3 million ha across NSW.[17]

White and black cypress (*C. endlicheri*) are listed as invasive native scrub (INS) species in eight catchment management areas in NSW under the *Native Vegetation Act 2003*. INS listing is associated with species that, within their natural range:

- *invades vegetation communities where it has not been known to occur previously OR a species that regenerates densely following natural or artificial disturbance, and*
- *the invasion and/or dense regeneration of the species results in change of structure and/or composition of the vegetation community.*[18]

For example, dense white cypress regeneration can change the structure and the composition of vegetation communities and therefore impact on biodiversity values.

Under the *Native Vegetation Act 2003*, cypress can be assessed and treated as INS, once an INS Property Vegetation Plan (INS PVP) is in place. This means a landholder can employ a range of management strategies, including prescribed thinning and clearing to maintain and improve environmental outcomes.

The *Native Vegetation Act 2003* also provides for thinning white cypress to a minimum benchmark which defines the range of abundance that different species occur in a particular vegetation community. This means a landholder can thin a particular vegetation community of white cypress back to a prescribed benchmark once it has been assessed and a Thinning Property Vegetation Plan (Thinning PVP) is in place.

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15 For example, national parks, nature reserves and state conservation areas.

16 Based on best available information to date. This is likely to be refined as the assessment progresses.

17 Department of Agriculture, Fisheries and Forestry - Australian Forest Profiles: *Callitris*. Accessed at www.daff.gov.au/brs

18 NSW Government. 2006. *Managing invasive native scrub*. Native vegetation management in NSW. Info Sheet 9. http://www.environment.nsw.gov.au/vegetation/infosheets.htm

Like the treatment of INS, thinning is said to 'improve or maintain' environmental outcomes as it may encourage the growth of groundcover species that will in turn reduce soil erosion.

3.1.4 As a timber source on private land

Private Native Forestry (PNF) is regulated in NSW under the *Native Vegetation Act 2003*. White cypress can be harvested on private and leasehold land through a PNF Property Vegetation Plan (PNF PVP). The 'Private Native Forestry Code of Practice for Cypress and Western Hardwood Forests' sets the minimum operating standards for harvesting in private native forests.[19]

There are currently 34 approved PNF PVPs for western hardwoods and cypress.[20] The majority (80 per cent) of these are located in the north-eastern sections of the state, with the remainder in the NRC's assessment area.

3.2 The practicalities of managing cypress

Cypress regeneration is driven by favourable environmental conditions, such as summer rainfall and low herbivore (especially rabbit) grazing. Under favourable conditions, cypress can regenerate prolifically,[21] although in the past conditions favourable to such regeneration have occurred infrequently. Without natural or management processes to thin cypress stands they can form dense stands of narrow stems that compete with each other and grow very slowly. Where these stands occupy extensive areas they can be of limited biodiversity value because of their low structural and floristic diversity. These dense stands can also be of low production value because there is little or no component of harvestable saw logs.

Creating structural diversity in cypress stands requires natural or artificial thinning to release nutrients, light and water and drive the growth of remaining stems. In practice, land managers find it costly to conduct this management because there is no immediate return from the thinning. The pay-back period on realising structural diversity or timber value can be many decades.

In order to describe the historic and current management of the forests, the NRC will document:

- how Forests NSW manages the south-western state forests
- the Government's decisions on management of the Brigalow and Nandewar forests and how the new state forest groups and reserves have been managed since
- the typical rules in place to manage cypress pine on private and leasehold land which are regulated under the *Native Vegetation Act 2003* and *Native Vegetation Regulation 2005* in the form of a:
  - INS or Thinning PVP negotiated between CMAs and landholders
  - PNF PVP negotiated between DECCW and landholders

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19 Department of Environment Climate Change – *Private Native Forestry Code of Practice for Cypress and Western Harwood Forests*, available at: http://www.environment.nsw.gov.au/pnf/index.htm

20 Public register of approved private native forestry property vegetation plans available at: http://www.environment.nsw.gov.au/pnf/approvedpnfpvps.htm

21 In some areas, such as the southern Riverina, low regeneration and remnant dieback is likely to be an issue.

- common and distinct elements of these management arrangements; and
- how and why these different arrangements are being utilised across a spectrum of different vegetation assemblages in which cypress pine is present.

3.2.1 Key issues for submissions

Key issues on which the NRC seeks submission include:

4. What are the environmental, economic and social impacts of the different management arrangements on different tenures in practice?
5. How are forests on private, leasehold and national park lands managed in practice, and what are the implications?
6. How are different land managers dealing with the challenge of the high costs and low returns of thinning cypress forests?
7. What role has active management played in developing vegetation structure?
8. What role have natural processes and other external factors (e.g. rabbit plagues) played in developing vegetation structure?
9. To what degree are cypress forests on private land providing environmental, economic and social benefits? How can these benefits be maximised?

3.2.2 Summary of available sources of information

The NRC will source information to complete this analysis from Forests NSW, CMAs, DECCW and the forestry industry. However, the NRC is keen to hear about further data sets or information not represented in **Table 3**.

Table 3: Preliminary information available to the NRC

Type	Reference & Source
Manual	DECC (2008), *Private Native Forestry Code of Practice for Cypress and Western Hardwood Forests*. NSW Department of Environment and Climate Change, Sydney.
Resource package	NSW Dept Land & Water Conservation (2001), *Native Vegetation Resource Package for the Mid Lachlan Region*, report, strategy and maps inc. CD, prepared for Mid Lachlan Regional vegetation Management Committee.
Manual	AgForests (undated), *Management and Forest Products Guide – White Cypress Native Forests and Woodlands*, Ag Forests Queensland, available online at http://www.agforests.com.au/uploads/white_cypress_native_forests_woodlands.pdf
Manual	Andrews, S (2003), *Regrowth white cypress pine and natural resource management*, Greening Australia NSW Inc, Armidale, NSW.
Unpublished report	Ayers D, Melville G, Szigethy-Gyula J, Read D, Rees R and Atkinson A (2001) ,*Woody Weeds and Biodiversity in Western New South Wales*, WEST 2000, Dubbo, NSW (unpublished report).
Book	Bowman DMJS and Harris S (1995), *Conifers of Australia's dry forest and open woodlands*. In 'Ecology of Southern Conifers.' (eds NJ Enright, RS Hill) pp. 252-270 (Melbourne UP: Melbourne).
Report	Curby, P (1997), *Forest History Project for State Forests of New South Wales, Narrandera Study on Buckingbong, Gillenbah and Matong State Forests.* FNSW, NSW.

Type	Reference & Source
Report	Allen, MR (1997), *Forest History Project for State Forests of New South Wales, 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.* FNSW, NSW.
Brochure	BRS (1997), *Australian Forest Profiles 6, White Cypress Pine*, National Forest Inventory, Bureau of Resource Sciences, ACT (unpublished brochure).
Report	Cobar Vegetation Management Committee (2006), *A vegetation management plan for areas invaded by native trees and shrubs in the Cobar peneplain*, a submission to the NSW Natural Resources Commission, available online at http://www.nrc.nsw.gov.au/content/documents/Submission%20-%20LVP%20-%20Cobar%20Vegatation%20Management%20Committee%20(2).pdf
Book	Dargavel, J, Hart, D and Libbis, B (eds) (2001), *Perfumed Pineries: Environmental history of Australia's Callitris forests*, Centre for Resource and Environmental Studies, Australian National University, ACT.
Manual	DECCW (2009), *Silvicultural Guidelines – Private Native Forestry Code of Practice*, State of NSW and Department of Environment, Climate Change and Water, Sydney.
Report	Native Vegetation Framework Review Task Group (2009), *Australia's Native Vegetation Framework, Consultation Draft*, Australian Government, Department of the Environment, Water, Heritage and the Arts, Canberra.
Report	Hassall & Associates (2006), *Documenting the science behind the invasive native scrub tool – final report.*
Report	DNR (2005a), *Clearing/Thinning of Native Vegetation Known as Invasive Scrub Under the Native Vegetation Act 2003*, Department of Natural Resources (DNR), NSW, available online at http://www.environment.nsw.gov.au/resources/vegetation/INS060419.pdf
Regulation	DNR (2005b), *Native Vegetation Regulation 2005: Environmental Outcomes Assessment Methodology*, NSW Department of Natural Resources (DNR), Sydney.
Brochure	DNR (2006), *Managing Invasive Native Scrub – Infosheet 9*, NSW Department of Natural Resources, Sydney.
Report	FCNSW (1988), *Notes on the Silviculture of Major NSW. Forest Types. 10. Cypress Pine Types*, Forestry Commission of NSW, Sydney.
Report	FCNSW (1989), *Research Note 17: Forest Types in New South Wales*, Forestry Commission of NSW, Sydney.
Journal article	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, pp. 160–167.
Journal article	Horne, R (1990b), Stand height response following variable spacing of wheatfield white cypress pine regeneration in New South Wales, *Australian Forestry,* Vol. 53, pp. 47–54.
Journal article	Horne, R, Robinson, G (1987), White cypress pine in N.S.W.: growth patterns and optimal thinning regimes for 60 to 80 year old stands, *Australian Forestry*, Vol. 50, pp. 216–223.
Report	Kerle, JA (2005), *Collation and review of stem density and thinning prescriptions for the vegetation communities of New South Wales*, report prepared for Department of Environment and Conservation (NSW), Policy and Science Division.
Report	Knott, J (1995), *White cypress pine thinning trials of the Western Region, Australia*, Research Paper No. 27. State Forests of NSW, Sydney.
Report	Lacey, CJ (1972), *Factors influencing occurrence of Cypress Pine regeneration in NSW*, Technical Paper No. 21. Forestry Commission of NSW, Sydney.

Type	Reference & Source
Report	Lacey, CJ (1973), *Silvicultural characteristics of White Cypress Pine*, Research Note No. 26. Forestry Commission of NSW, Sydney.
Brochure	Nicholson D (1997) *Managing cypress pine on your property*, State Forests of NSW - Western Division, Dubbo, NSW.
Book	Noble, JC (1997), *The Delicate and Noxious Scrub*, CSIRO studies on the native tree and shrub proliferation in the semi-arid woodlands of eastern Australia, CSIRO Wildlife and Ecology, Canberra.
Journal article	Rhoades, CC (1997), Single-tree influences on soil properties in agroforestry: lessons from natural forest and savanna ecosystems, *Agroforestry Systems*, Vol. 35, pp. 71-94.
Brochure	Oxley, R (1995), *Photostandards for visually estimating the amount of pasture in Callitris forests,* State Forests of NSW.
Report	Taylor, D, King, J, Swift, S, Hopewell, G, Debuse, V, Roberts, S and 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/FWPRDC/MDBC – Joint Venture Agroforestry Program. Publication No. 04/184, available online at https://rirdc.infoservices.com.au/downloads/04-184.pdf
Report	Western Lands Commission (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.*
Report	Wilson, AD, Oxley, RE and Bratby, WJ (1997), *A Grazing Management Strategy for Buckingbong State Forest*, Reliance Printing, Deniliquin, NSW.

4 What values do the forests support?

To complete the balance of Step 2 of the analytical framework, the NRC will describe how the forests' extent, structure and condition affects the uses and values they currently support.

4.1 Ecological values

To assess the ecological values of cypress forests, the NRC will:

- evaluate the historical change in cypress pine extent and structural and floristic diversity within the whole landscape
- describe the extent, condition and associated vegetation type classifications on both public and private land, and other key ecological parameters of the cypress forests
- assess the ecological and conservation values of the forests at local, regional, state and national scales
- review impacts of past agriculture and silviculture on ecological and landscape values
- discuss responsive management in the landscape context, such as grazing management, and management of cypress as an invasive native scrub
- describe how the cypress state forests contribute to sustainability outcomes for industry and conservation in the wider landscape
- assess the importance of landscape connectivity using spatial link tools
- map the occurrence of threatened species and endangered ecological communities; and
- assess the resilience under current management regimes and practices.

4.1.1 Key issues for submissions

Key issues on which the NRC seeks submission include:

10. What is the ecological value of cypress in state forests, leasehold land, other crown lands and on private land?
11. What information can local communities provide on the ecological values of individual cypress forests? How can this be accessed and documented in the timeframe?
12. How should JANIS[22] criteria be applied given only a small proportion of cypress forests exist on south-west state forests? Can other approaches to protect conservation values, such as Forestry Management Zoning and private covenanted land, support environmental values in the long-term?
13. What is the ecological functionality of cypress forests, for example, vegetation connectivity to aid the movement of fauna through the landscape?
14. What role do cypress forests have in the landscape and in landscape processes, for example in hydrological processes?
15. What is the ecological resilience of cypress forests under current management regimes and practices?

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22 A common reference to a broader framework - *Nationally Agreed Criteria for the Establishment of a Comprehensive Adequate and Representative Reserve System for Forests in Australia*

4.1.2 Summary of available sources of information

The NRC will source information to complete this analysis through consultation with stakeholders and experts, and using publicly available data. However, as much of the information about the ecological values of the forests will be held at the local level, the NRC is keen to hear from interested stakeholders about any further data sets or information not represented in **Table 4**.

Table 4: Preliminary information available to the NRC

Type	Reference & Source
Resource package	NSW Dept Land & Water Conservation (2001), *Native Vegetation Resource Package for the Mid Lachlan Region*, report, strategy and maps inc. CD, prepared for Mid Lachlan Regional vegetation Management Committee.
Report	Date and Paul (2000), *Fauna Survey of the North-west Cypress/Ironbark Forests*, State Forests of NSW, Dubbo.
Database	Atlas of NSW Wildlife Atlas, available online at http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp
Database	EPBC Act 1999:- Protected Matter Search Tool, available online at http://www.environment.gov.au/erin/ert/epbc/index.html
Database	Biometric Vegetation Type Database, available online at http://www.environment.nsw.gov.au/pestsweeds/biometrictool.htm
Database	PlantNET – NSW Flora Online, Royal Botanic Gardens, Sydney, available online at http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm
Report	Allen, MR (1998), *Forest History Projects for State Forests of New South Wales*, 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, FNSW, NSW.
Journal article	Anderson, RH (1941), The effect of Settlement Upon the New South Wales Flora. Presidential Address. *The Proceedings of the Linnean Society of NSW*, 1941, part I-II, nos. 293-294, p. v-xxiii.
Journal article	Antos, MJ and Bennett, AF (2005), How important are different types of temperate woodlands for ground-foraging birds? *Wildlife Research*, Vol. 32, pp. 557-572.
Journal article	Arthur, AD, Pech, RP, Drew, A, Gifford, E, Henry, S and McKeown, A (2003), The effect of increased ground-level habitat complexity on mouse population dynamics. *Wildlife Research,* Vol. 30, pp. 565-572.
Journal article	Auld, TD and Denham, AJ (2001), Flora conservation issues at Kinchega National Park, western NSW, *Cunninghamia*, Vol. 7(1), pp. 27-42.
Journal article	Austin, M and Williams, OB (1988), Influence of climate and community composition on the population demography of pasture species in semi-arid Australia, *Vegetation*, Vol. 77, pp. 43-49.
Journal article	Benson, J (1991), The effect of 200 years of European settlement on the vegetation and flora of New South Wales, *Cunninghamia* Vol. 2(3), pp. 343-370.
Book	Bowman DMJS and Harris S (1995), *Conifers of Australia's dry forest and open woodlands*. In 'Ecology of Southern Conifers.' (Eds NJ Enright, RS Hill) pp. 252-270 (Melbourne UP: Melbourne)

Type	Reference & Source
Journal article	Bowman, DMJS and Latz, PK (1993), Ecology of White Cypress Pine on the MacDonald Ranges, *Australian Journal of Botany,* Vol. 41, pp. 127-225.
Journal article	Briggs, SV, Seddon, JA and 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.
Journal article	Bustard, R (1968), The reptiles of Merriwindi State Forest, Pilliga West, Northern New South Wales, Australia. *Herpetelogica*, Vol. 24, pp. 131-140.
Journal article	Cameron, M (2005), Group size and feeding rates of Glossy Black-Cockatoos in central New South Wales, *Emu,* Vol. 105, pp. 299-304.
Report	Carlton, C and Paull, D (2002), *Pilliga State Forest Flora and Fauna Survey, 14th – 19th November 2001*, National Parks Association of NSW, Sydney.
Journal article	Chisholm EC (1936), Birds of the Pilliga Scrub, *The Emu*, Vol. 37, pp. 32-38.
Journal article	Cleland JB (1919), The birds of the Pilliga Scrub, New South Wales, *Emu*, Vol. 18, pp. 272-85.
Journal article	Cohn, JS (1995), The vegetation of Nombinnie and Round Hill Nature Reserves, central western New South Wales, *Cunninghamia* Vol. 4, pp. 81-101.
Journal article	Cox, SJ, Sivertsen, DP and Bedward, M (2001), Clearing of native woody vegetation in the New South Wales northern wheatbelt: extent, rate of loss and implications for biodiversity and conservation, *Cunninghamia* Vol. 7, pp. 101-155.
Report	Curby P (1997), *Forest History Project for State Forests of New South Wales. Narrandera Study on Buckingbong, Gillenbah and Matong State Forests*, FNSW, NSW.
Book of Conference Proceedings	Dargavel, J, Hart, D and Libbis, B (eds) (2001), *Perfumed Pineries: Environmental history of Australia's Callitris forests*, Centre for Resource and Environmental Studies, Australian National University, ACT.
Journal article	Date EM, Ford HA, Recher HF (2002), Impacts of logging, fire and grazing regimes on bird species assemblages of the Pilliga woodlands of New South Wales, *Pacific Conservation Biology*, Vol. 8, pp. 177-195.
Book	Date EM, Goldney DC, Bauer JJ and Paull DC (2000), *The status of threatened vertebrate fauna in New South Wales cypress woodlands: implications for State Forest Management*. In 'Nature Conservation 5: Nature Conservation in Production Environments: Managing the Matrix.' (eds JL Craig, N Mitchell and DA Saunders) pp. 128-145. Surrey Beatty and Sons, Sydney.
Journal article	Dowling, DK, Antos, M and Sahlman, T (2003), Dispersal and recruitment of juvenile Red-capped Robins, *Petroica goodenovii*. *Emu,* Vol. 103, pp. 109-205.
Journal article	Eldridge, DJ and Freudenberger, D (2005), Ecosystem wicks: woodland trees enhance water infiltration in a fragmented agricultural landscape in eastern Australia, *Austral Ecology* Vol. 30, pp. 336-347.
Database	Forests NSW – Biodata records (fauna surveys).
Report	Forests NSW (2009) Harvesting and associated road work operations in south-western NSW, Environmental Impact Statement, available at www.dpi.gov.au/forests/info/riverina.

Type	Reference & Source
Journal article	Harris, MR, Lamb, D and Erskine, PD (2003), An investigation into possible inhibitory effects of white cypress pine (*Callitris glaucophylla*) litter on germination and growth of associated ground cover species, *Australian Journal of Botany*, Vol. 51, pp. 93-102.
Journal article	Jurskis, V (2009), River red gum and white cypress forests in south-western New South Wales, Australia: Ecological history and implications for conservation of grassy woodlands, *Forest Ecology and Management,* Vol. 258, pp. 2593–2601.
Journal article	Lunt, ID and Spooner, PG (2005), Using historical ecology to understand patterns of biodiversity in fragmented agricultural landscapes, *Journal of Biogeography,* Vol. 32, pp. 1859–1873.
Journal article	Lunt, ID, Jones N, Spooner PG and Petrow, M (2006), Effects of European colonization on indigenous ecosystems: post-settlement changes in tree stand structures in Eucalyptus-Callitris woodlands in central New South Wales, Australia, *Journal of Biogeography* Vol. 33, pp. 1102-1115.
Journal article	McHenry, MT, Wilson, BR, Lemoin, JM Donnelly, DE and Growns, IO (2006), Soil and vegetation response to thinning white cypress pine (*Callitris glaucophylla*) on the north-western slopes of NSW, Australia, *Plant and Soil*, Vol. 285, pp. 245-255.
Journal article	McHenry, MT, Wilson, BR, Lockwood, PV, Guppy, CN, Sindel, BM, Tighe, MK, Growns, IO and 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 Rangeland Journal*, Vol. 31, pp. 321-328.
Journal article	Major, RE, Christie, FJ, Gowing, G and Ivison, TJ (1999a), Age structure and density of red-capped robin populations vary with habitat size and shape, *Journal of Applied Ecology*, Vol. 36, pp. 901-908.
Journal article	Major, RE, Smith, D, Cassis, G, Gray, M. and Colgan, DJ (1999b), 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, pp. 611-624.
Journal article	Major, RE, Christie, FJ, Gowing, G, Cassis, G and Reid, CAM (2003), The effect of habitat configuration on arboreal insects in fragmented woodlands of south-eastern Australia, *Biological Conservation*, Vol. 113 (1), pp. 35-48.
Journal article	Martin TJ, Major RE (2001), Changes in wolf spider (Araneae) assemblages across woodland-pasture boundaries in the central wheat-belt of New South Wales, Australia, *Austral Ecology* Vol. 26, pp. 264-274.
Journal article	Maron, M (2007), Threshold effect of eucalypt density on an aggressive avian competitor, *Biological conservation, Vol.* 136, pp. 100-107.
Journal article	Metcalfe, L, Sivertsen, DP, Tindall, D, Ryan, KM, (2003), Natural vegetation of the New South Wales wheat-belt (Cobar-Nyngan-Gilgandra, Nymagee-Narromine-Dubbo 1:250,000 vegetation sheets), *Cunninghamia*, Vol. 8, pp. 253–284.
Journal article	Michael, DR, Lunt, ID and Robinson, WA (2004), Enhancing fauna habitat in grazed native grasslands and woodlands: use of artificially placed log refuges by fauna, *Wildlife Research,* Vol. 31, pp. 65-71.
Journal article	Mitchell, PB (1991), Historical perspectives on some vegetation and soil changes in semi-arid New South Wales, *Vegetation*, Vol. 91, pp. 169-182.

Type	Reference & Source
Unpublished report	NPWS (2001), *New South Wales South West Slopes Bioregion Scoping Study, NSW Biodiversity Strategy*, NSW National Parks and Wildlife Service, Dubbo (unpublished report).
Unpublished report	NPWS (2002), *Brigalow Belt South Bioregion Scoping Study, NSW Biodiversity Strategy, Draft Report*, NSW National Parks and Wildlife Service, Sydney (unpublished report).
Unpublished report	Paull, D (1997), *Conservation Management Options for Vertebrate Fauna with respect to Forestry Operations in the North West and South West Cypress management Areas*
Journal article	Sass, S (2006), The reptile fauna of Nombinnie Nature Reserve and State Conservation Area, western NSW, *Zoologist,* Vol. 33(4), pp. 511-518.
Journal article	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, pp. 147-154.
Journal article	Shelly, D (1998), Survey of vertebrate fauna and habitats in a cypress pine-ironbark forest in central-west New South Wales, *Australian Zoologist*, Vol. 30, pp. 426-436.
Report	Shelly D (2001), *Flora and Fauna of the Tottenham / Bobadah District*, Department of Land and Water Conservation, Dubbo, NSW.
Journal article	Sivertsen, D and Metcalfe, L, (1995), Natural vegetation of the southern wheat-belt (Forbes and Cargelligo 1:250,000 map sheets), *Cunninghamia*,Vol. 4, pp. 103–128.
Journal article	Spooner P, Lunt I and 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, pp. 117-126.
Journal article	Stafford, MJ and Eldridge, DJ (2000), Vegetation, soils and management of 'Zara': a sandhill remnant on the Riverine Plain, *Cunninghamia*, Vol. 6(3), pp. 717-746.
Journal article	Tighe, M Reid, N, Wilson, B and Briggs, SV (2009), Invasive native scrub and soil condition in the semi-arid south-eastern Australia, *Agriculture, Ecosystems and Environment* Vol. 132, pp. 212-222.
Journal article	Thompson, WA and Eldridge, DJ (2005), White cypress pine (*Callitris glaucophylla*): a review of its roles in landscape and ecological processes in eastern Australia, *Australian Journal of Botany*, Vol. 53, pp. 555-570.
Journal article	Thompson, WA and Eldridge, DJ (2005), 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, pp.545-554.
Journal article	Westbrooke ME and Miller, JD (1995), The vegetation of Mungo National Park, western New South Wales, *Cunninghamia* Vol. 4, pp. 63-80.
Journal article	Westbrooke, ME, Kerr, MKC and Leversha, J (2001), The vegetation of Kinchega National Park, western New South Wales, *Cunninghamia* Vol. 7, pp. 1-25.
Journal article	Westbrooke, ME, Miller, JD, Kerr, MKC (1998), The vegetation of the Scotia 1:100,000 map sheet, western New South Wales, *Cunninghamia* Vol. 5, pp. 665-684.

4.2 Social and cultural values

South-western cypress state forests have important social and cultural histories. Local communities may have strong social and cultural connections to the cypress forests on both public and private land, and use them for a range of activities.

To assess social and cultural values associated with cypress forest, the NRC will:

- complete a desktop study of cultural Indigenous and non-Indigenous heritage values
- complete a desktop study of tourism and recreation activities in the region
- consult with stakeholders such as local councils, historical societies and Indigenous and non-Indigenous community leaders, tourism and recreational groups and forest industry to confirm and expand on these desktop studies
- conduct a Town Resource Cluster Analysis to define the extent of association between the south-western cypress forests and communities in the region; and
- conduct a Sensitivity Analysis to assess the relative community resilience to any change to the timber industry and other forest uses in the region.

4.2.1 Key issues for submissions

Key issues on which the NRC seeks submission include:

16. Which cypress state forests are most highly valued and for what purposes?
17. How can the NRC effectively engage stakeholders to identify the social and cultural values associated with so many isolated cypress forests across such a wide area?
18. How does an on-going social and cultural association with a cypress state forest enhance community resilience and capacity to cope with change?
19. How can communities be involved in promoting sustainable outcomes for the future use and management of the cypress state forests?

4.2.2 Summary of available sources of information

The NRC will source publicly available information including ABS data and relevant publications. Information will also be sourced directly from Forests NSW, DECCW, CMAs, Local Government, local Indigenous groups and other local groups.

4.3 Economic values

The NRC will primarily focus its assessment of the economic value of cypress forests on the timber industry and its contribution to the economy.

To assess economic values associated with cypress forest, the NRC will:

- review the cypress timber resources on public land, including sustainable yields using FRAMES modelling, harvest history, quality of the resource, management costs and current investment in the industry
- review and understand the management and contribution of cypress timber resources on private and leasehold land

- review and understand the contribution of other activities on state forests such as grazing and apiary
- document the size and structure of the timber industry, its value chain and its contribution to local and regional economies
- estimate the number of people the industry employs both directly and indirectly
- assess uses of the forests other than timber production, such as recreation and commercial uses and their values to local and regional economies; and
- assess the market outlook for the cypress timber industry, its long-term sustainability and its future resilience.

4.3.1 Key issues for submissions

Key issues on which the NRC seeks submission include:

20. Is there a sufficient resource base to supply the current market demand?
21. What is the market outlook for cypress products?
22. What potential is there to boost the cypress timber industry by finding ways to economically manage the large proportion of cypress that exists on private land?
23. Are there emerging new markets and values for cypress forests and their landscapes? What investment may be required to manage these emerging values?

4.3.2 Summary of available sources of information

The NRC will source publicly available information including Australian Bureau of Statistics (ABS) data and relevant publications. Information will also be sourced directly from organisations associated with the timber industry, including Forests NSW and local mill owners in the region.

5 How are the forests changing?

In Step 3 of the assessment framework the NRC will identify how changes to the forests may alter the resilience, function, extent and condition of the south-western cypress forests, woodlands and associated ecosystems.

5.1 State and transition of cypress forests

The structure and composition of vegetation has changed since European settlement. For example, vegetation has been cleared for agriculture and urban development. In other areas, some vegetation has become denser due to changes in land management.

The structure and composition of pre-European vegetation landscapes is sometimes contested. However, it is likely that many of the pre-European landscapes in NSW, where cypress forests are now found, were a mosaic of cypress, eucalypt and acacia species.[23] Studies have suggested that these mosaics were once dominated by eucalyptus species (78 per cent of basal area).[24] Since then, many state forests have transitioned from eucalyptus to cypress dominance,[25] accounting for more than 80 per cent of total tree basal area in some cypress-dominated areas.[26]

The NRC will explore the extent to which state and transition models can help assess likely future states and transitions in the cypress forests.

5.2 Climate change projections and impacts

The majority of the cypress state forests under assessment are located in the central region of NSW (see **Figure 2**).

The best available climate change predictions for this region indicate that:

- rainfall is likely to shift to more summer dominance[27]
- state forests in the southern section of the region are likely to receive significantly less winter rainfall[28]; and
- temperatures are likely to increase from 0.6°C to 2°C (10th and 90th percentiles respectively).[29]

Cypress forests span large geographical ranges representing a range of tenures and of soil, temperature and rainfall conditions. Cypress forests may therefore be in a better position than some species to adapt to any step changes in climate across the broader landscape. The lack of

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23 Thompson, W.A. and Eldridge, D.J. (2005) White cypress pine (*Callitris glaucophylla*): a review of its roles in landscape and ecological processes in eastern Australia. *Australian Journal of Botany*, 53, 555-570.

24 Lunt, I.D., Jones N., Spooner P.G. and Petrow, M. (2006) Effects of European colonization on indigenous ecosystems: post-settlement changes in tree stand structures in Eucalyptus-Callitris woodlands in central New South Wales, Australia. *Journal of Biogeography,* 33, 1102-1115.

25 *Ibid.*

26 *See note 23.*

27 See www.climatechange.gov.au/climate-change/impacts/national-impcats/murray-darling-basing.aspx

28 *Ibid.*

29 See www.climatechangeinaustralia.gov.au

any specific models for cypress forests' response to predicted climate change constrains the NRC's capacity to assess potential climate-related changes.

To assess how the forests are changing, the NRC will:

- describe the current trajectory of cypress forests
- broadly summarise the predicted projected range of impacts from climate change; and
- analyse, to the extent possible, the potential impacts of such changes on the trajectory and health of the forests and the values they can support.

5.2.1 Key issues for submissions

The NRC will also need to consider how these changes will impact upon existing values and therefore which values are more likely to be supported into the future.

Key issues on which the NRC seeks submissions include:

24. Have we got the right management mix of cypress across private and public lands to support identified environmental, economic and social values?
25. Can the cypress forests readily adapt to climate change given the current diversity in range and management?

5.2.2 Summary of available sources of information

The NRC is keen to hear about further data sets or information not represented in **Table 5**

Table 5: Preliminary information available to the NRC

Type	Reference & Source
Datasets, maps and time series graphs	Australian Bureau of Meteorology
Report	Chiew FHS, Cai W and Smith IN (2009), *Advice on defining climate scenarios for use in Murray-Darling Basin Authority Basin Plan Modelling*, CSIRO report for the MDBA.
Report	Climate change in Australia – science updates. Compiled by the Australian Climate Change Science Program
Report	CSIRO NSW Regional Climate Change Reports
Models	DECCW – projected climate change impacts on Keith Vegetation classes
Report	DECC - NSW Biodiversity and Climate Change Adaptation Framework, 2007–2008.
Models and reports	Intergovernmental Panel on climate change
Report	Hennessy, K, Page, C, McInnes, K, Jones, R, Bathols, J, Collins, D and Jones, D (2004), *Climate Change in New South Wales - Part 1: Past climate variability and projected changes in average climate* & *Part 2: Projected changes in climate extremes*.
Report	Hennessy, K, Page, C, McInnes, K, Jones, R, Bathols, J, Collins, D and Jones, D (2005), *Climate change impacts on fire-weather in south-east Australia*. CSIRO Marine and Atmospheric Research and Bushfire CRC and Bureau of Meteorology.
Journal article	Whipp, RA, Lunt, ID, Deane, A and Spooner, PG (2009), Historical forest survey data from *Eucalyptus–Callitris* forests: a valuable resource for long-term vegetation studies, *Australian Journal of Botany*, 2009, Vol. 57, pp. 541–555.
Journal articles	See also Lunt, ID *et.al.* (2006) and Thompson, WA and Eldridge, DJ (2005), in Table 4.

6 How should the forests be managed in the future?

Much of the standing commercial timber volume of the south-western cypress state forests is already committed to supply wood to one business that operates two mills at Narrandera and Condobolin under a 20-year wood supply agreement. This agreement was negotiated in the industry restructure that followed the Brigalow and Nandewar forest agreements announced by the NSW Government in 2005.

Acknowledging that this 20-year agreement is in place, in Step 4 of the analytical framework the NRC will need to identify management objectives and develop management principles for the cypress forests and woodlands.

The NRC will engage and consult with key stakeholders to identify these objectives and develop management principles at a local scale. The NRC will also explore tenure and institutional arrangements to promote resilient environmental, economic and social outcomes.

The most appropriate mix of management and tenure to promote long-term productivity and health of the forests will be mapped at a coarse scale. This mapping will form the basis for consideration in the development of recommendations (Step 5) of the assessment.

The key tasks to be completed in this step of the assessment will include:

- synthesise and where necessary improve upon current management principles for cypress state forests and other cypress forests across the landscape to support a diversity of values
- assess the potential synergies and trade-offs between ecological, social, cultural, economic and heritage values in the south-western cypress state forests and in cypress forests elsewhere across the landscape
- assess the practical limitations and constraints to change imposed by the requirement for the NSW Government to honour the existing 20-year wood supply agreement to mills; and
- use the analysis of the resilience of the forests, local communities and the timber industry to determine their ability to adapt to any proposed changes, and any future impacts from projected climate change.

6.1.1 Key issues for submissions

Key issues on which the NRC seeks submission include:

26. Are current management objectives and principles meeting stated outcomes? What information do we have to support this assessment?
27. Are current tenure arrangements the most appropriate to maximise the communities' current and anticipated future values of the cypress forests?
28. Are there alternative institutional arrangements that could improve the resilience of the forests, forest industry and communities?

Attachment 1 – Terms of Reference

Premier of New South Wales
Australia

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 Aboriginal 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 28 February 2010 and 30 April 2010.*

Attachment 2 – Technical Review Panel Members

Technical Review Panel members	Role and Organisation
Mr Daryl Green	General Manager Western Catchment Management Authority
Dr David Freudenberger	Director of Science Greening Australia
Dr Denis Saunders	President WWF-Australia
Ms Di Bentley	Natural Resources Commission
Dr Glen Kile	Director Plant Health Australia
Dr Ian Lunt	School of Environmental Sciences Charles Sturt University
Mr Mark Allen	Forestry Consultant
Dr Matthew Colloff	Floodplain Ecosystem Function Commonwealth Scientific and Industrial Research Organisation
Professor Peter Kanowski (Panel Chair)	Forest and Environment Policy Australian National University
Mr Rob deFégely	Forestry Consultant Myoora Investment Pty Ltd
Professor Stewart Lockie	School of Sociology Australian National University

Attachment 3 – State forests under the NRC's assessment

State Forests under the NRC's Assessment			
Albert	Bulbodney	Edols	Lake Urana
Ardlethan	Bunganbil	Eringanerin	Lake View
Back Creek	Bygalore	Euchabil	Lester
Back Yamma	Cadow	Euglo South	Limestone
Bald Hill	Calleen	Eurabba	Little Blow Clear
Balgay	Canbelego	Fifield	Little Caragabal
Balowra	Caragabal	Forbes	Lonesome Pine
Barbingal	Carawandool	Ganmain	Mairjimmy
Barrow	Cargelligo	Gap Dam	Mandagery
Beckom	Carolina	Gilgandra	Mandamah
Bedooba	Carrabear	Gilgunnia	Manna
Bendick Murrell	Carroboblin	Gillenbah	Matong
Berewombenia	Clear Ridge	Gilwarny	Maudry
Berida	Combaning	Gin Gin	Mejum
Berrigan	Conapaira East	Girilambone	Melbergen
Berry Jerry	Conapaira South	Goolgowi	Mellerstain
Bimbi	Condobolin	Grahway	Melougel
Binya	Cookamidgera	Grayrigg	Meriwagga
Blow Clear	Cope	Gunning Gap	Merri Merri
Blow Clear West	Coradgery	Gunningbland	Merrinele
Blue Mallee	Coreen	Hiawatha	Meryula
Bobadah	Corringle	Holybon	Miandetta
Bogalong	Cowal	Jerilderie	Milbrulong
Booberoi	Cullivel	Jimberoo	Minter
Boona	Cumbijowa	Jindalee	Momo
Booroorban	Cumbine	Jingerangle	Monumea Gap
Bourbah	Curra	Kentucky	Moombooldool
Boxalls	Curraburrama	Kiacatoo	Mount Nobby
Bretts	Currajong	Killonbutta	Mount Tilga
Broken Range	Currawananna	Kindra	Mulyandry
Brookong	Denny	Kockibitoo	Murda
Buckingbong	Derriwong	Kolkilbertoo	Nangerybone
Buddigower	East Cookeys Plains	Kulki	Naradhan
Buggajool	Edgar	Lachlan Range	Narraburra

State Forests under the NRC's Assessment			
Narraway	Tailby	Walleroobie	Yarragong
Nebea	Talgong	Warraderry	Yarranjerry
Nerang Cowal	Tallegar	Warregal	Yathong
Paddington	Taratta	Warrie	Yelkin
Palmer	Tenandra	Weddin	Yeo Yeo
Pangee	Therarbung	Weelah	Young
Peisley	Thorndale	West Cookeys Plains	Booligal
Priddle	Tomanbil	Wharfdale	Banandra
Pullabooka	Tottenham	Widgiewa	Billenbah
Reefton	Towyal	Wilbertroy	Dubbo
Ringwood Tank	Trundle	Wilga	Dungeree
Sandgate	Tuckland	Willows	Hilston
Stackpoole	Tullamore	Wingadee	Narrandera
Steam Plains	Ugobit	Wombin	Puckawidgee
Strahorn	Ungarie	Wyalong	Tholobin
Tabbita	Vermont Hill	Wyrra	
Tabratong	Wahgunyah	Yambira