Moree Plains Shire

Koala Habitat Mapping

June, 2008

Moree Plains Shire Council

Parsons Brinckerhoff Australia Pty Limited ABN 80 078 004 798

Ernst & Young Centre,
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001
Australia
Telephone +61 2 9272 5100
Facsimile +61 2 9272 5101
Email sydney@pb.com.au

NCSI Certified Quality System ISO 9001

2116693A-PR_5422_revB

Author: ..... M. Predavec and A. McMillan

Signed: .....

Reviewer: ..... S. Harrington

Signed: .....

Approved by: ..... M. Predavec

Signed: .....

Date: ..... 4 June 2008

Distribution: ..... Moree Plains Shire Council, PB File

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Acknowledgments

Parsons Brinckerhoff would like to acknowledge and thank the following people for their assistance in providing mapping data, database records of Koalas in Moree, general information on specific aspects of the ecology of the species in Moree Plains and access to properties.

- Liz Savage (Border Rivers Gwydir Catchment Management Authority)
- Yvonne Mack (wildlife carer)
- Peter Glennie (Norwood)
- Bruce Peasley (Department of Natural Resources)
- Steven McLane (Border Rivers Gwydir Catchment Management Authority)
- Angela McCormack (Department of Natural Resources)
- Blake O'Mullane (Moree Plains Shire Council).

1. Introduction

Parsons Brinckerhoff (PB) was commissioned by the Moree Plains Shire Council to develop a Koala habitat map illustrating the distribution of suitable habitat for Koalas in the local government area.

Koalas (*Phascolarctos cinereus)* are tree-dwelling, medium-sized marsupials that have an iconic status is Australia. Within New South Wales (NSW), Koalas are listed as vulnerable under the *Threatened Species Conservation Act 1995* and their habitat is further protected under State Environment Planning Policy (SEPP) number 44 – Koala Habitat Protection.

A Koala habitat map will enable the implementation of appropriate land use zoning and development standards and controls to prevent future development and rezoning that will compromise Koala habitat.

The objectives of this report are to provide:

- information regarding the biology and ecology of the Koala in the Moree Plains Shire
- a Koala habitat map of the Moree Plains Shire
- recommendations for the conservation of Koalas within the Shire that coincide with future development.

It should be noted that this report does not however represent a comprehensive Koala plan of management as represented under SEPP44.

1.1 Moree Plains Shire

Moree Plains Shire is located in north western New South Wales (Figure 1-1) on the Queensland – New South Wales border. Covering an area of 17,852 square kilometres, the shire has a population of 15,737, with the main population centre being Moree. The primary industry in the shire is agriculture, with the primary crops being cotton, grain and oilseeds (Moree Plains Shire Council 2007a).

Moree Plains Shire is located within two bio-geographic regions. The eastern half of the shire falls within Brigalow Belt South bioregion, whilst the western half is located within the Darling Riverine Plains bioregion (Thackway & Cresswell 1995).

The Shire of Moree Plains is located in the fertile Gwydir Valley and McIntyre River Valley, which dominate the landscape systems. Seven Mitchell landscapes occur within the shire (Table 1-1). Mitchell Landscapes are a system of ecosystem classification mapped at the 1:250,000 scale, based on a combination of soils, topography and vegetation (NSW National Parks and Wildlife Service 2002). They present a good description of the landscape scale environment.

Seven formal conservation areas occur within the Shire, including Boomi West Nature Reserve, Boronga nature Reserve, Careunga Nature Reserve, Midkin Nature Reserve, Kirramingly Nature Reserve, Gimilaroi Nature Reserve and a small part of Mount Kaputar National Park (Figure 1-1). Several State Forests occur in the south-eastern corner of the Shire (Figure 1-1).

Figure 1-1 Moree Plains Shire

Figure 1-2 Mitchell landscapes within Moree Plains Shire

Table 1-1 Mitchell landscapes within Moree Plains Shire

Mitchell Landscape[1]	Description[2]	% cleared[2]
Gwydir Alluvial Plains	Holocene fluvial sediments of backplain and channelised backplain facies on the Gwydir River fan, relief 2 to 5 m. Grey and brown silty clay deposited from suspended sediments in floodwater, often with gilgai. Elevated margins with red-brown texture-contrast soils. Open to scattered Myall, Rosewood, Coolibah, Belah, Wilga, Bimble Box, Whitewood, Leopardwood, Gidgee, Thorny Saltbush, Mueller's Saltbush, Wild Orange, Buck Bush, Warrior Bush, Budda, Nepine, Mitchell Grasses, Neverfail, Goathead Burr, Copperburr, And Warrego Summer-Grass, on lower clay plains and drainage lines. Coolibah, Black Box, River Cooba Swamp Wilga, and flowering lignum in depressions and channels. Dense to moderate White Cypress Pine, Bimble Box, Leopardwood, Belah, Wilga, Sandplain Wattle, Prickly Wattle, Budda, Quinine Bush, Sandhill Riceflower and grasses on sandy rises. Extensively cleared, cropped and grazed.	46
Gwydir Channels and Floodplains	Holocene fluvial sediments of channel and meander plain facies of the Gwydir River alluvial fan and distributary stream system, relief in the channels 5 to10 m. Streamflow is nearly permanent. Sinuous channels entrenched in the meander plain with a silt and clay suspended load and some fine sand bed load. Banks and plains with brown to grey silt and cracking grey or brown clay minor areas of red-brown texture-contrast soils on low levees. The Gwydir raft is major coarse woody debris dam choking a main channel and diverting flow. Narrow fringing River Red Gum and Coolibah with River Paper-bark along deeper main channels. Floodplains with scattered to moderate Coolibah, Black Box, Whitewood, Isolated Rosewood, Belah, River Cooba, Swamp Wilga, Lignum, Nitre Goosefoot, Neverfail, Warrego Summer-grass, Windmill Grasses, Copperburrs and forbs. Bimble Box on western plains, Yellow Box and Rough-barked Apple on the distal fan and higher red brown soil on terraces. Sparse gidgee on elevated areas.	52
Barwon Alluvial Plains	Barwon Alluvial Plains ecosystem includes parts of seven land systems: Gingie, Jomara, Llanillo, Nidgery, Rugby, Tatala and Wombeira. Highly channelised floodplain with small scalded areas, relief to 1 m. Level and slightly elevated floodplains of Holocene alluvium of the backplain facies of the Marra Creek Formation with shallow discontinuous drainage lines and small low sandy rises, relief to 3 m. Areas of associated sand hills and hummocks interspersed with depressions, relief to 8 m. Grey cracking and non-cracking days on plains, with brown texture-contrast soils on rises. Sands interspersed with yellow texture-contrast soils, grey cracking and non-cracking clays in sand hill areas. Limited distribution Holocene source bordering sand dunes aligned along the channels and abandoned channels of the Barwon River system, relief to 5 m. Probably includes some unrecognised low lunettes on the eastern side of relic lake features. Poorly sorted, friable orange-brown fine quartz sand, clay content and compaction increases with depth.	14
Barwon Channels and Floodplains	Barwon Channels and Floodplains ecosystem includes parts of five land systems: Eurie, Long Meadow, Mid-Darling, Nidgery and Upper Darling. Floodplains of sinuous perennial and ephemeral tributaries of the Barwon River. Holocene alluvium of the channel and meander plain facies of the Marra Creek Formation. Channels in defined drainage lines with levees and swamps incised to 2 to 15 m into alluvium. Deep grey cracking clays, often crab-holey, with minor areas of red-brown texture-contrast soils on slight elevations. Barwon Alluvial Plains ecosystem includes parts of seven land systems: Gingie, Jomara, Llanillo, Nidgery, Rugby, Tatala and Wombeira.	22
Macintyre Alluvial Plains	Holocene fluvial sediments of meander plain and backplain facies on the Macintyre River, relief 5 to 12 m. Brown silty clay with patches of sand and carbonate nodules deposited from suspended sediments in floodwater, often with gilgai in grey and brown clays. Elevated areas with red-brown texture-contrast soils. Sediment grain size increases toward the ranges. Open grasslands with scattered Coolibah, Black Box, River Cooba, Bimble Box, Belah, Lignum, Saltbush, Warrior Bush, Gidgee And Myall. Sparse White Cypress Pine on lighter textured soils. Patches of Brigalow on heavy soils with gilgai. Extensively cleared, cropped and grazed.	55

Mitchell Landscape[1]	Description[2]	% cleared[2]
Croppa Clay Plains	Extensive alluvial fans and rolling downs on Quaternary sediments and planar surfaces of Cretaceous calcareous silty sandstones and shales on either side of Croppa and Gil Gil Creeks draining from the Yallaroi Basalts Ecosystem. General elevation 275 to 230 m, local relief 5 m. Deep grey to black clay uniform cracking soils of moderate fertility. Poplar Box and Belah woodlands, remnant Brigalow on heavier soils with gilgai. Patches of Myall and Rosewood with grasses.	85
Macintyre Aeolian Sands	Limited distribution Holocene source bordering sand dunes aligned along the channels and abandoned channels of the Macintyre River system, relief to 5m. May includes some unrecognised low lunettes on the eastern side of relic lake features. Poorly sorted, friable orange-brown fine quartz sand, clay content and compaction increases with depth. Open forest of White Cypress Pine and Carbeen is characteristic generally with a ground cover of grasses.	4
Strathmore Sandstones	Rolling hills and downs on Jurassic calcareous lithic sandstone, quartz sandstone, siltstone, mudstone, thin coal seams, general elevation 250 to 400 m, local relief 50 to 80 m. Brown and grey, hard setting sandy clay loam over dark clay, Dark texture-contrast profiles with shallow gilgai. Mixed Ironbark and Brown Bloodwood woodland, remnant Brigalow shrublands, extensively cleared.	53
Kaputar Slopes	Lower slopes of the Kaputar volcanic complex with radiating finger-like ridges capped by basalt over lower Permian and Triassic quartz sandstone, lithic sandstone, silty sandstone, conglomerate and thin coal measures. General elevation 300 to 500 m, local relief 80 m. Shallow stony red-brown loam and clay loam in uniform profiles on basalt, yellow and yellow-brown texture-contrast profile on sandstone, deep black earths in lowest valleys. Kurrajong, Yellow Box, White Box, Rough-Barked Apple and Blakely's Red Gum on lower slopes and valleys.	42
Kaputar Hill Crest Flows and Sands	Remains of a Tertiary central volcano with a thick sequence of basaltic lavas. Benched slopes mark different lava flows. General elevation 500 to 1,000 m, local relief 250 m. Frequent rock outcrop interspersed with shallow stony brown loams. Black earth on lower slopes and valleys. Silver-Topped Stringybark, Mountain Gum, Broad-Leaved Stringybark Black Cypress Pine, White Cypress Pine, Silver-Leaved Ironbark, Narrow-Leaved Ironbark, Red Stringybark, Tumbledown Red Gum, Dwyer's Mallee Gum and patches of mallee and heath on stony ridges.	67
Tamworth - Keepit Slopes and Plains	Extensive area of undulating to rolling slopes and plains with low hills and low ranges forming the western fall of the New England plateau. Complex geology of folded and faulted sedimentary and metamorphic rocks with minor interbedded volcanics. Rock types include; Silurian-Devonian chert, slate, phyllite, tuff, schist and Carboniferous conglomerate, sandstone, mudstone, andesite and small areas of limestone. General elevation 500 to 800 m, local relief 250 m, with some peaks reaching 1,100 m. Shallow stony soils on ridges. Texture-contrast soils on almost all slopes shifting in colour from red-brown on upper slopes to yellow with harsh subsoils prone to gully development on lower slopes. White box grassy woodlands, with Yellow Box, Blakely's Red Gum, Willow Wattle and lightwood on lower slopes. Rough barked apple and yellow box on flats. River oak along major streams with River Red Gum increasing to the west. Patches of Red Stringybark and Red Ironbark on steeper slopes in the east.	71

Notes: 1. (NSW National Parks and Wildlife Service 2002), 2 – descriptions are from the *BioMetric Assessment Tool* (NSW Department of Environment and Conservation 2005).

Mean minimum temperatures range from 3.4°C in July to 19.2°C in January. Mean maximum temperatures range from 18.5°C in July to 34.8 in January. Average annual rainfall is 579 mm (Moree Plains Shire Council 2007b).

2. Relevant legislation and plans

Protection of biodiversity is a key element of ecologically sustainable development and is part of the core business of Council. Environmental legislation and policies create the framework in which Council makes planning and land use decisions and consideration of the effects of such on Threatened biodiversity.

The Koala is listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995.* In order to fulfil sustainable development planning objectives and environmental legislative requirements including the NSW *Environmental Planning and Assessment Act 1979* and NSW *Threatened Species Conservation Act 1995,* the potential impacts on the species must be addressed comprehensively and integrated early in the planning process.

There are a number of pieces of legislation and policies within Australia that provide protection for biodiversity in general and in some case specifically for Koalas and their habitats. Their relevance to Koalas is discussed below.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The provisions of the *Environment Protection and Biodiversity Conservation Act 1999* are triggered by developments that may have a significant impact on Matters of National Environmental Significance including threatened species.

Koalas are not currently listed as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. The species has been nominated for listing, but the Scientific Committee rejected the nomination on the grounds that although Koalas had suffered a significant decline in numbers in Australia since the arrival of Europeans, there was no evidence to suggest the current decline in Koala numbers across the species' national or natural range has been substantial (Threatened Species Scientific Committee 2006). It was the view of the committee that the Koala was not eligible for listing under any of the five criteria.

2.1.2 National Koala Conservation Strategy

Despite not being listed under as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999*, the Australian and New Zealand Environment and Conservation Council has prepared a *National Koala Conservation Strategy* (Australian and New Zealand Environment and Conservation Council 1998) that highlights the cultural significance of the species, while at the same time recognising that it doesn't meet the criteria for listing as Threatened. The strategy includes the following objectives:

- conserve Koalas in their existing habitat
- rehabilitate and restore Koala habitat and populations
- develop a better understanding of the conservation biology of Koalas

- ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale
- manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care
- manage over-browsing to effectively prevent both Koala starvation and ecosystem damage in discrete patches of habitat.

2.2 State

2.2.1 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act* is the Act under which Threatened species, population and communities are listed. Listing under the Act provides statutory protection for these species and communities and provides a mechanism by which impacts are assessed during the development application process. The Koala is listed as Vulnerable under the *Threatened Species Conservation Act 1995* meaning that it is facing a high risk of extinction in New South Wales in the medium-term future.

Part 4 of the *Threatened Species Conservation Act 1995* deals with the preparation of recovery plans. The object of a recovery plan is to promote the recovery of the Threatened species, population or ecological community to which it relates to a position of viability in nature. A draft recovery plan has been prepared for the Koala (NSW National Parks and Wildlife Service 2003). The objectives of the *National Koala Conservation Strategy* (see Section 2.1.2) have been adopted as the specific objectives of the recovery plan.

Part 5A of the *Threatened Species Conservation Act 1995* provides for the preparation of *Threatened Species Priority Action Statements.* These statements set out the strategies to be adopted for promoting the recovery of each Threatened species. Twenty-nine priority actions have been developed for the Koala (see Table 2-1, Department of Environment and Conservation 2007b). Some of the actions will have relevance to the management of Koalas in Moree Plains Shire.

Table 2-1 Priority actions for the Koala

Description of priority action	Priority	Relevant?[1]
Recovery strategy: Aboriginal liaison and/or interpretation		
Investigate the cultural significance of Koalas to indigenous Australians in each Koala Management Area.	Low	No
Recovery strategy: Captive Husbandry or ex-situ collection/propagation		
Accredited and licensed wildlife rehabilitation groups will continue to rescue and rehabilitate injured, orphaned and/or diseased Koalas according to the DEC policy "Koala Care in NSW: Guidelines and Conditions".	Medium	No
Identify appropriate locations for the release of rehabilitated animals which cannot be released at point of capture, to assist wildlife rehabilitation groups.	Medium	Yes
Recovery strategy: Community and land-holder liaison/awareness and/or education		
Disseminate information gathered during the implementation of the recovery plan, including the distribution, status, habitat preferences and habitat maps for Koalas.	Medium	Yes

Description of priority action	Priority	Relevant?[1]
Provide information to dog owners in areas where Koala populations occur regarding the threats posed to Koalas by dogs and how dog owners can reduce this threat.	Low	Yes
Prepare and disseminate information to drivers in areas where Koala populations occur regarding the threat posed to Koalas by cars.	Low	Yes
Prepare and disseminate information to residents in areas where significant Koala populations occur regarding the threat posed to Koalas by swimming pools.	Low	Yes
Recovery strategy: Habitat management: Feral Control		
Establish a register of areas where wild or improperly controlled domestic dogs are posing a significant threat to Koala populations and alert land managers, recommending appropriate risk limiting actions. Rural Lands Protection Boards to be advised where relevant.	Medium	No
Recovery strategy: Habitat management: Ongoing EIA - Advice to consent and planning authorities		
Liaise with Minister for Planning to amend Schedule 2 (Feed Tree Species) of SEPP 44 to reflect the regional food tree species of Koalas.	High	No
Prepare and distribute Environmental Impact Assessment (EIA) guidelines for the Koala to inform investigators, consent and determining authorities of the potential impacts to Koalas from developments.	High	No
Provide advice from recovery plan to consent and determining authorities re decision-making responsibilities under SEPP 44, Environmental Planning and Assessment Act 1979 and Native Vegetation Act 2003.	Medium	No
Information regarding Koalas and Koala habitat, including maps of Koala habitat will be prepared and disseminated to relevant Bush Fire Management Committees, to assist in the development of Bush Fire Management Plans.	Medium	Yes
Provide appropriate regional Koala food tree species lists to Catchment Management Authorities.	Medium	No
Recovery strategy: Habitat management: Other		
Identify Koala strongholds for active management, monitoring and conservation and approach key stakeholders to negotiate conservation outcomes.	High	Yes
Identify small and isolated Koala populations at risk of extinction, develop strategies for active management, monitoring and conservation and approach key stakeholders to negotiate conservation outcomes.	High	No
Complete and distribute Guidelines for the preparation of Comprehensive Koala Plans of Management, and promote the preparation of such plans to priority local government areas.	Medium	No
Management of all Department of Environment and Conservation-managed land will specifically provide for the protection of Koalas, through Plans of Management, Pest Management Plans, Fire Management Plans and Reviews of Environmental Factors etc.	Low	No

Description of priority action	Priority	Relevant?[1]
Recovery strategy: Habitat management: Site Protection (e.g. Fencing/Signage)		
Create a register of Koala blackspots on roads, recommend management measures to road managers to limit risks to Koalas, and advise consent and determining authorities on measures to reduce risks to Koalas for new road constructions.	Medium	No
Recovery strategy: Habitat Protection		
Prepare local Koala management plans for entire Koala Management Areas, significant populations or at-risk populations, in consultation with the Koala Recovery Team.	Medium	No
Recovery strategy: Habitat Rehabilitation/Restoration and/or Regeneration		
Identify priority areas for work in each Koala Management Area and provide technical advice and support, for Koala habitat rehabilitation/revegetation activities undertaken by individuals, community groups and government agencies.	High	No
Recovery strategy: Monitoring		
Koala Recovery Team will design and implement a program to monitor changes in the status of Koalas and Koala habitat and evaluate the success of recovery actions in improving the conservation status of Koalas in NSW.	Medium	No
Recovery strategy: Recovery Plan Preparation: Single species		
Finalise the recovery plan for the Koala in 2006.	Medium	No
Recovery strategy: Recovery team and plan coordination		
Appoint a Koala Recovery Plan coordinator to facilitate the consistent implementation of the Koala Recovery Plan across NSW, and maintain support for the Koala Recovery Team.	Medium	No
Recovery strategy: Research: causes of decline		
Koala Research Sub-committee to identify priorities for future research with the primary aim of recovering Koalas. This list will be circulated among universities to assist with identifying research programs.	Medium	No
Recovery strategy: Research: general biological and ecological studies		
Ensure all research proposals involving radio-tracking will adhere to the protocols for Koala radio-collaring research to ensure welfare of animals is not compromised.	Medium	No
Recovery strategy: Survey and/or Mapping		
Survey the northern, central and southern tablelands of NSW to determine primary and secondary food tree species and assess the status of Koala populations in these areas.	High	No
Survey the western plains of NSW to determine the distribution, abundance and status of Koala populations and their food tree species preferences.	High	No
Map and/or model Koala habitat throughout the species' distribution in NSW.	High	Yes
Recovery strategy: Translocation and/or reintroduction		
Prepare a translocation proposal consistent with DEC Policy for the Translocation of Threatened Fauna in NSW for proposed movement of Koalas. Translocation to be considered as a potential management tool for endangered populations. Disseminate info.	High	No

Notes: 1 - does the mapping contribute towards addressing the priority action?

2.2.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* is the overarching piece of legislation covering the assessment of proposed environmental actions within NSW. The aim of the Act is to encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas and forests, while at the same time promoting the orderly and economic use and development of land. A further aim is to encourage the principles of ecologically sustainable development, including the precautionary principle as defined under the *Protection of the Environment Administration Act 1991*.

Section 5A of the Act sets out the factors that a consent authority (including Council) must take into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. This includes consideration of a species distribution, life cycle and habitat requirements in relation to the proposed action.

Part 3 of the *Environmental Planning and Assessment Act 1979* relates to the preparation of environmental planning instruments including Local Environment Plans and Development Control Plans. Local Environment Plans divide the area they cover into 'zones' such as residential, industrial and commercial zones. Each zone usually has a list of 'objectives' and a list of the types of development that are permissible without consent, permissible with consent, and prohibited.

Council needs to be confident that the zoning is compatible with the existing environment and that there is unlikely to be a significant impact on Threatened species, populations and communities. Section 34A of the *Environmental Planning and Assessment Act 1979* states that: "A Council must consult with the Director-General of National Parks and Wildlife before preparing a draft local environmental plan, if in the opinion of the council, critical habitats or threatened species, populations of ecological communities, or their habitats, will or may be affected by the draft plan."

2.2.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* is administered by the Department of Environment and Conservation. It contains provisions that relate to the protection of native terrestrial fauna and some flora as well as Endangered Ecological Communities. Under the *National Parks and Wildlife Act 1974* it is an offence to harm threatened species; buy, sell or possess Threatened species; damage critical habitat; or damage the habitat of a Threatened species without approval under the Act. Under Section 171 of the Act the Director General of the National Parks and Wildlife Service may authorise the harming of Threatened and protected flora and fauna and habitats. It a defence to prosecution under the Act, if the offence is necessary for carrying out a project that has received development consent under the *Environmental Planning and Assessment Act 1979.*

2.2.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* aims to:

- end broadscale clearing of native vegetation unless it improves or maintains environmental outcomes
- encourage revegetation and rehabilitation of land with native vegetation.

The Act focuses on preventing broadscale clearing in vegetation and landscapes that have already been over cleared or are listed as Threatened at the national, regional or landscape scales, unless the vegetation is in poor condition. Clearing can only proceed in situations when it maintains or improves native vegetation. The system is based on voluntary, yet binding, agreements between landholders and Catchment Management Authorities called Property Vegetation Plans. The plans are underpinned by a computer modelling program – the *PVP Developer*. The PVP Developer weighs up the positive and negative aspects of different management plans and activities, allowing landholders to make practical decisions based on the best scientific information available. Experts from the local Catchment Management Authority (CMA) use this tool and their professional judgement when assessing clearing proposals. The relevant Catchment Management Authority is the consent authority. For Moree Plains Shire this is the Border Rivers/Gwydir Catchment Management Authority.

An application to the Catchment Management Authority is required for approval to clear any native vegetation (excluding regrowth) that is not part of a PVP under the *Native Vegetation Act 2003*. Factors that are considered in approving clearing applications include vegetation, Threatened species and salinity. Each factor includes the test that it improves or maintains the various values.

With regard to vegetation clearing, 'red lights' or prohibitions for clearing appear either in landscapes or vegetation types that have been over cleared, or in listed Endangered Ecological Communities. Over cleared vegetation and landscapes are defined as being greater than 70% cleared (NSW Department of Natural Resources 2005). Moree Plains Shire contains 11 landscapes (see Figure 1-2 and Table 1-1). Two of these landscapes are considered over cleared (Table 1-1). Of the 11 vegetation types that contain primary and secondary feed tree species, four are considered over cleared under the *Native Vegetation Act 2003* (Table 2-3). Two additional vegetation types are listed as Endangered Ecological Communities under the *Threatened Species Conservation Act 1995*. These landscapes and vegetation types would be considered 'red light' areas and it is unlikely that clearing would be allowed (NSW Department of Natural Resources 2005).

Table 2-2 Extent of vegetation clearing in vegetation types

Mapping Name[1]	Biometric Vegetation Type[2]	% cleared[2]
Belah	Northern Belah	90
Black box/coolibah (EEC)*	Black Box and Coolibah on floodplains	50
Brigalow	Brigalow Acacia woodland	75
Cypress/carbeen (EEC)*	White Cypress pine and Carbeen Open forest	25
Cypress/ironbark	White Pine/Silver-leaved Ironbark Forest	65
Eucalypt/cypress	Mixed Eucalypt and Pine	30
Ironbark/bloodwood	Mixed ironbark and Bloodwoods	30
Poplar box	Bimble Box woodlands on alluvial plains	50
Red gum/coolibah	River Red Gum Riparian	70
White box (EEC)*	White box grassy Open Forest	90
Yellow box (EEC)*	Yellow Box Blakely's Red Gum Woodland	80

Notes: 1, mapping from Peasley and Walsh (2001), 2, information from BioMetric (NSW Department of Environment and Conservation 2005). * Endangered Ecological Community.

2.2.5 State Environmental Planning Policy (SEPP) 44 – Koala Habitat Protection

The purpose of this policy is to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas, in order to ensure that permanent free living populations are maintained over their present range. It requires the assessment of potential and core Koala habitat in conjunction with local Council. Under this policy "potential Koala habitat" refers to areas of native vegetation where the trees that are listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. "Core Koala habitat" refers to land with a resident population of Koalas, evidenced by attributes such as breeding females and recent sightings as well as historical records of a population.

SEPP44 applies to land within Local Government Areas (LGAs) listed in Schedule 1 of the policy for which a development application has been made and Council is the determining authority. SEPP44 does not apply to land listed under the *National Parks and Wildlife Act 1974*, or the *Forestry Act 1916* as State Forest or flora reserve, or to land where Council is not the determining authority.

Moree Plains is listed under Schedule 2 of SEPP44 and hence the policy applies.

Part 3 of SEPP44 relates to preparation of plans of management relating to Koalas. These can be prepared for:

- the whole of a local government area listed in Schedule 1, or
- a part of such a local government area (including an area of land that is the subject of a development application).

All plans of management must be approved by the Director-General of the Department of Environment and Conservation.

Part 4 of SEPP44 relates to the identification of potential and core Koala habitat and giving consideration to preparing an appropriate development control plan for land that is or adjoins core Koala habitat.

The SEPP also gives authority to the Director-General of the Department of Environment and Conservation to require studies as part of a local environment plan if it is proposed to zone or rezone land that is potential Koala habitat or core Koala habitat otherwise than as environment protection.

2.3 Local

2.3.1 Moree Plains Local Environment Plan 1995

The general objective of the plan is to encourage the proper management, development and conservation of natural and man-made resources within the Moree Plains area to promote the social and economic well-being of the community and the protection of the environment.

The zoning and development controls within the Local Environment Plan govern the type of development that can occur and must also be considered when determining permissibility of an activity.

The Local Environment Plan is currently being updated to reflect the Standard Instrument (Local Environmental Plans) Order (2005). The standard instrument provides for protection of biodiversity under a number of different zones:

- Residential Zone (4) – Rural Residential – to provide rural/residential housing, while preserving environmentally sensitive locations.
- Rural Zone (1) – Agriculture – to provide for the protection, enhancement and conservation of areas of significance for nature conservation, of habitat of threatened species, populations and ecological communities and of other areas of native vegetation.
- Rural Zone (4) – Investigation – to protect land that has a potential for conservation and biodiversity.
- Recreation Zone – (1 and 2) Local Open Space – Public and Private - to enhance, restore and protect the natural environment for recreational purposes.
- Recreation Zone (3) – Regional Open Space – to preserve and enable the management of regional open space for conservation and recreational purposes for the recreational needs of the regional community.
- Environment Protection Zones - (1) Natural Areas - to enable the management and appropriate use of land that is reserved under the *National Parks and Wildlife Act 1974*.
- Environment Protection Zones - (2) Waterways/Watercourses - to protect the ecology and scenic values of waterways and watercourses
- Environment Protection Zones - (3) Conservation
  a) to conserve areas of environmental significance
  b) to conserve biological diversity, native vegetation corridors
  c) to prevent development that could destroy or damage areas of environmental significance.

The Miscellaneous provisions of the Standard Instrument also provide protection of biodiversity though limiting development in riparian and floodplain areas.

3. Koala - *Phascolarctos cinereus* - biology and ecology

The following is a brief summary of the biology and ecology of the Koala. A more detailed summary can be found in the draft recovery plan (NSW National Parks and Wildlife Service 2003).

3.1.1 Species description

The Koala (*Phascolarctos cinereus*) is an arboreal, medium-sized marsupial. It has a stocky body, sharp claws and fur ranging in colour from grey to brown above with a consistently white under belly (Photograph 3-1).

There is a gradient in body weight from north to south across their range. Adult males in the south (Victoria) range from 9 to 15 kg whereas adult males in the north are much smaller ranging from 4 to 9 kg. Males tend to be larger than females (NSW National Parks and Wildlife Service 2003).

Photograph 3-1 Koala

3.1.2 Distribution

The Koala is distributed widely throughout eastern Australia from the temperate southern climate of South Australia and Victoria to the Northern tropical regions of Queensland. In New South Wales Koalas are mainly distributed in the central and north coast regions, with some fragmented populations occurring in the west (NSW National Parks and Wildlife Service 2003).

The distribution of Koalas Australia wide is driven by the preferred climatic conditions along the east coast whilst the distribution of localised populations is driven by resource availability primarily the occurrence of specific eucalyptus species (NSW National Parks and Wildlife Service 2003). The Koala's distribution is not continuous across its range and occurs in a number of populations separated by cleared land or unsuitable habitat (Martin & Handasyde 1999; NSW National Parks and Wildlife Service 2003).

Within New South Wales, population densities range from high (4 to 8 Koalas per hectare) on the North Coast to low (0.006 Koalas per hectare) near Eden on the South Coast (Mezler et al. 2000; Threatened Species Scientific Committee 2006).

3.1.3 Habitat

In New South Wales the Koala is known to inhabit a range of eucalypt forest and woodland communities. These include coastal forests, the woodlands of the tablelands and slopes and riparian communities of the western plains (NSW National Parks and Wildlife Service 2003).

The quality of forest and woodland communities as habitat for Koalas is influenced by a range of factors, but primarily it is the presence of particular *Eucalyptus* species that determines habitat quality. Koalas prefer to feed on only a few specific *Eucalyptus* species which form the bulk of the diet and utilise other species including non eucalypts for shelter and a supplementary diet.

Quality of Koala habitat is also influenced by a number of other factors including the size of tress (White 1999), the structural and species diversity of vegetation within the area (NSW National Parks and Wildlife Service 2003), soil nutrients (Cork et al. 1990) and the presence of suitable shelter or shade trees in harsh environments (NSW National Parks and Wildlife Service 2003). A recent study of Koalas in Noosa Shire, indicated that the presence of Koalas best predicted by a multilevel model that included the proportion of the landscape occupied by high quality habitat, the neighbourhood effect, the mean nearest neighbour distance between forest patches, the density of forest patches and the density of sealed road (McAlpine et al. 2006).

Habitat use by Koalas can change in relation to climate, season and time of day (Ellis et al. 1995; Ellis et al. 1998). For example, Koalas may use different trees by day and night, change vegetation community preferences seasonally or modify their habitat use based on temperature.

3.1.4 Diet

Koalas rely primarily on the foliage of *Eucalyptus* species for their diet. Throughout New South Wales Koalas utilise up to 70 different eucalypt species; however there are marked differences in the preferred tree species consumed among local populations (NSW National Parks and Wildlife Service 2003).

In any one area Koalas feed almost exclusively on a small number of preferred tree species. These species are known as primary feed trees and vary widely on a regional, local and seasonal basis (Hindell et al. 1985). Moree Plains Shire is located within the Western Slopes and Plains Koala management area (NSW National Parks and Wildlife Service 2003) and Table 3-1 lists primary, secondary and supplementary species for that region. Primary food trees exhibit a level of use that is significantly higher than that of other *Eucalyptus* species and independent of tree density. The use by Koalas of secondary and/or supplementary food

trees is generally less than that of primary food trees (except where primary food trees are absent) and appears to be dependent on both the density and/or size of the trees (NSW National Parks and Wildlife Service 2003; Phillips & Callaghan 2000). Significantly higher levels of use of other (non-food) tree species has been observed when they occur in close proximity to a preferred food tree species (Lunney et al. 1998; Phillips et al. 2000).

Table 3-1 Koala feed tree species in the western slopes and plains Koala management area

Primary Food Tree Species	Secondary Food Tree Species	Stringybarks/Supplementary Species
River Red Gum *E. camaldulensis*	Dirty Gum *E. chloroclada*	Red Stringybark *E. macrorhyncha*
Coolibah *E. coolabah*	Bimble Box *E. populnea*	Narrow-leaved Stringybark *E. sparsifolia*
	Pilliga Box *E. pilligaensis*	
	Fuzzy Box *E. conica*	
	Western Grey Box *E. macrocarpa*	
	Yellow Box *E. melliodora*	
	White Box *E. albens*	
	Dwyer's Red Gum *E. dwyeri*	
	Tumbledown Gum *E. dealbata*	
	Blakely's Red Gum *E. blakelyi*	
	Apple-toppped Box *E. bridgesiana*	
	Black Box *E. largiflorens*	
	Mallee Red Gum *E. nandewarica*	
	E. vicina	
	E. volcanica	
	Red Box *E. polyanthemos*	
	Orange Gum *E. prava*	

Notes: information from (NSW National Parks and Wildlife Service 2003)

3.1.5 Breeding

Although Koalas are often regarded as solitary animals, they live in complex social groups where individual home ranges overlap (Martin & Handasyde 1995). Koalas live in breeding aggregations, generally comprised of a dominant male, a small number of mature females and juveniles of various ages.

Koalas generally reach sexual maturity at approximately two years of age. Females can produce one offspring each year, with the breeding season between October and May (Martin & Handasyde 1990, 1995). Gestation lasts up to 35 days, with the young then living in the pouch for up to 6 months. The young are dependent on the mother up to 12 months

Juvenile Koalas may remain in their mother's home range for 2 to 3 years. After this period, the young disperse to establish an individual home range which may vary from 1 to 11 to 50 km (Gall 1980; Mitchell & Martin 1990). Once Koalas mature and become incorporated in stable breeding aggregations they generally exhibit long term fidelity to their individual home range areas (Mitchell & Martin 1990).

3.1.6 Threats

Throughout their range Koalas are subject to a number of threats including:

- habitat loss
- habitat fragmentation and degradation
- vehicle collision
- predation by dogs
- disease
- starvation due to over-browsing
- fires
- drought
- reduced genetic variability (NSW National Parks and Wildlife Service 2003; Threatened Species Scientific Committee 2006).

Because of the wide distribution of the Koala, the presence and severity of the various threats vary across their range (Threatened Species Scientific Committee 2006). Threats are discussed in more detail in the draft Recovery Plan (NSW National Parks and Wildlife Service 2003).

4. Koalas in Moree Plains Shire

There are 22 records of Koalas within the Atlas of NSW Wildlife (Department of Environment and Conservation 2007a) recorded in Moree Plains Shire (Figure 4-1). Thirteen of the records are prior to 1990, while the latest record is from 2005. Eight of the records are from the Terry Hie Hie area in the south east of the shire and others are adjacent to roads such as the Newell Highway. The Atlas of NSW Wildlife is not based on systematic surveys across New South Wales and the number of records is generally biased towards areas where people commonly visit, such as National Parks. It is also biased towards particular species, reserves and roads. The records in the Terry Hie Hie area are likely to reflect sightings recorded by State Forests.

Discussions with locals with knowledge of Koalas within the shire indicates that the Atlas records do not reflect the true distribution of Koalas within the Shire and many more individuals are known to exist, particularly in riverine areas (Figure 4-1).

As a result of the paucity of records within the shire, the true distribution and abundance of Koalas within Moree Plains Shire is unknown.

Figure 4-1 Distribution of Koala records in Moree Plains shire

5. Methods

5.1 Data source

The Koala habitat map was prepared using the Vegetation Landscape Mapping of Moree Plains Shire (see Figure 5-1, Peasley & Walsh 2001a) as a base. This mapping was based around the various topographic map sheets for Moree Plains Shire (either 1:50,000 or 1:25,000) and was mapped with a positional accuracy of ± 50 m. The mapping process involved aerial photographic interpretation, comparison and compilation of earlier mapping data, field inspections and mapping audits (Peasley & Walsh 2001b). The audit indicated a minimum accuracy of 85% (Peasley & Walsh 2001b). Attributes mapped included:

- Land Cover/Land Use (11 classes : 64 sub classes)
- Timber Regrowth (5 classes)
- Tree and Shrub Canopy Density (12 classes)
- Understory (9 classes)
- North West Vegetation Associations.

Although other more detailed mapping is available for small areas within the shire (e.g. mapping of the lower Gwydir), the vegetation landscape mapping was used since it provides a consistent mapping layer for the entire shire.

5.2 Koala habitats

The determination of Koala habitat was based on the presence of feed tree species with reference to those species used by Koalas in the western slopes and plains Koala management area (see Table 3-1, NSW National Parks and Wildlife Service 2003).

The vegetation mapping identified 197 vegetation associations (Appendix A) based on the dominant canopy species. From this list areas that provided less than 1% tree cover or with highly modified landuses (e.g. continuous cropping and quarries) were removed from the data. Although these areas may be used by Koalas, they are unlikely to provide significant habitat because of their modified nature.

Based on the earlier vegetation mapping, Koala habitat types were categorised using the methods of Phillips (2000) as presented in the draft Recovery plan for the Koala (NSW National Parks and Wildlife Service 2003). The three categories are:

Primary Habitat – areas of forest and/or woodland wherein primary food tree species comprise the dominant (i.e. ≥ 50%) overstorey tree species. Capable of supporting high density (≥ 0.75 Koala/ha) Koala populations.

Secondary Habitat (Class A) – primary food tree species present, usually (but not always) growing in association with one or more secondary food tree species. Capable of supporting medium density (≥ 0.10 Koala/ha but < 0.75 Koala/ha) Koala populations.

Figure 5-1 Vegetation landscape mapping of Moree Plains Shire

Secondary Habitat (Class B) – primary food tree species absent, habitat comprised of secondary and supplementary food tree species only. Capable of supporting viable, low density (< 0.10 Koala/ha) populations.

Although other Koala habitat categorisation options have been proposed (e.g. option 2 (Callaghan, unpublished) in NSW National Parks and Wildlife Service 2003), they rely on more detailed vegetation and floristic data such as the per cent species composition of each vegetation community.

Each vegetation association that contained a Koala feed tree species was assigned to one of the three categories following the definitions above (see Appendix A).

5.3 Field inspection

A field inspection was completed over three days on the 19 to 21 February 2007. The aim of the inspection was to confirm the suitability of the vegetation mapping including dominant species and where possible vegetation boundaries.

In addition, a preliminary assessment of tree usage by Koalas in relation to tree availability was done using the methods proposed in the Coffs Harbour Comprehensive Koala Plan of Management (Lunney et al. 1999). Ten sites were chosen to cover a range of vegetation types (Figure 5-1). At each site records were made of:

- site position (Australian map grid coordinates, description)
- vegetation type
- topography (ridge, slope, gully)
- aspect
- name(s) of recorders
- date
- time
- weather conditions.

At each site a 20 by 20 m quadrat was randomly selected and marked out. For each tree in the quadrat the following attributes were recorded:

- number of trees
- tree species
- diameter at breast height (over bark)
- Koala present/absent
- scratches on tree trunk present/absent
- presence/absence of Koala scat (Photograph 5-1) in a 1 m radius around the base of the tree.

Figure 5-2 Location of quadrat sites

Searches for Koala scats involved a thorough examination of the leaf litter. A tree was defined as any live woody stem of any plant species (except grass trees) with a diameter at breast height of at least 10 cm.

Photograph 5-1 Koala scats

The frequency distribution of all trees recorded within the quadrats was compared to the frequency distribution of those with evidence of Koalas using a chi-squared goodness of fit test (Zar 1984). A further similar analysis was completed, restricting the analysis to only those species with recorded evidence of Koala activity.

5.4 Limitations

The Koala habitat mapping is limited by the resolution and accuracy of the base vegetation mapping. While the mapping metadata indicates a high degree of accuracy and the brief field inspection confirmed general boundaries and dominant species, it is likely that errors will be present in the mapping.

The general lack of historical records of Koalas within Moree Plains Shire and mapping data such as soils means that more complex habitat modelling cannot be completed.

6. Results

6.1 Tree species and preferences

Within the ten quadrats sampled (Appendix B), a total of 87 trees were identified (Appendix C). No Koalas were sighted in the quadrats or in the shire during the field inspection, but sixteen of the trees within five of the quadrats showed signs of Koala activity including scratches and scats (Appendix C). A comparison of the frequency distributions of all trees recorded and those with Koala activity showed that there was a significant difference between the two distributions ($\chi^2 = 34.8$, d.f. = 13, $p < 0.05$). Generally those species used by Koala among those sampled were those recognised as feed tree species including *Eucalyptus camaldulensis*, *E. populnea*, *E. coolabah* and *E. albens* (Figure 6-1). An exception was *Casuarina cristata* (Belah), which is not recognised as a feed tree species, but which is used for shelter. Such shelter species are an important habitat component in harsh environments (NSW National Parks and Wildlife Service 2003).

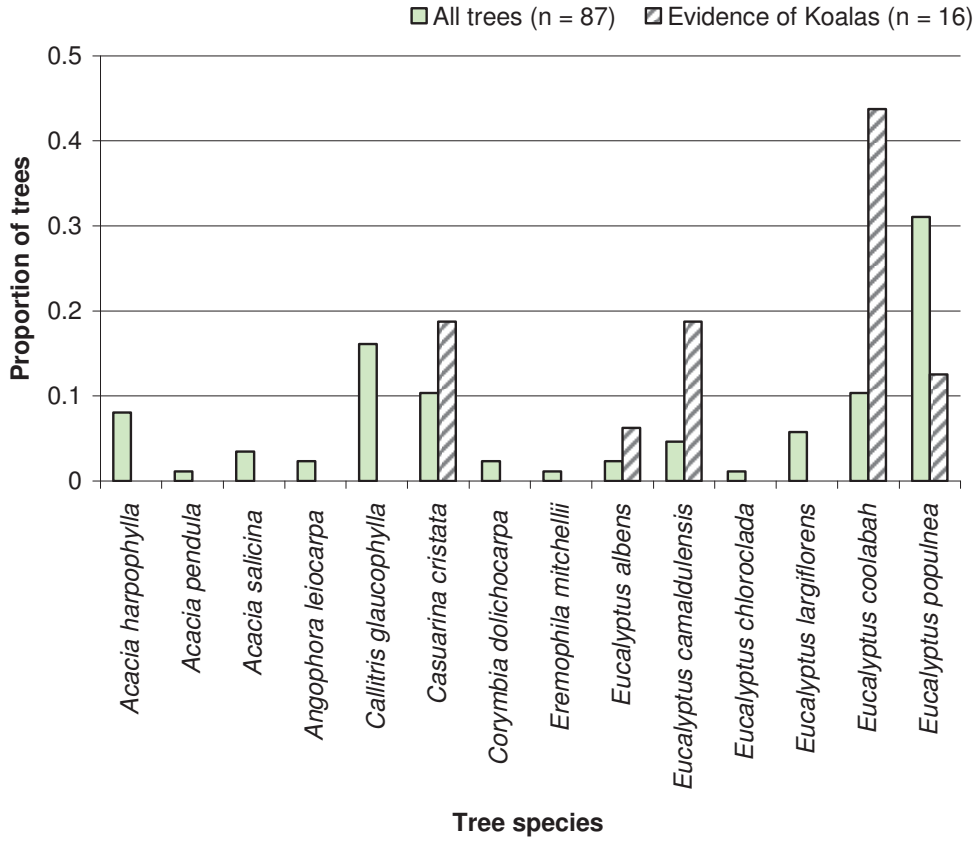

Figure 6-1 Tree species recorded and used by Koalas

There was also a significant difference comparing the frequency distribution of trees in those species found to be used by Koalas with the proportion of those species recorded generally (Figure 6-2, χ^2 = 13.8, d.f. = 4, p < 0.05). The results support the determination of *E. camaldulensis* and *E. coolabah* as primary feed tree species in that they are exhibit a level of use that is significantly higher than that of other *Eucalyptus* species and independent of tree density. Although some anecdotal evidence suggests that Koalas in Moree Plains Shire preferentially use *E. populnea*, the use of this species appears to be at lower frequency than that available (Figure 6-2). This would again support the inclusion of *E. populnea* as a secondary feed tree species.

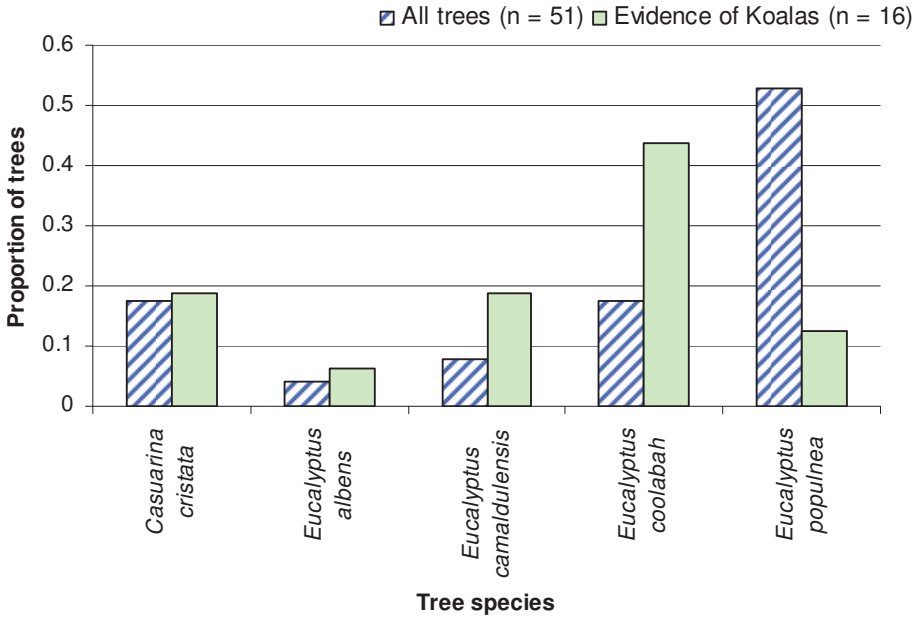

Figure 6-2 Tree species used in relative proportions

While these data do support the listing of the primary and secondary feed tree species, the small sample size means they should be treated with some caution. It should also be noted that feed tree preference can show considerable local/regional variation and the above should be used as a broad guide only.

6.2 The Koala habitat map

Of the 179 vegetation associations (Appendix A), 17 were assigned to Primary Habitat, based on the presence and dominance of primary feed trees species. The mapped extent of primary habitat totalled 2,538 km^2 and was closely associated with the rivers and floodplains of the Gwydir and MacIntyre Rivers and their associated creeks (e.g. Carole Creek) (Figure 6-3). Only two communities associations were assigned to Secondary Habitat (Class A), totalling 95 km^2. This habitat was found in the west of the Shire (Figure 6-1). Eighty-one associations were assigned to Secondary Habitat (Class B), totalling 1,178 km^2. This habitat was dominated by the various box gum species including *E. populnea, E. albens* and *Eucalyptus largiflorens* and was found in the drier eastern half of the shire (Figure 6-1). Together the three categories of mapped Koala Habitat cover 3,811 km^2, which represents 21% of the shire's area.

Figure 6-3 Koala habitat map

The distribution of the various habitat types does not at first inspection appear to fit with the official records of Koalas from the Atlas of NSW Wildlife (see Section 4), in which the majority of records are located east of the Newell Highway in Secondary (Class B) habitat. However these records are possibly biased by the inclusion of State Forest records from the Terry Hie Hie region (see Figure 4-1) and from records of Koala along the Newell Highway and possibly reflect areas where people have visited rather than the true distribution of Koalas in the Shire. Local information obtained from wildlife carers (Yvonne Mack, *personal communication*, 21 February 2007) and the Catchment Management Authority (Liz Savage, *personal communication*, 19 February 2007) relating to the location of Koalas in the Shire (Figure 4-1), corresponds with the habitat mapping.

Metadata for the Koala habitat map is presented in Appendix D.

7. Planning and management recommendations

7.1 Relationship of the Koala habitat map to SEPP44

The determination of potential Koala habitat under SEPP44 relates to the presence of feed tree species listed in Schedule 2 of the SEPP. Three of the Schedule 2 feed tree species are found within Moree Plains Shire: *Eucalyptus camaldulensis*, *E. albens* and *E. populnea*. Forty-three of the mapped vegetation associations contain at least one of these three species (Appendix A) and given that they are dominant they would most likely comprise 15% of the trees in these associations and be considered potential Koala habitat. These associations comprise 1,403 km^2, or 40% of the mapped Koala habitat.

The draft Recovery Plan for the Koala and the Priority Action Statements indicate Department of Environment and Conservation will liaise with the Minister for Planning to amend Schedule 2 (Feed Tree Species) of SEPP44 to reflect the regional food tree species of Koalas (NSW National Parks and Wildlife Service 2003). While this has not been done, it is recommended that the full complement of feed tree species be used instead of only those listed in Schedule 2 of SEPP44. This would mean that all Koala habitat mapped in Figure 6-1 can be considered potential Koala habitat under SEPP44.

It should be noted however that the process of SEPP44 does not eliminate the requirement of Council to consider impacts of actions on the Koala as a Threatened species listed under the *Threatened Species Conservation Act 1995* and in such a case the best information available on habitat should be used.

7.2 Planning controls

The Koala habitat map suggests that large areas of Moree Plains Shire (20%) can be considered potential Koala habitat and should be taken into consideration in terms of future land use planning within the shire. The Koala habitat map should be used as an overlay to inform future planning decisions (see Figure 7-1).

In areas proposed for rezoning or future development, Council should take into consideration the presence of potential Koala habitat as mapped within the area and should be confident that the rezoning or development would:

- be consistent with SEPP44 in that development in core Koala habitat must follow a plan of management prepared in accordance with Part 3 of SEPP44
- not result in development within areas of Primary Koala habitat or within secondary habitat with an important role in connectivity (and their associated buffers)
- allow only low impact development in other areas of secondary habitat
- minimise the removal of preferred Koala food trees
- not result in the severance of Koala movement across the site.

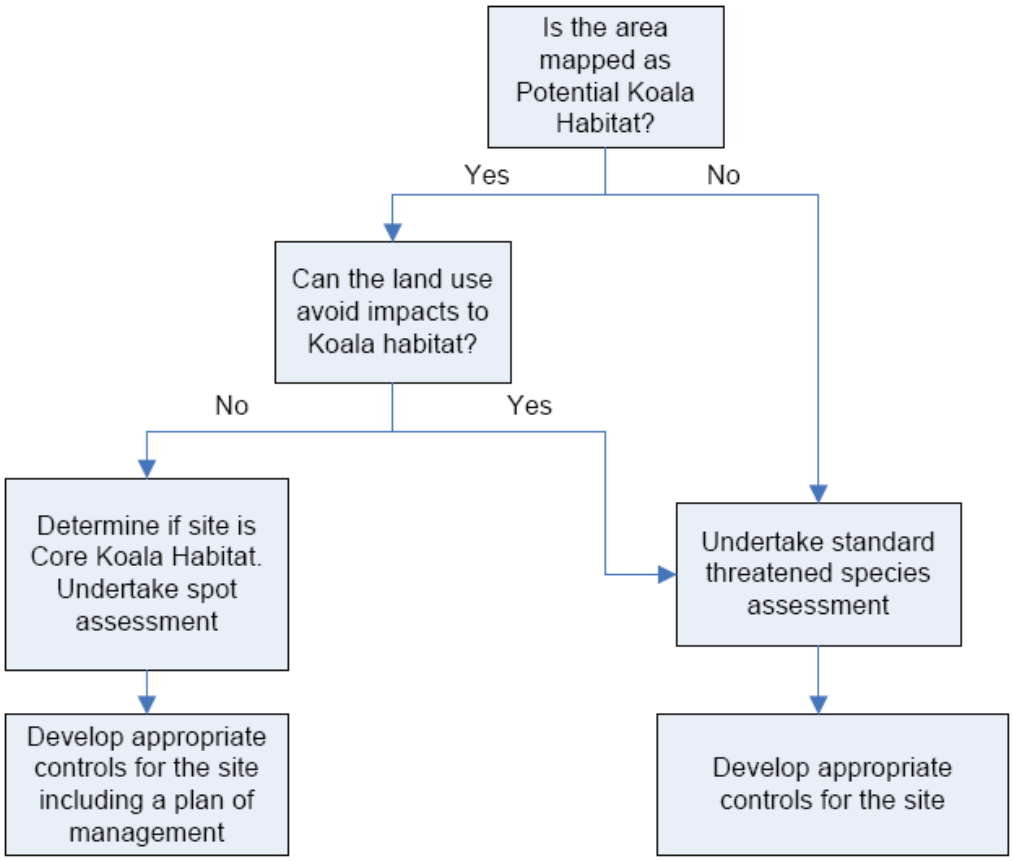

Figure 7-1 Decision tree for use of koala map

Such performance criteria have been adopted by coastal Council's that have developed Comprehensive Koala Plans of management, such as Port Stephens Council (Port Stephens Council 2002). If Council is unsure of the likely impacts of future development in areas of mapped Koala habitat and still wants to proceed with rezoning, then the use of the land by Koalas should be determined using the Koala spot assessment technique (Phillips & Callaghan 1995). This method determines the use of habitat by Koalas and can be used to determine core Koala habitat as defined under SEPP44.

At either the stage of the structure plan, subdivision or development application, in areas that are mapped with Koala habitat, survey for Koalas should be completed using the Koala spot assessment technique (Phillips & Callaghan 1995), if this has not already been done at the rezoning stage. In areas where Koalas are found to be present representing core Koala habitat, Council should request:

- A plan of management for the area as well as appropriate development controls.
- Comprehensive assessment of the likely impacts of the proposal under the *Threatened Species Conservation Act 1995* and the *Environmental Planning and Assessment Act 1979.* This assessment should demonstrate that alternatives that do not include clearing or primary Koala habitat are not available and that the activity has been located so as to minimise the loss of Koala habitat.

7.3 Buffers

Buffers have not been included in the Koala habitat map, but should be considered on a case by case basis. It is recommended that as a minimum, a buffer of 50 m is applied to all areas of mapped Koala habitat where evidence of Koala activity has been found. In cases that show evidence of Koala activity (through use of the Koala spot assessment technique), it should be the responsibility of the proponent to demonstrate the extent of Koala activity outside of the mapped areas and hence the need for larger or smaller buffers. The consideration of buffers should include:

- the size of the mapped area of habitat
- the nature of adjoining vegetation
- connectivity of the mapped area to tother mapped areas
- the presence of Koala activity both in and adjacent to the mapped habitat.

7.4 Further recommendations

- As part of its development applications and general business, Council should maintain records of sightings or evidence of Koalas within Moree Plains Shire including the use of tree species. These data should be used to refine the Koala habitat mapping and should be kept as a separate GIS layer to further inform planning decisions.
- Council should provide information on Koala habitat to the Rural Fire Service so that these data can be incorporated into future bushfire planning.
- Council's noxious weed officer should consider weed control strategies in significant areas of weed infestation. Important areas of habitat inspected during the field inspection were heavily infested with weeds. For example, the area of the Gwydir Raft is heavily infested with African Boxthorn (*Lycium ferocissimum*) (Photograph 7-1). The dense infestation of this species is likely to block access for Koalas. Other areas contained Tiger Pear (*Opuntia aurantiaca*), which has been implicated in Koala deaths (North West Weeds 2006).

Photograph 7-1 African Boxthorn adjacent to the Gwydir River

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