Introduction to NECs 1.14 to 1.23: Riparian eucalypt communities in the arid / semi-arid region of Australia

The riparian eucalypt communities of arid / semi-arid Australia have a particularly important place in the ecology of the region, often providing habitat for numerous species in an otherwise inhospitable environment. In the broader sense, the riparian ecosystems have a wide range of values. For example, aboriginal people have important relationships with rivers, associated with both traditional belief systems and with resource use (NSW NPWS 2000). Riparian ecosystems, or components of them, also have iconic and scenic values (the river red gums of the Flinders Ranges; the gorges of the NT and WA; famous trees of the Coopers Creek area).

Reading the literature about them gives an overwhelming sense of the complexity and beauty of these systems, and of the long (post-European) history of alteration to them. In many ways, the treatment of the riparian communities in this report is incomplete. These communities, perhaps more than any other NECs, provide the opportunity for a multi-faceted analysis of not just the vegetation, but the birds, mammals, reptiles and invertebrates that inhabit them, and of the interactions between all these and the hydrologic features of the systems. It would be much more satisfactory to treat the riparian communities on their own, so that adequate time could be spent on them. Further, it could be argued that a better approach is to consider the riparian systems as a unit, not just focussing by vegetation type, but studying the whole system as one. This would be consistent with the underlying philosophy of considering ecological communities. There is evidence that the proper functioning of a number of these systems involves a complex interplay of various habitats and species (e.g., Briggs *et al.*, 2000; Kingsford and Porter 1999). Threatening processes also tend to operate in similar ways on the range of communities in a riparian system. Therefore, a useful approach may be to consider riparian ecosystems as a unit. We suggest that this be considered as an option for the future.

Nevertheless, this introduction covers some of the general issues that we have noticed in dealing with the arid and semi-arid riparian eucalypt woodlands, and a discussion of the issues behind the grouping of the proposed NECs.

Definitions and Conventions

Riparian zone means any land that adjoins, directly influences, or is influenced by, a body of water (including land immediately alongside small creeks and rivers, such as banks, gullies and dips that sometimes run with surface water, areas surrounding lakes (including terminal lakes), and wetlands that interact with rivers in times of flood) (Lovett and Price 1999, cited in NSW NPWS 2003a). Riparian zones are transitional areas between the bed of the watercourse and the surrounding landscapes. They can vary in width from narrow ribbons (<10m) to broad areas of more than a kilometre (Queensland Parks and Wildlife Service, 2000).

Taxonomy: The coolibahs have been revised relatively recently. We follow Hill and Johnson (1994) for the taxonomy of the coolibahs (Appendix C, Figure 1). Many of the state records in NVIS have not been updated to reflect the changes, so we provide the original names and postulated updates.

The **arid / semi-arid** border, as defined in this report, has generally been applied as a "hard" border. In other words, we have not searched outside the border for related communities, because riparian communities by their nature are much more of a continuum than other communities There are some exceptions to this approach that are explained within the individual NECs.

Structural formations: In developing the NECs we have included forests with the woodland, because the forests generally represent similar communities with taller trees reflecting more fertile or permanently wet locations. In addition, the classification of the communities into "forest" or "woodland" is more arbitrary for the riparian communities than for others – often, the written descriptions emphasize the variation in structure and the classification has had to opt for "forest" or "woodland", even though both are present within the mapped polygons.

The communities

The NECs have been formed from communities dominated by *E. camaldulensis* (river red gum); the arid and semi-arid coolibahs (*E. victrix*, *E. coolabah* ssp. *arida*, *E. coolabah* ssp. *coolabah*, *E. helenae* and *E. barklyensis*); *E. largiflorens* (black box); and *E. ochrophloia* (yapunyah). Poplar box (*E. populnea*) is also a common component of the riparian communities, but communities dominated by poplar box (usually on alluvial plains) have been dealt with in the poplar box NEC(s). There were 87 riparian communities found in the NVIS mapping or in other major descriptive works. These are tabulated in the relevant NECs. In addition, there are numerous other references about riparian communities that have been accessed in describing the NECs. The full reference list is atAppendix 1.

Table 1 presents nine riparian NECs, and provides information about why they have been grouped in this way. For these, more than other communities, it is difficult to find a classification that satisfactorily separates and groups the communities. Other categorisations could also be justified. The table includes comments on difficulties with the current classification.

Table 1: *Classification of the riparian woodlands and justifications.*

NEC#	Name	Explanation and comments
1.14	Coolibah woodlands and open woodlands in the Mulga Lands and Darling Riverine Plains	This includes 2 broad communities – coolibah woodlands on frequently flooded channels and coolibah open woodlands of floodplains. The NEC could be split into two. Both communities appear threatened. They both also occur further west, but face different threats and different degree of threat, so the NEC is restricted to these two bioregions. We suggest that the NEC should include the whole bioregion – i.e., DRP to the east of the western division boundary.
1.15	*E. coolabah* inland woodlands on levees and banks of major drainage lines, billabongs and permanent waterholes	Includes woodlands of inland SA, Qld (CHC & SSD). Related communities may occur in the NT, but could not be identified.
1.16	*E. camaldulensis* inland woodlands on levees and banks of major drainage lines, billabongs and permanent waterholes	Includes woodlands of SA, Qld (MUL, CHC, SSD) and NT. This one is a particularly broad alliance, and the communities at the extremes are likely to be quite dissimilar. We suggest ways that it could be split.
1.17	Inland eucalypt open woodlands on drainage lines and floodplains	Includes the coolibah open woodlands of inland SA, Qld (CHC and SSD) and NT. Some *E. camaldulensis* woodlands could belong here, but the level of detail in community descriptions is generally insufficient to allocate them. It is unclear whether all the sub-communities placed in this NEC truly belong in it, and whether there are comparable communities in western NSW – further work is needed to confirm the membership.
1.18	*Eucalyptus camaldulensis* woodland on levees and banks of drainage lines in the Flinders and Olary Ranges	*E. camaldulensis* on drainage lines that tend to be ephemeral. The NEC is restricted to these ranges because the threats seem to be different compared with similar communities in NSW.
1.19	River red gum and / or coolibah woodlands of the Mitchell Grass Downs and Mount Isa Inlier bioregions	This separates the more tropical woodlands. It is a diverse group and could be separated eg on the basis of dominant species.
1.20	Yapunyah woodlands	*E. ochrophloia* woodlands are not extensive but are different enough to be considered separately.
1.21	Black Box woodlands	This is a large alliance. It could be split; suggestions are given. At the small mapping scale available for many of these communities the mapped areas include many mosaics, and black box woodlands are in unmapped areas.
1.22	Riparian eucalypt communities on levees and banks of major drainage lines in WA	These are separated from similar ecosystems further east because they are different floristically.
1.23	Eucalypt floodplain communities in WA	The floodplain communities have different dynamics compared with the ones lining major drainage channels. There are 2 communities within this group that are considered by WA to be threatened: the communities fringing claypans and on calcrete areas. These could be separated from the rest if there are sufficient data to support the separation
na	River red gum communities on major drainage lines in arid / semi-arid parts of SE Australia	These are usually forests, and occur on rivers such as the Murray, Murrumbidgee and Darling Rivers. We have not formed them into an NEC because of their similarities with temperate communities. We detail the communities that should be considered as temperate in Appendix D.

Appendix C: Taxonomy of the coolibahs

The taxonomy of the coolibahs has recently been revised by Hill and Johnson (1994) and we have interpreted the NVIS and all other data in the light of the revision. However, original names are retained in sub-community references to enable future interpretation. Figure 1 shows the distribution of coolibah species. Hill and Johnson (1994) note that the species form a geographic replacement pattern with hybridisation at the margins, and that each individual taxon shows a slightly different habitat preference.

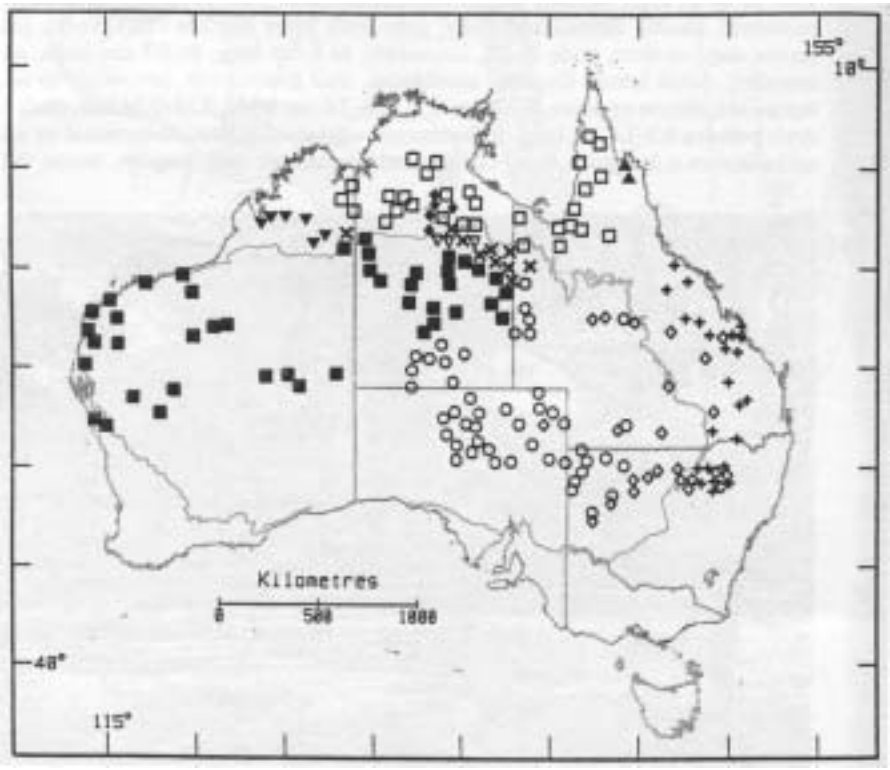

Figure 1: Distribution of the coolibahs (after Hill & Johnson 1994). The arid / semi-arid boundary has been added. The arid/ semi-arid species are: E. victrix *(solid square),* E. coolabah *ssp.* arid *(open circle),* E. coolabah *ssp.* coolabah *(open diamond),* E. barklyensis *(x),* E. helenae *(open inverted triangle). Note that* E. microtheca *(open square) is almost exclusively tropical.* E. coolabah *ssp*. excerata *(+) is close to the Western Division boundary in NSW.*

Appendix D: Riparian communities excluded from this report due to their temperate affinities

Name	Source and code	Comments	IBRA
Riverine Forest, river red gum forest	Fox 1991	*E. camaldulensis* on levees, *E. largiflorens* on flats and along smaller streams	MDD
Eucalyptus camaldulensis isolated trees Open Forest	NVIS; NSW_ID 20500031		DRP, CP, MUL
Eucalyptus camaldulensis Open Forest	NVIS; NSW_ID 21700001 21700003 21700004 21700062		RIV
Riverine Forest	Porteners(1993)	*E. camaldulensis* - river and creek levees and adjacent flats, channelised plains and other areas subject to frequent or periodic flooding	MDD, RIV
River red gum / coolibah forest / woodland	Dick (1990)	Currently excluded from NEC 1.16 because it may have more affinities with more easterly communities.	DRP

NEC 1.14: Coolibah woodlands and open woodlands in the Mulga Lands and Darling-Riverine Plains (and neighbouring lands)

Description

Introduction

This NEC includes woodlands and open woodlands dominated by coolibahs (*Eucalyptus coolabah* ssp. *coolabah*). It is primarily restricted to two bioregions of New South Wales and Queensland, Mulga Lands (MUL) and Darling Riverine Plains (DRP) because the woodlands face different types and degrees of threat in these bioregions compared with examples of similar communities further west. Even though this is part of a project investigating arid and semi-arid communities, we suggest that the bioregional occurrences should be considered as a whole, rather than truncating them at the Western Division boundary. The reasons for this and for the selection of part of the Brigalow Belt South (BBS) communities are:

- In NSW, these communities do not extend eastwards beyond the DRP, so there are no extensive occurrences in temperate NSW. The portion of the communities to the east of the Western Division boundary has no clear links with other temperate communities, and is best considered with the Western Division occurrences.
- Whilst the highest levels of clearing are towards the east in the wheatbelt, clearing is extending into the Western Division, so the threat is consistent in type if not degree across both bioregions.
- Two floristic associations that extend into the BBS region of Queensland are included in their entirety rather than artificially truncating them at the border of the DRP, but occurrences of other coolibah regional ecosystems in the BBS are not included. The details of why related Qld occurrences in the Brigalow Belt are excluded are presented in Attachment 14-1.

This NEC comprises two main communities, and could be split into two smaller NECs based on the part of the riparian landscape that they occupy. It currently remains as one because both communities are dominated by coolibahs, occur in similar geographic areas and face similar threats. Nevertheless, the differences between the two communities are presented here so that they could be separated.

The information about, and interpretation of, these communities follows that of Benson (in prep), and relies heavily on information supplied by him.

Key flora and fauna, and abiotic elements

The communities in this NEC can be broadly described as:

1. Coolibah woodlands of frequently flooded channels (in NSW = Benson's ID 39)
2. Coolibah open woodlands of outer floodplains (in NSW = Benson's ID 40)

Sub-communities are presented in Table 1. Only Benson's groups are included for NSW, because these summarise the existing data. The mapping and descriptive sources for each group are detailed in Attachment 14-2.

The following information is drawn from Benson (in prep) (some directly quoting him) and the relevant Queensland vegetation data (Table 1). Both broad types are dominated by *Eucalyptus coolabah* ssp. *coolabah*. The communities of the frequently flooded channels often also contain *E. camaldulensis*, shrubs (often in thickets) such as *Acacia stenophylla, Acacia salicina, Muehlenbeckia florulenta, Eremophila bignoniiflora* and *Rhagodia spinescens*, and tussock grasses such as *Leptochloa digitata* and *Paspalidium jubiflorum*. They occur on alluvial silty clay soils; the clays can be very deep, alkaline, grey or brown cracking clays. In Queensland the upper canopy is about 5-15m tall, with projective foliage cover of ~ 5-10%. The NSW components may be taller and less open. Benson (in prep) describes them as woodland to open forest; in Queensland the units that

appear comparable are open (or sometimes low open) woodlands. The woodlands of frequently flooded channels grade into those on floodplains more distant from the river, and in NSW into *E. largiflorens* communities on slightly higher ground (Benson, in prep).

The communities on outer floodplains (away from the river channels) tend to be more open, and *Acacia stenophylla* and *Muehlenbeckia florulenta* are less prevalent although they occur in the depressions on floodplains. Other trees may include *E. largiflorens*, *E. populnea* and sometimes *E. ochrophloia*, shrubs include Belah (*Casuarina cristata*), Black Oak (*Casuarina pauper*), and Rosewood (*Alectryon oleifolius* ssp. *canescens*). The ground cover is dominated by chenopods and grasses, including various *Atriplex* and *Sclerolaena* species and an array of grasses including *Enteropogon acicularis*, *Panicum decompositum* and *Paspalidium jubiflorum*. Sedges (*Elaeocharis* and *Carex* spp) and forbs are also present. They occur on flats, open depressions and alluvial plains with grey cracking clay or brown clays. In Queensland the upper canopy height varies from 5 to 12m, with a projective foliage cover of <5 to 10%. In both states they are referred to as low open to open woodlands. This community grades into the previous community (ID 39) or *E. camaldulensis* woodlands near river channels, into *E. populnea* communities on sandier soils, and in some areas on the floodplains into Mitchell grass grasslands or saltbush shrublands (Benson, in prep).

Details of the floristics and structure of the relevant units are given in Attachment 14-3.

These communities are associated with a high fauna diversity, particularly mammal and bird species. Mature trees provide hollows for fauna especially nesting birds (Sattler and Williams 1999). Dick and Andrew (1993) recorded 118 faunal species in the coolibah woodlands (ID39) of the Culgoa and Birrie River floodplains (Attachment 14-4). Whilst they note that the occurrence of the species within the woodlands does not imply a dependent relationship on them, nevertheless it is clear that these woodlands are hosts to a wide array of fauna. Sattler and Williams (1999) report that there has been little systematic fauna survey in the MUL and DRP bioregions; they list those surveys that have been done (their Table 6.5, page 6/31 and Table 11.5, page 11/70). They comment that, in the Mulga Lands, the eucalypt woodlands associated with riparian areas show the highest species richness per unit area, particularly in the bird and plant taxonomic groups. Wilson (1997) details numbers of species in the riparian eucalypt woodlands (including those on floodplains). He records the following numbers of species in each group: 339 plant, 234 bird, 41 mammal, 51 reptile and 20 amphibian. He also presents many additional references which may add valuable information to this section.

Processes by which the biotic and abiotic elements interact

The eucalypts in riparian areas utilize the favourable water regimes of these situations. Different species predominate depending on the local variation in habitat (Neldner 1984; Figure 1).

The species diversities of the communities varies with year and time of year – for example, Dick (1990) estimated that species diversity could be reduced by 60-70% after a prolonged drought. The effect is most prominent in the ground layer. The communities change in response to frequency of flooding, with a proposed increase in tree and shrub cover with increased flood frequencies (Dick 1990). Coolibahs require periodic flooding for seed germination (Benson, in prep, and see the information for *E. victrix* in NEC 1.23). Dense post-flooding regrowth of trees gradually self-thins over time; after 100 years only 3% or the original trees may remain (Benson in prep, citing Maher 1995)

These communities often occur within a landscape with a diverse range in vegetation structure (e.g., forests, woodlands, shrublands and grasslands). Dick (1990) proposes that "the diversity of structural assemblages may have a significant effect on diversity and distribution of of fauna species within the land system". Similar arguments have been proposed in other areas of high structural diversity – for example, the dry lakes of inland NSW (Briggs 2000).

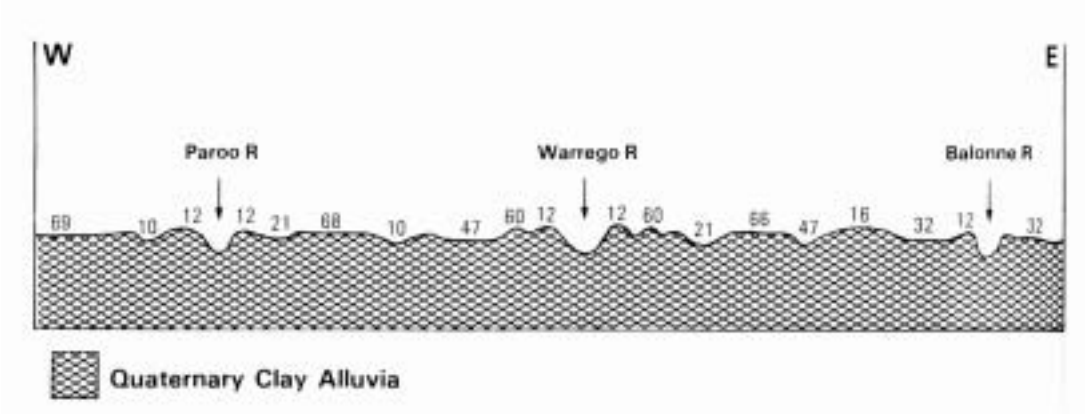

Figure 1: Position in the landscape of vegetation of south central Queensland around the Warrego River *(from Neldner 1984). Map units are the numbers along the landscape profile. The woodlands in this NEC are part of map units 47 and 32; other neighbouring units are* E. camaldulensis ± E. coolabah *woodlands (map unit 12),* E. ochrophloia *woodland (map unit 21), and* Acacia victoriae ± Eucalyptus *spp. tall open woodland (map unit 60)*

Natural distribution

Known natural distribution (including bioregions, conservation areas)

As described earlier, this NEC is defined as occurring primarily within the MUL and DRP bioregions, with minor occurrences in neighbouring subregions of the Brigalow Belt (BBS) and Cobar Peneplain (CP). An indicative map is shown in Figure 2; this is not precise because the western MUL occurrences are either not yet mapped or the data have not been purchased by the Department of the Environment and Heritage (see Fig 3 of Introduction); much of the western division mapping in NSW is small scale (1:1 000 000) and includes occurrences of other communities. Subregions in which the community occurs are in Table 1, and reserved areas are listed in Table 2.

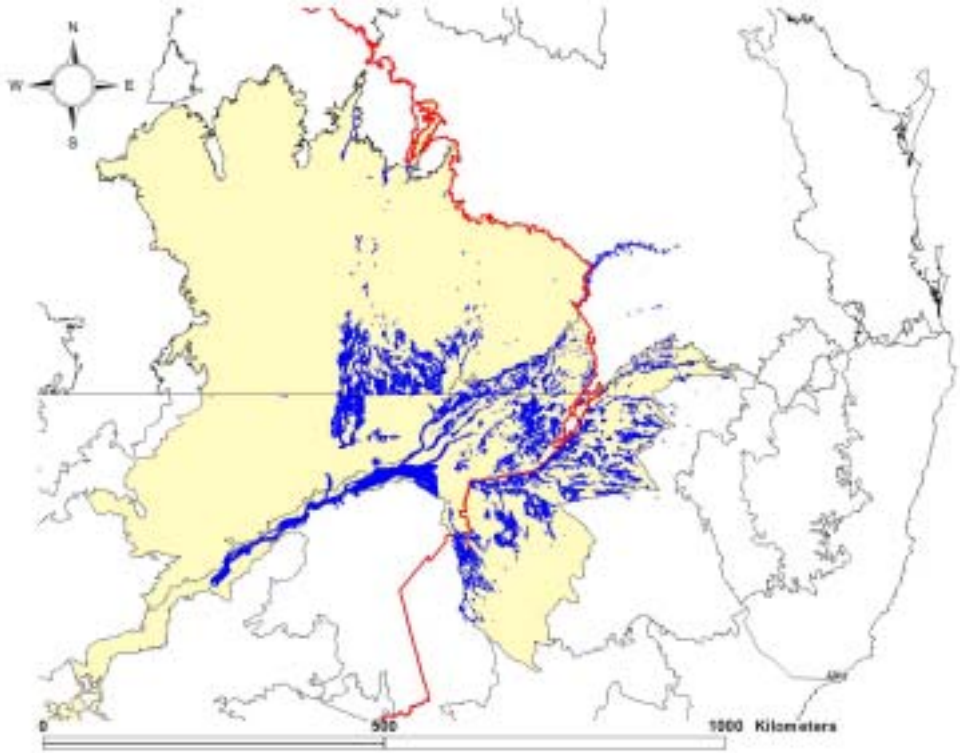

Figure 2: Approximate distribution of this NEC. *The arid/ semi-arid zone is inland of the red line. The MUL DRP regions are shown in buff. Mapped coolibah communities are shown in blue; note that the Qld mapping in western MUL is not available in NVIS.*

Table 1: Coolibah communities in the arid /semi-arid areas of the Darling Riverine Plains and Mulga Lands bioregions*. For NSW, only the Benson groups are included in the table because these summarise the available mapping and descriptions in detail. Conservation status for Qld REs refers to status under the* Vegetation Management Act 1999 */ Biodiversity status according to EPA Qld.*

Sub-comm'y #	Sub-community / Regional Ecosystem name	Unit ID or source	State	IBRA Subregion	Conservation status	Benson group
1	*Eucalyptus coolabah*, *Acacia stenophylla* low open woodland on alluvium.	RE 6.3.7	QLD	MUL5,MUL8, MUL9. Confined largely to the lower Warrego River floodplain	Not of concern/Not of concern	39
2	*Eucalyptus coolabah, E. populnea* open woodland on alluvium.	RE 6.3.9	QLD	MUL1,MUL3, MUL5, MUL7, MUL11	Not of concern/Of concern	40
3	*Eucalyptus camaldulensis* ± *E. coolabah* ± *Acacia cambagei* woodland on major drainage lines/rivers.	RE 6.3.2 (part only)	QLD	MUL9, MUL10	Not of concern/Of concern	Parts of this (Neldner map unit 47a) are dominated by *E. coolabah* and have been mapped as 6.3.2a (EPA 2003); these appear closest to #40
4	*Eucalyptus coolabah* woodland on alluvial plains.	RE 11.3.3	QLD	BBS12, BBS15, BBS19, BBS20, DRP1, DRP3, DRP4	Of concern/Of concern	Relevant portions of this for NEC14 are Neldner 1984 floristic association 32 (=map unit 32b) and map unit 32a (??floristic association??); and Galloway et al 1974 LU 71&74. This selection discussed in Appendix 2. Appears closest to Benson #40
5	*Eucalyptus coolabah, Acacia stenophylla, Muehlenbeckia florulenta* open woodland - woodland on alluvial plains.	RE 11.3.15	QLD	DRP1, DRP3	Of concern/Of concern	Appears closest to Benson #39
6	*Casuarina cristata* +/- *Eucalyptus coolabah* open woodland on alluvial plains.	RE 11.3.28 (part only)	QLD	BBS12, BBS15, BBS19, BBS20, DRP1, DRP3, DRP4	Of concern/Of concern	Only floristic association 33 (Neldner 1984) (=map unit 32c). Consistent with Benson #39
7	Coolibah - River Coobah - Lignum woodland of frequently flooded channels	Benson (in prep) ID 39	NSW	DRP1, DRP2, DRP3, DRP4, DRP5, DRP6, DRP9, CP1, MUL5, MUL7, BBS20	Listed as endangered in NSW	39
8	Coolibah open woodland with chenopod/grassy ground cover of the outer floodplains mainly Darling Riverine Plain Bioregion	Benson (in prep) ID 40	NSW	DRP4, DRP5, BBS22, MUL7	Listed as endangered inNSW	40

In relation to reservation, Benson (in prep) comments that both NSW communities are inadequately conserved across their distribution – i.e., a better representation of the breadth of the community is required in reserves. In particular, in relation to the outer floodplain community (ID 40), he comments that it is: "very poorly reserved given its large distribution and extent. Sites should be selected based on vegetation mapping and survey reports and expert knowledge. Condition varies and it is important to check before any conservation action takes place". He also comments that ID39 is very poorly conserved in reserves considering its pre-European extent. The Queensland communities are also generally poorly reserved (Table 2).

Table 2: Reservation of sub-communities (Environmental Protection Agency Qld 2003d)

Sub-community	**Conservation Reserves**	**% reserved**
6.3.7	none	No representation?
6.3.9	Culgoa Floodplain NP	Medium (6%)
6.3.2 (only map unit 47a)	Currawinya NP	Low (<1%).
11.3.3 (only floristic association 32)	Culgoa Floodplain NP	Low
11.3.15	none	No representation
11.3.28 (only floristic association 33)	none	No representation
Benson ID 39	Budelah NR 93 ha Culgoa NP 6600 ha Narran Lake NR 50 ha Nocoleche NR 5000 ha Paroo-Darling SCA 500 ha Paroo-Darling NP 3500 ha	15743 ± 1600 ha reserved, which is ~ 16% of current extent and ~ 5% of pre-European extent
Benson ID 40	Macquarie Marshes NR 395 ha Boomi West NR 28 ha Midkin NR 10 ha Culgoa NP 5600 ha Paroo-Darling NP 4000 ha Paroo-Darling SCA 300 ha Bundah Narren Lake NPWSland 585 ha Budelah NR 1840 ha Gundabooka NP 4000 ha Boomi NR 40 ha Boronga NR 20 ha	16818 ± 5000 ha reserved, which is ~ 4.2% of current extent and 1.4% of pre-European extent

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

Benson's communities (ID39 and ID40) were listed as an endangered ecological community under the NSW Threatened Species Conservation Act on 14 May 2004. The name of the listed ecological community is "Coolabah-Black Box woodland of the northern riverine plains in the Darling Riverine Plain and Brigalow Belt South bioregions". Of the six Qld regional ecosystems included in this NEC, five are considered "of concern" based on their biodiversity status by the EPA Qld. The three Brigalow Belt regional ecosystems are also considered to be "of concern" under the *Vegetation Management Act 1999*.

Information about listed threatened species that may occur within the NEC has not yet been collated.

Decline in geographic distribution

Estimates of area occupied are incomplete for the reasons explained under "natural distribution". The NSW data have been analysed in detail (Benson in prep) and the area estimates are much more realistic than the mapping. In NSW, Benson (in prep) estimates the current extent of ID39 as 100000 ± 3000 ha, and of ID 40 as 400000 ± 12000 ha. He provides a breakdown for the areas from each data source. These represent 33 ± 10 and 29 ± 12 percent respectively of their pre-European distribution (Benson in prep). EPA (2003b) estimate that for REs 6.3.2, 6.3.7 and 6.3.9, > 30% of the pre-clearing extent remained, whereas for REs 11.3.3, 11.3.15 and 11.3.28, 10-30% of the pre-clearing extent remained. Note that this NEC, as currently defined, does not include all of half of these REs (Table 1). If the EPA have estimates of decline for individual map units or floristic association these would provide more pertinent detail.

In summary, the decline in geographic distribution of some sub-communities within this community is substantial or bordering on substantial.

Threats to the national ecological community

Threats to the sub-communities of this NEC are presented in Table 3. Sattler and Williams (1999) comment that "the Mulga Lands is widely recognised as the most extensively degraded landscape in Queensland… more than two-thirds of Mulga Lands properties west of the Warrego River showed signs of serious land degradation in the form of soil erosion, increase in abundance of unpalatable shrubs and decrease in abundance of palatable perennial grasses. This degradation occurs across most land types but is particularly severe within mulga and alluvial land zones. The causes of the degradation are complex… Artificial watering points supplied by the Great Artesian Basin, and the ability of the ubiquitous mulga *Acacia aneura* tree to provide fodder, allow higher (sheep) stocking rates than the semi-arid climate and poor soils would normally support… (This leads to a) self-reinforcing cycle of reduced perennial grass cover, decreased fire frequency, increased woody shrub cover and increased soil erosion". They identify a link between increased land degradation and decreased economic viability of pastoral enterprises that perpetuates the degradation cycle.

Table 3: Threats to sub-communities of the NEC. *From Environmental Protection Agency 2003b) and Benson (in prep). Note that the Benson notes are largely taken directly from his data.*

Sub-community	Threats
6.3.7	Not stated
6.3.9	Has been subjected to extensive clearing and/or thinning
6.3.2 (only map unit 47a)	Highly modified structural and floristic composition as a result of high total grazing pressure. Condition fair to poor due to scalding caused by wind and water erosion
11.3.3 (only floristic association 32)	Clearing (10-30% of pre-European extent remains). The ground layer of remnants of this regional ecosystem is often extensively modified by grazing. The structure of the tree canopy has often been modified by past thinning which has included the removal of many of the larger hollow bearing trees.
11.3.15	Clearing (10-30% of pre-European extent remains). Impacted by total grazing pressure and past thinning
11.3.28 (only floristic association 33)	Clearing (10-30% of pre-European extent remains). Alteration through thinning.
Benson ID 39	The eastern region of this widespread riverine/wetland community has been substantially cleared - in some parts to less than 20% ot its original extent - Moree to Goondiwindii. In the Western Division there has been less clearing, although there is pressure to clear near Walgett. All areas have been heavily grazed, therefore, few stands contain an understorey in good condition. Weeds abound in the east but are less prevalent in the Western Division, for example in the Coolibah woodland of the Culgoa (Dick 1990). Regrowth is abundant in the Culgoa/Narran River regions but less so in the northern wheatbelt. Changes to flooding regimes due to increased irrigation in NSW and Queensland may adversely affect this community over the long term. It is very poorly conserved in reserves considering its pre-

	European extent.
Benson ID 40	Clearing for cropping threatens the remaining stands of this community on private land. Besides remaining extent, it is this rate of clearing that threatens this community... Most remnants have been heavily grazed with palatable species having disappeared or reduced in abundance. In some places trees are aging with little recruitment of Coolibah trees due to grazing pressure and/or lack of flooding. Weeds dominate the ground cover in many places, of particular concern is Lippia (*Phyla canescens*) a ground forb that dominates disturbed sites under Coolibah and Black Box. Threatened because of the current rate of clearing per year (1% decline per year in the Moree region) Cox et al. (2001).

The data collected for the Terrestrial Biodiversity Assessment (Sattler and Creighton 2002) indicate threats that have been recorded for any ecosystem on a sub-regional basis (Table 3). These can be used to get a broad picture of the processes within the sub-regions, but will not all be applicable to these woodlands and are biased by survey effort. Nevertheless, they provide an overview of the processes operating in these subregions. They show these subregions have numerous threatening process operating in them, the most common being broad-scale vegetation clearing, grazing pressure and changed hydrology.

Table 4: Summary of threats to any ecosystems within the subregions (from Sattler and Williams 2002). " y" indicates that the threat has been recorded as present.

	BBS12	BBS15	BBS19	BBS20	BBS22	CP1	DRP1	DRP2	DRP3	DRP4	DRP5	DRP6	DRP9	MUL1	MUL3	MUL5	MUL7	MUL8	MUL9	MUL10	MUL11
Broad scale vegetation clearing	y	y		y	y	y	y	y	y	y	y	y	y	y	y	y	y	y			
Changed fire regimes				y	y		y	y	y	y	y	y	y						y		
Changed hydrology - other						y	y	y	y	y	y	y	y		y	y	y	y			y
Changed hydrology - salinity	y	y			y					y	y										
Exotic weeds	y	y		y	y		y	y	y	y	y	y	y			y					
Feral animals						y						y	y				y	y			
Firewood collection					y						y										
Grazing pressure	y	y		y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Increasing fragmentation	y	y	y	y	y		y	y	y	y	y			y	y						
Pathogens	y																				
Pollution					y						y										
Other					y				y	y				y			y				

Loss or decline of functionally important species

Data may exist but has not been identified

Reduction in ecological community integrity

See notes in Table 3 about invasion of exotic weeds, and in the "threats" section about land degradation in the Mulga Lands.

Rate of detrimental change

See notes in Table 3. These communities are in areas in which clearing is actively occurring; around Moree the rate of clearing has been estimated to be 1% per year (Cox et al 2001, cited in Benson in prep).

Summary and recommendation regarding category of threat under the EPBC Act

There is evidence under Criterion 1 (decline in geographic distribution), Criterion 4 (reduction in community integrity) and Criterion 5 (rate of continuing detrimental change) that this community is

threatened. In addition, the fact that it is poorly reserved across its distribution contributes to the threat to its long-term persistence. It is recommended that this NEC, once confirmed and supported by state experts, could be nominated for listing as a threatened ecological community.

Outstanding issues

The following decisions about this NEC need to be discussed with state experts as there was insufficient time to resolve them. Some issues relate to temperate areas, which were outside the scope of this report.

- Is this better considered as two NECs?
- Is the decision to restrict the NEC largely to the MUL and DRP satisfactory?
    - Apart from the consideration of threat, the other reasons for **excluding the CHC** occurrences are:
        - Fewer of them are "of concern"
        - Part of the problem of extending it to the CHC is that it is then hard to argue that the South Australian community that is similar (*Eucalyptus coolabah* ssp. *arida* (Coolibah) Woodland on levees and channel banks of regularly inundated floodplains; Neagle 2003) should not be included. This would make the NEC very broad.

      Note that the excluded portions are included in NEC 15.
    - Some Brigalow Belt occurrences have been included: is this appropriate? (see Attachment 14-2 for details and rationale)
    - There are additional occurrences of coolibah woodlands mapped by Sivertsen and Metcalfe (2001). They have not been mapped – check this interpretation.
- For Queensland, is the decision to include part of a regional ecosystem realistic? (see Attachment 14-2 for details and rationale)

Attachment 14-1: *Basis for decisions about the Queensland component of this NEC*

Some of the Queensland regional ecosystems included in this NEC have occurrences outside MUL and DRP. At the moment these have been excluded, for the reasons outlined below. These interpretations are based on the literature and need to be checked with the Queensland Herbarium.

1. RE 11.3.3 occurs in provinces 3, 4, 7, 8, 10, 11, 14, 24, 25, 27, 31, 35, 36 of the Brigalow Belt region (Sattler and Williams 1999). Provinces 35 and 36 are now part of the DRP. The remainder extend across the ranges as far north as Charleton. Figure 3 maps the occurrences of RE 11.3.3 in these provinces.

   According to EPA (2003b), the survey and mapping data contributing to this regional ecosystem are : Forster and Barton (1995), Coolibah; Galloway et al. (1974), LU71, LU74; Gunn et al. (1967), Funnel, Comet; Neldner (1984), 32a, 32b; Story et al. (1967), Comet. (these references, if not cited in this report, are in Sattler and Williams 1999). Many of these are distant from the DRP and MUL occurrences of the ecosystem (Figure 3). For the Neldner data: map unit 32a could not be identified in Neldner (1984), but it exists in the mapping as a component of 11.3.3. Floristic details cannot be provided. Unit 32b = Floristic association 32 (*Eucalyptus microtheca* open-woodland), which occurs in the central north of his south central Queensland study area (Latitude ~27ºS, longitude ~149.5ºE) but also near the border. This has been included. The small amount mapped in the Brigalow Belt is included because of its consistency with the rest of the unit, and because it exists in neighbouring sub-regions.

   Other components of RE 11.3.3 are excluded because most of them are distant from the arid / semi-arid area, being on the coastal side of the Great Dividing Range (see drainage basins indicated in Figure 3)

2. Floristic association 33 (map unit 32c) has been included, because the association appears consistent with the other sub-communities that have been included. It is mapped as part of 11.3.28. The other components of 11.3.28 are dominated by Belah (*Casuarina cristata*) and have been excluded. Some of 11.3.28 exists in the Brigalow Belt; these are all close to the MUL and DRP occurrences (in neighbouring subregions) and are included.

3. RE 11.3.37 is recorded in a number of Brigalow Belt provinces, including 35 & 36 (=DRP) but mapped occurrences could not be found in the NVIS version. The only mapped occurrences of 11.3.37 are east of the ranges (Figure 3). These are not included here.

4. Some of the communities extend into the Channel Country (CHC). There are regional ecosystems that appear to be similar to one or other of the communities of this NEC in the CHC of Queensland (specifically: for ID 39: 5.3.5 and 5.3.8 were suggested by Benson (in prep), and 5.3.20 may also be related; for ID 40: 5.3.6 is suggested by Benson (in prep)). However, all occurrences in the CHC have been excluded from this NEC because the threats in the CHC tend to be from grazing and feral animals, rather than clearing and changed water regimes, which are prevalent in MUL and DRP. Thus the MUL, DRP (and BBS) occurrences face different threats and can be considered separately to occurrences further west.

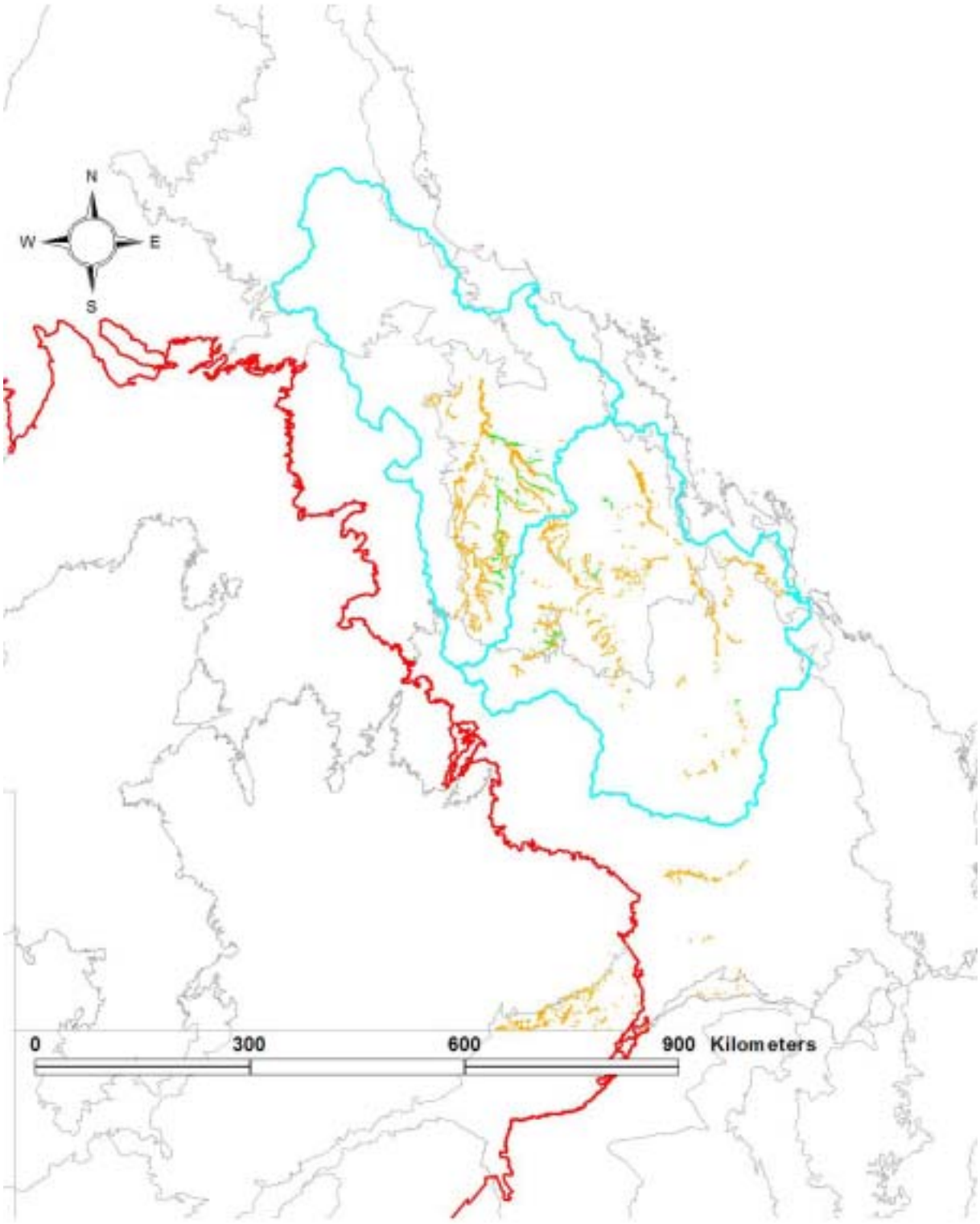

Figure 3: The distribution of regional ecosystems 11.3.3 (orange) and 11.3.37 (green) outside the semi-arid boundary (red). The grey lines indicate (IBRA) regional boundaries, and the aqua lines outline the drainage basins in which the north-eastern occurrences reside. Note that, for mosaic polygons, only the dominant RE has been mapped.

Attachment 14-2: *Mapping and descriptions relevant to Benson's groups*

The following information is taken directly from Benson (in prep). The references not accessed for this report, but cited here, are available in Benson (in prep).

ID 39: Coolibah - River Coobah - Lignum woodland of frequently flooded channels

Authorities: Northern most areas of map unit R3 in Sivertsen & Metcalfe (2001) including their Coolabah-Black Box unit, and part of map unit R2 in same. Includes map unit e41c in Peasley (2001). Combines map units 2-4 (Coolabah of various densities of tree crowns and understorey) in Dick (1990) and equivalent to Hunter & Earl (2002) Lignum Coolabah Woodlands for Culgoa region, eastern part of map unit 4 (Coolabah Open Forest) in Pickard & Norris (1994). Mapped for the Gwydir Watercourse by McCosker (2000). Probably includes the Coolabah in Green (1992) on the Warrego River. Includes community 5 in Hunter (2000c) for Mogil Mogil map sheet. Black Box occurs as a sub-dominant in some locations. Grades into ID40 on higher ground floodplains distant from watercourses mainly in the Darling Riverine Plain Bioregion but species composition overlaps. Grades into ID37 (Black Box) on slightly higher ground. Allied to Coolabah communities in the arid zone (ID230 and 231). This is recorded as an association even though it has a wide distribution, as it appears from the literature there is a consistent list of associated species. Field checked and main species listed by Benson (1999-2004).Mapping info: Mapable due to location of Coolabah along rivers but mixes with river Red Gum. Sivertsen & Metcalfe (2001) map Coolabah with Black Box and map it as mixed with other plant communities. It is more precisedly defined in the map by Peasley (2001) and maps of reserves such as Culgoa NP (Hunter & Earl 2002). Pickard & Norris (1994) mapped Coolibah in the broad sense mainly down the Darling River above Wilcannia but they included various other communities in the unit due to the small scale of their map.

ID 40: Coolibah open woodland with chenopod/grassy ground cover of the outer floodplains mainly Darling Riverine Plain Bioregion

Authorities: Equivalent to map unit R10 in Sivertsen and Metcalfe (2001). Includes the Coolabah-Belah and Poplar Box - Coolabah communities mapped in the Walgett and Brewarrina shires by Sawtell and Miller (2001). Includes map units E41, E41a, E41b and E41d in Peasley (2001) for Moree Plains Shire. Probably equivalent to map unit FW (Floodplain Woodland) for the lower Macquarie River floodplain in Steenbeeke (1996). Probably equivalent to the Coolabah-Poplar Box part of community 3 mixed low open woodlands in Hunter and Earl (2002). Part of the map unit 4 in Pickard and Norris (1994). Coolabah woodlands map unit for Gwydir Wetland in McCosker (2000). Checked by J Benson in October 2001.

Mapping info: Map unit R10 in Siversen and Metcalfe (2001). Mapped by various authors for Macquarie River. Peasley (2001) has mapped Coolibah in Moree Plains and Walgett Shires. Some areas mapped around Bourke and Louth by Pickard & Norris (1994). Most of BVT7 in Kerr et al (2003) for Macquarie-Castlereagh region area north of Dubbo.

Attachment 14-3: *Details of the sub-communities. Note that much of this data is taken directly from the source material. Details of the soil types are excluded here. Note that the Queensland survey data are largely not updated with respect to taxonomy; the exceptions:* E. microtheca *changed to* E. coolabah*;* Muehlenbeckia cunninghamii *changed to* M. florulenta. *Further details of other relevant data sources for the Qld REs can be obtained from Environmental Protection Agency Qld (2003b)*

What	Name	Source	Description	Upper	Mid	Ground	Landform	Notes
ID39:	Coolibah - River Coobah - Lignum woodland of frequently flooded channels	Benson in prep	Coolibah Box open forest and woodland dominated by Coolibah (*Eucalyptus coolabah* ssp. *coolabah*) often with River Red Gum (*Eucalyptus camaldulensis*) with understorey thickets of Lignum (*Muehlenbeckia florulenta*), River Coobah (*Acacia stenophylla*) or Coobah (*Acacia salicina*). *Melalueca triostachya* occurs on river banks in some areas. The ground cover contains tall tussock grasses such as *Leptochloa digitata* or *Paspalidium jubiflorum*, sedges and rushes (*Juncus* spp).	*Eucalyptus coolabah* ssp. *coolabah, Eucalyptus camaldulensis, Eucalyptus largiflorens, Melaleuca trichostachya, Casuarina cristata*	*Acacia stenophylla, Acacia salicina, Muehlenbeckia florulenta, Geijera parviflora, Eremophila mitchellii, Rhagodia spinescens, Capparis mitchellii, Acacia pendula, Apophyllum anomalum, Eremophila bignoniiflora, Alstonia constricta* Type form*, Acacia farnesiana, Eremophila maculata, Acacia cambagei*	*Leptochloa digitata, Paspalidium jubiflorum, Einadia nutans* ssp*. nutans, Sclerolaena* spp*, Solanum esuriale, Solanum esuriale, Atriplex muelleri, Cyperus bifax, Marsilea drummondii, Lachnagrostis filiformis, Alternanthera nodiflora, Eleocharis pallens, Eleocharis plana, Cyperus concinnus, Cyperus victoriensis, Panicum decompositum, Chloris ventricosa, Dichanthium sericeum* ssp*. sericeum, Sporobolus caroli, Pratia concolor, Abutilon oxycarpum, Daucus golchidiatus* sens. lat., *Goodenia pusilliflora*	floodplains	floodplains of the major rivers in DRP, NSW
ID40:	Coolibah open woodland with chenopod/grassy ground cover of the outer floodplains mainly Darling Riverine Plain Bioregion	Benson in prep	Mid-high open Coolabah woodland dominated by Coolabah (*Eucalyptus coolabah* ssp. *coolabah*) often with Black Box (*Eucalyptus largiflorens*) or Poplar Box (*Eucalyptus populnea* ssp. *bimbil*). Belah (*Casuarina cristata*), Black Oak (*Casuarina pauper*), ...Nitre Goosefoot (*Chenopodium nitrariaceum*).. may be present in the tall shrub and shrub layer. The ground cover is dominated by chenopods and grasses. The chenopods include various *Atriplex* and *Sclerolaena* species co-existing with an array of grasses including *Enteropogon acicularis, Panicum decompositum* and *Paspalidium jubiflorum*. Sedges (*Elaeocharis* and *Carex* spp) and forbs are also present. Lignum (*Muehlenbeckia florulenta*) and Nardoo (*Marseilea* spp) occur in low lying areas.	*Eucalyptus coolabah* ssp. *coolabah, Eucalyptus largiflorens, Eucalyptus populnea* ssp. *bimbil, Casuarina cristata, Casuarina pauper; Atalaya hemiglauca*	*Alectryon oleifolius* ssp *canescens, Chenopodium nitrariaceum, Rhagodia spinescens, Atriplex vesicaria* sens lat*., Atriplex nummularia, Capparis lasiantha, Eremophila bignoniflora, Geijera parviflora, Alectryon oleifolius* ssp*. elongatus, Myoporum montanum, Alstonia constricta* Type form*, Acacia excelsa* ssp *excelsa, Acacia farnesiana, Parsonsia eucalyptophylla*	*Einadia nutans* ssp*. eremaea, Paspalidium jubiflorum, Sclerolaena muricata* sens lat*., Salsoli tragus* ssp *tragus, Sclerolaena bicornis* var *bicornis, Tetragonia tetragonioides, Atriplex leptocarpa, Sclerolaena birchii, Oxalis chnoodes, Panicum decompositum, Sporobolus caroli, Enteropogon acicularis, Eleocharis acuta, Eleocharis pallens, Eleocharis pusilla, Marsilea drummondii, Carex inversa, Aristida platychaeta, Sida trichopoda, Cynodon dactylon*	flats, open depressions and alluvial plains of outer floodplains	mainly in DRP from Macquarie Marshes in the south extending into Queensland border in the north. Some outliers occur west and south of Bourke. This community is more open than the Coolibah community near rivers (ID 39) and generally occurs on higher ground more distant from the watercourse. Compared to ID 39, it lacks the same dominance by River Coobah and Lignum although they occur in depressions on the floodplain.

What	Name	Source	Description	Upper	Mid	Ground	Landform	Notes
RE 6.3.7	*Eucalyptus coolabah*, *Acacia stenophylla* low open woodland ..	Sattler and Williams 1999	*Eucalyptus coolabah* low open woodland often with scattered *Acacia stenophylla* in the mid layer and a grassy ground layer. Occurs on flat, frequently flooded alluvial plains.	details in following rows				
Note: this information is only partly relevant because this floristic association is divided across two REs (6.3.2 and 6.3.7), one that fits ID 39 and one, ID 40								
Floristic association 34 (part) = 6.3.7	(*Eucalyptus coolabah* low open-woodland)	Neldner 84	*Eucalyptus coolabah* predominates forming a well-defined but discontinuous canopy (Ht. 5-10 m; Cover < 5-10% (occasionally 30%); Density < 25-150 trees/ha.), with scattered tall shrubs and low trees occurring beneath it. Low shrubs are present and form a distinct layer dominated by *Muehlenbeckia florulenta* and *Chenopodium auricomum* in the wetter channels and swamps. The seasonally variable ground layer is open to dense, and usually dominated by perennial grasses, or in favourable seasons by ephemeral herbs.	*Eucalyptus coolabah, Acacia cambagei* (in places). A, *harpophylla* (in places), *A. stenophylla, Eremophila bignoniiflora*, *Eucalyptus ochrophloia* (in places), *Lysiphyllum gilvum* (only in north-west).	Frequently occurring spp: *Acacia farmesiana* (in west), *A. victoriae* (in west), *Chenopodium auricomum, Eremophila maculata, E. polyclada, Maireana aphylla, Muehlenbeckia florulenta*.	Forbs: .... *Malvastrum americanum, Marsilea* spp., ..., *Sclerolaena birchii, S. muricata, Tribulus tervrestris*, *Trigonella suavissima, Vigna lanceolata* var. *latifolia.* Graminoids*: Aristida ramosa, Bothriochloa decipiens, B. ewartiana, Chrysopogon fallax, Enteropogon acicularis, Panicum decompositum.*		A low woodland may develop along the larger channels, while wooded tussock grasslands occur on the drier areas of the flat plains. The ground layer is most frequently dominated by the perennial grass *Eragrostis setifotia,* with or without *Astrebla* spp. This association is mapped as mapping unit 47b (= the unit assigned to RE 6.3.7).
Mills and Lee 1990 LU .. = 6.3.7								
RE 6.3.9	*Eucalyptus coolabah, E. populnea* open woodland ..	Sattler and Williams 1999	*Eucalyptus coolabah, E. populnea* open woodland on seasonally flooded alluvial plains and depressions. Grey cracking clay soils.	details in following row			seasonally flooded alluvial plains and depressions	

What	Name	Source	Description	Upper	Mid	Ground	Landform	Notes
Floristic association 32 = 6.3.9 (also part of 11.3.3 in DRP/BBS)	(*Eucalyptus coolabah* open-woodland)	Neldner 84	*Eucalyptus coolabah* predominates forming a distinct but open canopy (Ht 10-12 m; Cover < 6%; Density < 150 trees/ha.). Scattered tall shrubs may be present, but a tall shrub layer is not developed. A low shrub layer is well-developed in some places. The ground layer is variable and composed mainly of forbs.	*Eucalyptus coolabah, Acacia farnesiana, Heterodendrum oleifolium.*	*Capparis lasiantha, C. mitchellii*, *Eremophila maculata.*	Forbs: Frequently occurring spp: *Boerhavia* spp*., Enchylaena tomentosa, Malvastrum americanum, Marsilea drummondii, Polymeria marginata, Portulaca* sp. aff. *oleracea, Sclerolaena muricata, Sida trichopoda, Solarium ellipticum, Teucrium racemosum, Trianthema triquetra;* Graminoids*: Aristida ramosa, Bothriochloa decipiens, B. ewartiana, Chrysopogon fallax, Enteropogon acicularis, Panicum decompositum.*		
RE 6.3.2 (part)	*Eucalyptus camaldulensis* ± *E. coolabah* ± *Acacia cambagei* woodland on major drainage lines/rivers.	Sattler and Williams 1999	The whole RE (not all applicable): *Eucalyptus camaldulensis* +/- *E. coolabah* +/- *Acacia cambagei* woodland on terraces, levees or banks of major drainage lines. Often with a well developed shrubby layer dominated by species such as *Acacia stenophylla* and *Eremophila bignoniflora*. Ground cover is variable and composed of forbs and grasses. Alluvial soils.	details in following rows			see notes	Areas dominated by *E. coolabah* occurring along narrow drainage lines in the northwest of the region are mapped as 6.3.2a (Neldner, 1984, 47a) – this is the part selected (see below)

Note: this information is only partly relevant because this floristic association is divided across two REs (6.3.2 and 6.3.7), one that fits ID 39 and one, ID 40

Floristic association 34 (part) (= the selected partt of 6.3.2)	(*Eucalyptus coolabah* low open-woodland)	Neldner 84	*Eucalyptus coolabah* predominates forming a well-defined but discontinuous canopy (Ht. 5-10 m; Cover < 5-10% (occasionally 30%); Density < 25-150 trees/ha.), with scattered tall shrubs and low trees occurring beneath it. Low shrubs are present and form a distinct layer dominated by *Muehlenbeckia florulenta* and *Chenopodium auricomum* in the wetter channels and swamps. The seasonally variable ground layer is open to dense, and usually dominated by perennial grasses, or in favourable seasons by ephemeral herbs.	*Eucalyptus coolabah, Acacia cambagei* (in places). A, *harpophylla* (in places), *A. stenophylla, Eremophila bignoniiflora*, *Eucalyptus ochrophloia* (in places), *Lysiphyllum gilvum* (only in north-west).	Frequently occurring spp: *Acacia farmesiana* (in west), *A. victoriae* (in west), *Chenopodium auricomum, Eremophila maculata, E. polyclada, Maireana aphylla, Muehlenbeckia florulenta*.	Forbs:... *Haloragis glauca, Hibiscus trionum, Ipomoea lonchophylla*, *Malvastrum americanum, Marsilea* spp., *.., Salsola kali, Sclerolaena birchii, S. muricata, Tribulus tervrestris*, *Trigonella suavissima, Vigna lanceolata* var. *latifolia.* Graminoids*: Aristida ramosa, Bothriochloa decipiens, B. ewartiana, Chrysopogon fallax, Enteropogon acicularis, Panicum decompositum.*		*Lysiphyllum gilvum* is a conspicuous tall shrub in this association on the flat alluvial plains and braided channels of the upper Bulloo River and Blackwater Creek in the north-west, and this variant is mapped as mapping unit 47a (= the unit assigned to 6.3.2).

What	Name	Source	Description	Upper	Mid	Ground	Landform	Notes
RE 11.3.3	*Eucalyptus coolabah* woodland on alluvial plains.	Sattler and Williams 1999	*Eucalyptus coolabah* woodland to open woodland with a grassy understorey. Other scattered tree or shrub species, such as *E. populnea, Melaleuca bracteata, Alectryon oleifolium* and *Acacia pendula, A. cambagei, A. farnesiana* and occassionally *Muehlenbeckia florulenta* may be present. Can include small areas of grassland with scattered trees. Occurs on Cainozoic alluvial plains with clay soils.	details in following rows			alluvial plains	
Floristic association 32 (=part of 11.3.3) 9 (also part of 6.3.9 in MUL)	*Eucalyptus coolabah* open-woodland.	Neldner 1984	*Eucalyptus coolabah* predominates forming a distinct but open canopy (Ht. 10-12 m; Cover < 6%; Density < 150 trees/ha.) Scattered tall shrubs may be present, but a tall shrub layer is not developed. A low shrub layer is well-developed in some places. The ground layer is variable and composed mainly of forbs.	*Eucalyptus coolabah, Acacia farnesiana, Heterodendrum oleifolium*	*Capparis lasiantha, C. mitchellii*, *Eremophila maculata.*	Forbs*: Boerhavia* spp.*, Enchylaena tomentosa, Malvastrum americanum, Marsilea drummondii, Polymeria marginata, Portulaca* sp. aff*, oleracea, Sclerolaena muricata, Sida trichopoda, Solarium ellipticum, Teucrium racemosum, Trianthema triquetra;* Graminoids*: Aristida ramosa, Bothriochloa decipiens, B. ewartiana, Chrysopogon fallax, Enteropogon acicularis, Panicum decompositum*.	in broad drainage depressions on flat alluvial plains,	This association occurs in the central-north **but also mapped near border; included in mapping unit 32b.
LU 71 (contributes to 11.3.3)		Galloway et al 1974	Open woodland of *Eucalyptus coolabah*. Occasional *Casuarina cristata*, usually scattered lower trees, *Acacia stenophylla*, occasional *A. pendula, A. omalophylla*….	details in Galloway et al 1974, but similar distribution and species to Neldner 1984, floristic association 33			back plains and back swamps subject to flooding; SLOPES 0.05 - 0.3%	
part of LU 74 (contributes to 11.3.3 and 11.3.15 (EPA 2003b))		Galloway et al 1974	Open woodland of *Eucalyptus coolabah*, shrub layer of *Acacia stenophylla* and *Eremophila longifolia* usually open; sparse ground cover of *Panicum decompositum, Cyperus bifax, Sporobuls mitchellii, Paspalidium jubiflorum, Thellunigia advena*, and *Bassia quinquecuspis*				flooded depressions in alluvial clay plains = back swamps and shallow channels, frequently flooded; slopes ~ 0.1-1%	in frequently flooded areas. Note that this LU is broad and contibutes to 2 REs (11.3.3 and 11.3.15), one consistent with Benson 39 and one with Benson 40 (see Table in main text)

What	Name	Source	Description	Upper	Mid	Ground	Landform	Notes
RE 11.3.15	*Eucalyptus coolabah*, *Acacia stenophylla*, *Muehlenbeckia florulenta* open woodland - woodland on alluvial plains.	Sattler and Williams 1999	*Eucalyptus coolabah* open woodland to woodland with scattered dense to open *Muehlenbeckia florulenta* low shrub layer. Scattered *Acacia stenophylla* and *Eremophlia bignoniflora* are usually present and may form a distinct mid layer in some areas. Occurs on depressions within Cainozoic alluvial floodplains often adjacent to frequently flooded chanels. Soils are heavy clays that remain wet for long periods.	details next row				Differentiated from 11.3.3 by its occurance on lower lying more frequently flooded areas with heavier clay soils and the occurance of *Muehlenbeckia florulenta Eremophila bignoniflora* and *Acacia stenophylla* in the mid layer.
Floristic association 31 = part of RE 11.3.15	*Eucalyptus coolabah* shrubby woodland.	Neldner 1984	*Eucalyptus coolabah* predominates forming a distinct but disjunct canopy (Ht. 9-12 m; Cover < 1-8%.). Dense low shrub layers of *Muehlenbeckia florulenta* with or without *Acacia stenophylla* occur. The ground layer is sparse, but dominated by forbs and sedges.	*Eucalyptus coolabah*, E*remophila bignoniiflora, Eucalyptus camaldulensis* (in places).	*Acacia stenophylla*, *Muehlenbeckia florulenta*	Forbs*: Aeschynomene indica, Atriplex lindleyi, Malvastrum americanum, Sclerolaena birchii, S. muricata, Sesbania cannabina, Sida fibulifera, Solanum esuriale;* Graminoids*: Aristida jerichoensis, Chrysopogon fallax, Cyperus bifax, Eragrostis setifolia, Panicum effusum, Paspalidium jubiflorum, Sporobolus caroli, S. mitchellii.*	fringing woodland along channels and swamps in the south.	This association is very limited in extent; mapped as mapping unit 32d.
RE 11.3.28 (part)	*Casuarina cristata +/- Eucalyptus coolabah* open woodland on alluvial plains.	Sattler and Williams 1999	*Eucalyptus coolabah* predominates forming a distinct open woodland canopy layer. Scattered or clumped *Casuarina cristata* trees often form part of the canopy. Scattered tall shrubs or low trees are often present but do not ususally form a well defined layer. *Muehlenbeckia florulenta* may be present as a low shrub in wetter areas.The ground layer is open to moderately dense and usually dominated by grasses, especially *Astrebla* spp., although forbs may be conspicuous after winter rains or flooding.	details next row				This RE is mapping unit 32c of Neldner 1984, which is mainly Floristic association 33; association 132, which has dominant *Casuarina*, is a minor part but is not included in the NEC

What	Name	Source	Description	Upper	Mid	Ground	Landform	Notes
Floristic association 33 contributes to 11.3.28	*Eucalyptus coolabah* ± *Casuarina cristata* open-woodland.	Neldner 1984	*Eucalyptus coolabah* predominates forming a distinct but open canopy (Ht. 9-15 m; Cover < 5-10%; Density < 180 trees/ha.). Scattered *Casuarina cristata* trees often form part of the canopy. Scattered low trees and tall shrubs may occur, but do not usually form well-defined layers. *Muehlenbeckia florulenta* may be present as a low shrub in wetter areas. The ground cover is open to moderately dense and dominated by grasses, usually *Astrebla* spp. Forbs are conspicuous after winter rains or flooding.	*Eucalyptus coolabah*, *Casuarina cristata, Flindersia maculosa* (near St. George).	*Acacia pendula* (in places), A. *salicina, A. stenophylla*, *A. victoriae*, *Eremophila bignoniifloras, Heterodendrum oleifolium; : Eremophila longifolia, Muehlenbeckia florulenta* (in depressions).	Forbs*:..Atriplex lindleyi, A. muelleri, A. semibaccata, Boerhavia* spp*., Calotis scabiosifolia, Dissocarpus paradoxa, Einadia nutans, Haloragis glauca, Malvastrum americanum, Marsilea drummondii, .. Salsola kali, Sclerolaena birchii, S. calcarata, S. muricata, S. tricuspis, Sida fibulifera, ..* Graminoids*: Aristida ramosa, Astrebla lappacea, A. squarrosa, Bothriochloa decipiens, Chloris truncata, Cyperus bifax, Dichanthium affine, D. sericeum, Enteropogon acicularis, Eragrostis cilianensis, E. setifolia, Eriochloa crebra, E. pseudoacrotricha, Iseilema vaginiflorum, Panicum decompositum, Paspalidium jubiflorum, Sporobolus actinocladus, S. mitchellii, Thellungia advena.*	on plains and swamps, subject to flooding,	This association is extensive on the alluvial floodplains of the Balonne and associated rivers in the south-east.In some areas, *Astrebla lappaaea* and *Sclerolaena muricata* form zones of dominance in the ground layer. This association is the dominant association of mapping unit 32c.

Attachment 14-4: *Fauna species identified from Coolibah woodlands of the Culgoa and Birrie River floodplains (Dick and Andrew 1993)*

		Dependence on trees (legend below)	
Scientific name	**Common name**	**feeding**	**roost/den**
	Mammals		
Capra hircus	Goat		
Chalinolobus gouldii	Gould's Wattled Bat		H
Eptesicus vulturnus	Little Forest Eptesicus		H
Felis cattus	Domestic Cat		
Lepus capensis	Brown Hare		
Macropus giganteus	Eastern Grey Kangaroo		
Macropus rufus	Red Kangaroo		
Nyctophilus geoffroyi	Lesser Long-eared Bat		H
Nyctophilus gouldi	Gould's Long-eared Bat		H
Oryctolagus cuniculus	Rabbit, European Rabbit		
Petaurus spp.	Sugar Glider, Squirrel Glider	T	H
Planigale gilesi	Paucident Planigale		
Planigale tenuirostris	Narrow-nosed Planigale		
Pteropus scapulatus	Little Red Flying-fox	T	F
Scotorepens greyii	Little Broad-nosed Bat		H
Sminthopsis crassicaudata	Fat-tailed Dunnart		
Sus scrofa	Pig		
Trichosurus vulpecula	Common Brushtail Possum	P	H
Vulpes vulpes	Red Fox, Fox		
Wallabia bicolor	Swamp Wallaby		
	Birds		
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	P	
Acanthiza nana	Yellow Thornbill	T	F
Acanthiza uropygialis	Chestnut-rumped Thornbill		H
Accipiter cirrhocephalus	Collared Sparrowhawk	P	F
Aegotheles cristatus	Australian Owlet-nightjar	P	H
Anas gibberifrons	Grey Teal		
Aprosmictus erythropterus	Red-winged Parrot	T	H
Aquila audax	Wedge-tailed Eagle		F
Ardea novaehollandiae	White-faced Heron		F
Artamus cinereus	Black-faced Woodswallow		
Artamus cyanopterus	Dusky Woodswallow	P	F
Artamus leucorynchus	White-breasted Woodswallow	P	F
Artamus minor	Little Woodswallow	P	H/F
Artamus personatus	Masked Woodswallow	P	F
Artamus superciliosus	White-browed Woodswallow	P	F
Barnardius barnardi	Mallee Ringneck	P	H
Cacatua galerita	Sulphur-crested Cockatoo	P	H
Cacatua leadbeateri ?	Pink Cockatoo	P	H
Cacatua roseicapilla	Galah	P	H
Cecropis ariel	Fairy Martin		F
Cecropis nigricans	Tree Martin	P	H
Chenonotta jubata	Maned Duck		
Climacteris affinis	White-browed Treecreeper	P	H
Climacteris picumnus	Brown Treecreeper	T	H
Colluricincla megarhyncha	Little Shrike-thrush	P	F
Coracina novaehollandiae	Black-faced Cuckoo-shrike	T	F
Coracina papuensis	White-bellied Cuckoo-shrike	P	F
Corcorax melanorhamphos	White-winged Chough		F
Corvus bennetti	Little Crow		F
Corvus coronoides	Australian Raven		F
Cracticus nigrogularis	Pied Butcherbird	P	F
Cracticus torquatus	Grey Butcherbird	P	F
Dacelo novaeguineae	Laughing Kookaburra	P	H
Dicaeum hirundinaceum	Mistletoebird	T	F
Dromaius novaehollandiae	Emu		
Entomyzon cyanotis	Blue-faced Honeyeater	T	F
Falco cenchroides ?	Australian kestrel		H,F
Falco hypoleucos	Grey Falcon		F
Falcunculus frontatus	Crested Shrike-tit	T	F

		Dependence on trees (legend below)	
Scientific name	**Common name**	**feeding**	**roost/den**
Geopelia placida	Peaceful Dove		
Grallina cyanoleuca	Magpie-lark		F
Grantiella picta	Painted Honeyeater	T	F
Gymnorhina tibicen	Australian Magpie		F
Halcyon sancta	Sacred Kingfisher	P	H
Haliastur sphenurus	Whistling Kite		F
Hirundo neoxena	Welcome Swallow		F
Lichenostomus penicillatus	White-plumed Honeyeater	T	F
Lichenostomus virescens	Singing Honeyeater		
Malurus lamberti	Variegated Fairy-wren		
Manorina flavigula	Yellow-throated Miner	P	F
Melanodryas cucullata	Hooded Robin		F
Melopsittacus undulatus	Budgerigar		H
Merops ornatus	Rainbow Bee-eater		
Microeca fascinans	Jacky Winter		F
Myiagra inquieta	Restless Flycatcher	P	F
Nycticorax caledonicus	Rufous Night Heron		F
Nymphicus hollandicus	Cockatiel		H
Ocyphaps lophotes	Crested Pigeon		
Oreoica gutturalis	Crested Bellbird		F
Pachycephala rufiventris	Rufous Whistler	T	F
Pardalotus striatus	Striated Pardalote	T	H
Petroica goodenovii	Red-capped Robin		F
Phaps chalcoptera	Common Bronzewing		
Philemon citreogularis	Little Friarbird	T	F
Philemon corniculatus	Noisy Friarbird	T	F
Platycercus adscitus	Pale-headed Rosella	P	H
Plectorhyncha lanceolata	Striped Honeyeater	P	
Podargus strigoides	Tawny Frogmouth	P	F
Pomatostomus temporalis	Grey-crowned Babbler	P	F
Psephotus haematonotus	Red-rumped Parrot		H
Psephotus varius	Mulga Parrot	P	H
Rhipidura leucophrys	Willie Wagtail		F
Smicrornis brevirostris	Weebill	P	F
Struthidea cinerea	Apostlebird		F
	Reptiles		
Cryptoblepharus carnabyi	a skink	A	
Delma inornata	a legless lizard		
Diplodactylus tessellatus	Tesselated Gecko		
Egernia striolata	Tree Skink	A	
Gehyra australis	Northern Dtella or House Gecko	A	
Gehyra variegata	Tree Dtell	A	
Heteronotia binoei	Bynoes Gecko, Prickly Gecko		
Lerista muelleri	a skink		
Lerista punctatovittata	a skink		
Lophognathus gilberti	Gilbert's Dragon	A	
Menetia greyii	a skink		
Morethia boulengeri	a skink		
Oedura marmorata	Marbled Velvet Gecko	A	
Pogona barbata	Bearded Dragon, Jew Lizard	SA	
Proablepharus kinghorni	a skink		
Pseudonaja sp	a Brown Snake		
Unechis spectabilis	a snake		
Varanus gouldii	Gould's Goanna, Sand Monitor		
Varanus varius	Lace Monitor	A	
	Frogs		
Limnodynastes salmini	Salmon-striped Frog		
Limnodynastes tasmaniensis	Spotted Grass Frog, Spotted Mar		
Litoria rubella	Desert Tree Frog	SA	

Legend: H – Roosts or nests in hollows in tree trunks or limbs; F – Roosts or nests in foliage in trees;
T – Totally dependent on trees for foraging; P – Partially dependent on trees for foraging;
A – Species is arboreal in habit; SA – Species is semi-arboreal in habit.

NEC 1.15: *Eucalyptus coolabah* inland woodlands on levees and banks of major drainage lines, billabongs and permanent waterholes

This NEC description is not fully developed because priority was given to completing NECs where there were definite indications of threat. Explanation of the membership of this community, some relevant information, and references to further data are provided; the information indicates that these woodlands are not threatened, although there are processes impacting on them in some areas.

Description and natural distribution

This NEC, as currently defined, includes communities in the Channel Country (CHC) of Queensland, and several bioregions of SA (Table 1, Figure 1). Related communities may occur in southern NT and northwest NSW, but they could not be readily identified in the data.

These communities are dominated by coolibah (*E. coolabah* ssp. *arida* or *E. coolabah* ssp. *coolabah). Eucalyptus camaldulensis* may be present in sandy or gravely channels. A lower tree understorey or tall shrub layer may be present in places, with species such as *Acacia salicina, A. stenophylla, Lysiphyllum gilvum*, and *Melaleuca trichostachya*. Low shrubs frequently occur and in places form a distinct layer; species include A*cacia tetragonophylla, A. victoriae, Eremophila bignoniiflora, Muehlenbeckia florulenta,* and *Senna artemisioides* ssp. *coriacea*. The ground layer is variable being composed of grasses and forbs with either predominating depending on seasonal conditions. Sedges and rushes often occur. See Table 2 for further details.

In Queensland, soils are very deep, brown or grey clays with sand and silt bands common in the profile in Queensland (Neldner 1991). In South Australia the community occurs on alluvial silts and sands as well as clays (Neagle 2003).

All of these woodlands occur on the levees and banks of major drainage lines, around billabongs and permanent waterholes. Further away from the rivers, these communities grade into those on floodplains (NEC 1.17).

Eucalyptus camaldulensis woodlands (with or without *E. coolabah*) also occur in these regions on the levees and banks of major drainage lines. These are included in NEC 1.16. *Eucalyptus coolabah* is found on higher, less frequently flooded areas compared to *E. camaldulensis* (Pettit 2002, cited in Environmental Protection Agency Qld, 2003b).

Riparian woodlands often support a diverse fauna. For example, the Queensland community fringing waterholes and billabongs (RE 5.3.20) is an important drought refuge and waterbird habitat. It is habitat for rare and threatened fauna species including freckled duck *Stictonetta naevosa* (Sattler and Williams 1999). Sattler and Williams (1999) comment that the CHC bioregion is relatively rich in fauna species compared with other arid zone regions of Australia. They comment:

> "This is possibly due to the proximity of large areas of floodplains to an array of other habitat types. The eucalypt woodlands, which are mostly confined to watercourses, have the highest number of species recorded compared to all other broad habitat types, particularly bird, bat and frog species."

Sattler and Williams (1999, pg 5/6) provide further comments about temporal variations in the fauna, and list relevant fauna surveys (their Table 5.5, p 5/26) which could provide more detail. Morton *et al*'s (1995) analysis of refugia for biological diversity in arid and semi-arid Australia also refers to a number of the wetlands associated with the rivers and creeks of these IBRA regions, and gives important details of the refuge value, listed and other important species, key threats, and further references. For example, their refuge reference numbers SA 9, 10 and 11 (their pages 98 and 99) are relevant for South Australia. They also nominate the Queensland Channel Country as an extremely significant refuge (their pg 122). These records could add substantial information to this section.

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of the components of this NEC are listed under the EPBC Act. One of the three Queensland communities is listed as "of concern" (EPA biodiversity status) . In SA, the community is regarded as "Of concern" in their informal and unpublished lists (Neagle 2003).

Decline in geographic distribution

There are few data regarding decline in distribution of the communities included in this NEC. Many of these communities are not precisely mapped. The three Queensland regional ecosystems have >30% of their pre-European extent remaining.

Threats to the national ecological community

In common with most arid / semi-arid riparian woodlands, these are modified both floristically and structurally by heavy trampling and grazing (Table 2). Parts of the SA occurrences are also impacted by tourists.

At a broader level, the data collected for the Terrestrial Biodiversity Assessment (Sattler and Creighton 2002) indicate threats that have been recorded for any ecosystem on a sub-regional basis (Table 3). These can be used to get a broad picture of the processes within the sub-regions, but will not all be applicable to these woodlands and are biased by survey effort. Nevertheless, they add information to that already available. They show that grazing pressure, changed fire regimes and feral animals are the prevalent threats for the subregions inhabited by this NEC.

Loss or decline of functionally important species

Data may exist but has not been identified

Reduction in ecological community integrity

There is a decline in community integrity, largely as a result of grazing – see threats.

Rate of detrimental change

Data may exist but has not been identified

Summary and recommendation regarding category of threat under the EPBC Act

Although some areas are affected by extensive and long-term impacts from grazing, these communities do not appear to be eligible for listing.

Outstanding issues

- It is likely that other sub-communities exist that belong to this NEC (e.g., in NT). These need to be identified and added to the NEC.
- The current sub-division of the riparian woodlands into the NECs defined in this report is not without some difficulties (see introduction to riparian woodlands). Other categorisations could also be justified. Adjustments may be suggested by state experts.
- Riparian woodlands are usually rich in fauna and faunal records need to be added to the description of this NEC.

Table 1: Details of the sub-communities for this NEC

Sub-community / Regional Ecosystem name	Unit id or source	Further data sources	State	IBRA region (subregions)	Conservation status (= EPA status for Qld)
Eucalyptus coolabah ± *E. camaldulensis* open woodland fringing billabongs and permanent waterholes.	RE 5.3.20	Neldner (1991), 51a; Boyland (1984), 32	QLD	CHC (some or all of: CHC 2,4,5,7,8,9, 11, SSD5) (=Province 2,4)	Of concern
Eucalyptus coolabah ± *E. camaldulensis* ± *Lysiphyllum gilvum* open woodland on major drainage lines.	RE 5.3.5	Neldner (1991), 2a	QLD	CHC (some or all of: CHC 2,4,3,5,7,8,9, 11, SSD5) (=Province 2,3,4)	No concern at present
Eucalyptus coolabah low open woodland with *Muehlenbeckia florulenta* on braided drainage lines.	RE 5.3.8	Neldner (1991), 18; Boyland (1984), 8	QLD	CHC (some or all of: CHC 2,4,3,5,7,8,9, 11, SSD5) (=Province 2,3,4)	No concern at present
Eucalyptus coolabah ssp. *arida* (Coolibah) woodland on levees and channel banks of regularly inundated floodplains	Neagle (2003)	Neagle (2003), see following tables	SA	GAW, STP, FIN, SSD, CHC	Of concern

Table 2: Reservation, threat information

Unit ID or source	% of pre-European remaining	Extent reserved	Protected areas	Ecological values	Threatening processes
RE 5.3.20	>30%	low	Astrebla Downs NP, Diamantina NP, Welford NP.	Drought refuge and waterbird habitat. Habitat for rare and threatened fauna species including freckled duck *Stictonetta naevosa.*	Highly modified floristic and structural composition due to heavy trampling and grazing by domestic stock and feral animals such as pigs. Localised areas of soil compaction andbare ground are associated with domestic stock congregation points.
RE 5.3.5	>30%	low	Bladensburg NP, Diamantina NP, Goneaway NP, Lochern NP.		Heavily impacted by total grazing pressure. Habitat for feral pigs.
RE 5.3.8	>30%	low	Astrebla Downs NP, Diamantina NP, Lochern NP.		Habitat for feral cats and pigs
Neagle (2003)		Few conserved areas cf widespread occurrence of the community	Witjira National Park (Stony Plains Bioregion) Innamincka Regional Reserve (Channel Country Bioregion). No conserved occurrences in either the Gawler or Finke Bioregions.		While the overstoreys are usually intact the understoreys are generally heavily modified by more than a century of high total grazing pressure (stock and feral animals such as rabbits) and, less extensively, by tourism (Department for Environment and Heritage SA 2001).

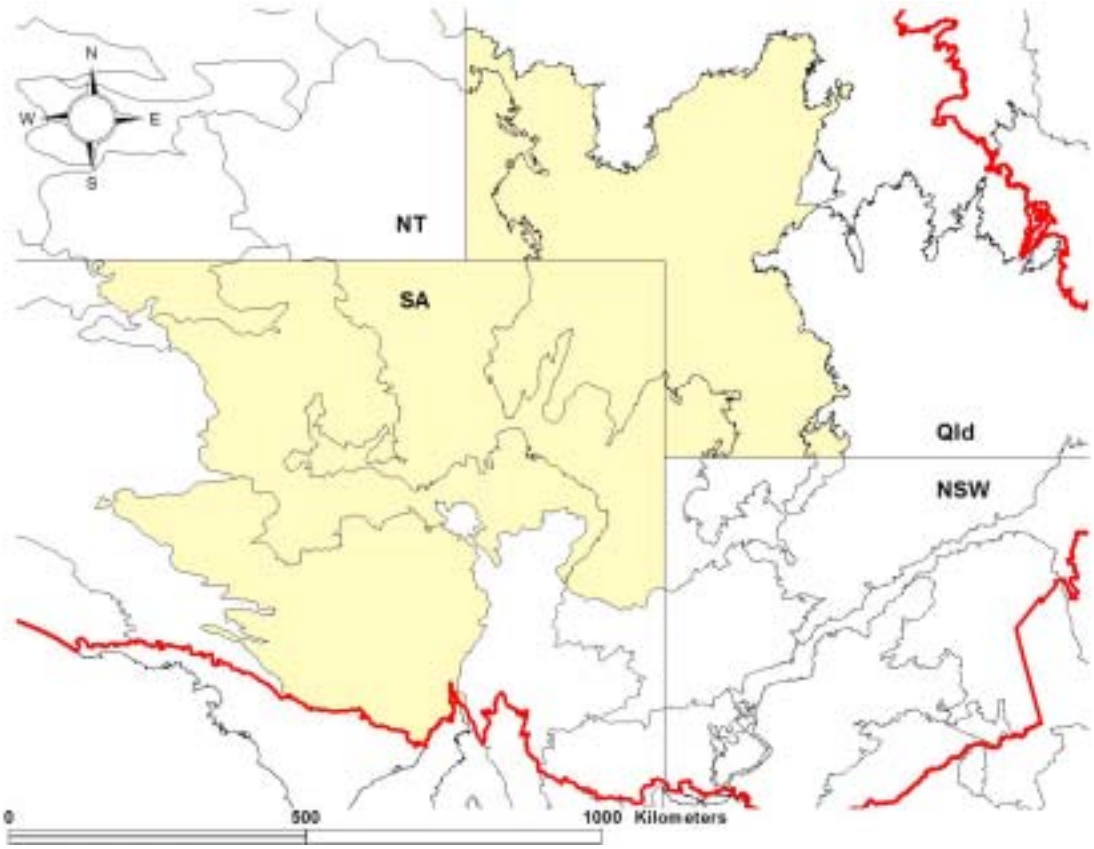

Figure 1: Bioregions in which the identified sub-communities occur *(shaded buff). The arid / semi-arid zone occurs within the red boundary. The black lines outline the IBRA regions.*

Table 3: Summary of threats to any ecosystems within the subregions (from data developed for Sattler and Williams 2002). " y" indicates that the threat has been recorded as present. Note that no threats are recorded, yet, for subregions FIN1, FIN2, FIN3, FIN4, GAW3, GAW4, SSD1, and SSD3.

	CHC1	CHC2	CHC3	CHC4	CHC5	CHC7	CHC8	CHC9	CHC11	GAW1	GAW2	GAW5	SSD2	SSD4	SSD5	SSD7	STP1	STP2	STP3	STP4	STP5
Broad scale vegetation clearing																					
Changed fire regimes												y			y		y	y	y	y	y
Changed hydrology - other														y			y	y	y	y	
Changed hydrology - salinity																					
Exotic weeds		y		y						y	y										
Feral animals		y						y				y			y		y	y		y	
Firewood collection																					
Grazing pressure	y	y	y	y	y	y	y	y	y	y	y		y	y	y	y	y	y	y	y	y
Increasing fragmentation												y					y	y			
Other												y		y	y		y	y	y	y	y
Pathogens																					
Pollution																					

Attachment 15-1: Details of sub-communities. Note that these records are largely unedited versions of the source data.

Unit	Source	Description	Frequent species	Notes
5.3.20 & 5.3.5	FA53 in Neldner (1991))	*Eucalyptus coolabah* usually predominates forming a distinct but discontinuous upper canopy layer (Ht. 7-14 m; Cover 5-35%; Density 100-400 trees/ha.). *E. camaldulensis* is conspicuous in sandy or gravely channels. A lower tree understorey or tall shrub layer may be present in places. Low shrubs frequently occur and in places form a distinct layer. The ground layer is variable being composed of grasses and forbs with either predominating depending on seasonal conditions.	Upper: *Eucalyptus camaldulensis, E. coolabah, Acacia cambagei* (in places), *A. salicina, A. stenophylla, Corymbia terminalis, Lysiphyllum gilvum, Melaleuca trichostachya* (in major channels). Mid: *Acacia tetragonophylla, A. victoriae, Capparis lasiantha, Chenopodium auricomum, Eremophila bignoniiflora, E. mitchellii, E. polyclada, Muehlenbeckia florulenta, Senna artemisioides* ssp*. coriacea.* Forbs: *Abutilon otocarpum, A. oxycarpum, Aeschynomene indica, Alternanthera nodiflora, Atriplex muelleri, A. spongiosa, A. vesicaria, Boerhavia* spp*., Calotis hispidula, C. inermis, Centipeda thespidioides, Cullen cinereum, C. patens, Goodenia fascicularis, Indigofera linnaei, Maireana villosa, Malvastrum americanum, Marsilea drummondii, M. hirsuta, Minuria integerrima, Neptunia dimorphantha, Portulaca oleracea, Salsola kali, Sclerolaena muricata, Sida* spp*., Solanum esuriale, Sphaeranthus indicus, Trianthema portulacastrum, Trichodesma zeylanicum.* Grasses: *Aristida contorta, A. jerichoensis, Astrebla lappacea, A. squarrosa, Bothriochloa ewartiana, Chloris pectinata, Chrysopogon fallax, Cyperus bifax, C. dactylotes, C. difformis, C. victoriensis, Dactyloctenium radulans, Dichanthium sericeum* ssp*. humilius, D. sericeum* ssp*. sericeum, D. sericeum* ssp*. polystachyum, Digitaria brownii, D. coenicola, Eleocharis pallens, Eragrostis cilianensis, E. dielsii, E. elongata, E. tenellula, Eriochloa pseudoacrotricha, Eulalia aurea, Iseilema membranaceum, Leptochloa digitata, Panicum laevinode, Paspalidium jubiflorum, Sporobolus actinocladus, S. mitchellii, Themeda triandra, Tripogon loliiformis*.	Widespread throughout the region on levees and banks of major drainage channels on braided alluvial plains. Soils very deep, brown or grey clays with sand and silt bands common in profile. Floristically and structurally varies considerably. Asteraceae prevalent following favourable seasons. Forms mapping unit 2a (=RE 5.3.5). Lines the Georgina River, with *Acacia georginae* a frequent tall shrub, in this situation mapped as unit 2c. Also surrounds permanent waterholes in major rivers, in these situations mapped as unit 51a (=RE 5.3.20). May grade into Floristic Association 53 (RE 5.3.2), which is dominated by *E. camaldulensis*
5.3.8	FA 65 from Neldner (1991)	*Eucalyptus coolabah* predominates forming a distinct but discontinuous canopy (Ht. 6-12 m; Cover 1-10%; Density 40-200 trees/ha.). Other scattered low trees or tall shrubs frequently occur. Along drainage channels, *Muehlenbeckia florulenta* forms a distinct and semi-continuous, low shrub layer. The ground cover is variable composed mainly of ephemeral forbs but grasses do occur. Structural formation range: Low open-woodland to woodland.	Upper: *Eucalyptus coolabah, Acacia stenophylla, Eremophila bignoniiflora, Lysiphyllum gilvum.* Mid: *Acacia farnesiana, A. victoriae, Chenopodium auricomum, Muehlenbeckia florulenta* (very dense in places). Forbs: *Aeschynomene indica, Alternanthera nodiflora, Boerhavia* spp*., Calotis hispidula, Centipeda thespidioides, Chamaesyce drummondii, Commelina ensifolia, Cullen cinereum, Eryngium supinum, Goodenia fascicularis, Haloragis glauca, Ipomoea diamantinensis, Leiocarpa brevicompta, Malvastrum americanum, Marsilea drummondii, Polymeria longifolia, Portulaca oleracea, Pycnosorus* spp*., Salsola kali, Sclerolaena muricata, Senecio lautus, Stemodia glabella, Streptoglossa adscendens, Trigonella suavissima, Wahlenbergia gracilis, Xanthium occidentale.* Graminoids: *Astrebla lappacea, A. pectinata, Brachyachne convergens, Cyperus betchei, C. bifax, C. victoriensis, Chloris pectinata, Dactyloctenium radulans, Dichanthium sericeum, Eragrostis setifolia, E. tenellula, Iseilema membranaceum, I. vaginiflorum, Leptochloa digitata, Panicum laevinode, Sporobolus actinocladus, S. mitchellii.*	Widespread in south-west, dominating braided channels on alluvial plains and major drainage channels. Soils very deep, grey and brown cracking clays. Surface silt and sand bands common in soil profile. *Muehlenbeckia florulenta* forms dense stands. Flooding frequency high. Ground flora dominated by ephemeral forbs. Apiaceae, Brassicaceae, Convolvulaceae, Fabaceae, Goodeniaceae and Malvaceae species occur infrequently but are seasonally prominent. Forms mapping unit 18.

Unit	Source	Description	Frequent species	Notes
Eucalyptus coolabah ssp. *arida* (Coolibah) Woodland on levees and channel banks of regularly inundated floodplains	Neagle (2003)	*Eucalyptus coolabah* ssp. *arida* (Coolibah) Woodland on levees and channel banks of regularly inundated floodplains is one of the most characteristic ecosystem of the riverine and floodplain land systems of the rangelands of South Australia. These areas tend to retain water for long periods between floods, either as standing water in waterholes or as a subsurface source in sandy channel beds. It occurs on alluvial silts and sands as well as clays, and may vary in structure from an open forest with a dense understorey of shrubs to two metres in height, to a low open woodland with scattered smaller shrubs, grading into shrubland. *Eucalyptus camaldulensis* var. *obtusa* (Northern River Red Gum) may occur as a codominant and there is, on occasions, a tall shrub layer of *Acacia salicina* (Willow Wattle) and *A. stenophylla* (River Cooba). A dense shrub layer of *Muehlenbeckia florulenta* (Lignum) is frequently found where the ecosystem occurs along deeper channels. Groundcover is comprised of ephemerals. This ecosystem occurs extensively in association with the major river channels across the far north of the state, but tends to be more sparsely wooded on minor channels at the southern limit of its range (southern Stony Plains and northern Gawler Bioregion). *Distribution in SA Rangelands Bioregions:* • In the Gawler Bioregion this ecosystem is associated with watercourses of the Arcoona Plateau and those that drain to the south and west from the Stuart Range • In the Stony Plains Bioregion this ecosystem is found along clay drainage channels, floodout plains and temporary swamps of the western Lake Eyre Basin • In the SA portion of the Finke Bioregion this ecosystem is found in association with the main watercourses, particularly the Alberga River and Hamilton Creek. • SSD: Occurrences of this ecosystem can be found in association with all the major watercourses in the SA portion of this bioregion, namely the Macumba River and the Warburton, Cooper and Strzelecki Creeks • This ecosystem occurs extensively in association with the major river channels of the Channel Country Bioregion and is the dominant woodland community of the region.		

NEC 1.16: *Eucalyptus camaldulensis* inland woodlands on levees and banks of major drainage lines, billabongs and permanent waterholes

This NEC description is not fully developed because priority was given to completing NECs where there were definite indications of threat. Explanation of the membership of this community, some relevant information, and references to further data are provided; the information indicates that these woodlands are not threatened, although there are processes impacting on them in some areas.

Description and natural distribution

This NEC is more an alliance than a community – it includes all riparian woodlands that are:

- dominated by *E. camaldulensis*; and
- on levees and banks of major drainage lines, billabongs or permanent waterholes; and
- in central or eastern parts of the arid and semi-arid areas of Australia.

As such, it includes a range of climates and soil types, and communities at either end of this range may be quite dissimilar from each other.

It does not include:

- any WA woodlands. These are treated in NECs 1.22 and 1.23.
- riparian woodlands of the more northern areas. These (of the Mitchell Grass Downs and Mount Isa Inlier bioregions) are treated in NEC 1.19.
- *E. camaldulensis* woodlands of the Flinders and Olary Ranges. These face different threats and are on generally more intermittent drainage lines. They are treated separately in NEC 1.18.
- *E. camaldulensis* forests on the major rivers of south-east Australia (close to or in the arid and semi-arid areas, these are primarily on the Murray, Darling and the Murrumbidgee Rivers). These are related to temperate communities which are outside the scope of this report (see Introduction to the riparian communities).
- riparian woodlands in these areas that are dominated by *E. coolabah* (see NECs 1.14 and 1.15).

The sub-communities that appear to fit within this NEC are listed in Table 1. There are likely to be other occurrences which could be added when identified. Currently, NSW communities of the DRP (including those of Dick (1990)) are excluded, but these could be included, given further investigation. The suggested alternative is to consider them with the more easterly DRP occurrences (east of the Western Division boundary), within the temperate zone (see Introduction to the riparian NECs).

The *E. camaldulensis* communities of this NEC line the channels of major rivers and creeks in inland Australia. *Eucalyptus coolabah* – dominated woodlands occur in the same regions and in similar parts of the landscape, but tend to be found on higher or less frequently flooded areas compared to *E. camaldulensis* (Pettit 2002, cited in Environmental Protection Agency Qld (2003b); Figure 1 in NEC 1.14). The *E. camaldulensis* woodlands often include other tree or tall shrub species such as *E. coolabah, Melaleuca trichostachya, Atalaya hemiglauca, Acacia aneura* and *A. cambagei.* Shrubs are usually sparse in the streamlines, but may occur in dense stands above the river banks. Species include *Acacia farnesiana, A tetragonophylla, Parkinsonia aculeata, Eremophila latrobei* and *Muehlenbeckia florulenta.* The ground layer is sparse to dense and dominated by tussock grasses, including *Bothriochloa* spp., *Cenchrus pennisetiformis, Dichanthium fecundum, Eragrostis* spp, *Themeda* spp., *Atriplex* spp., and *Triodia* spp. in the NT. Sedges are frequent on the channel floors and banks. Disturbed sandy areas are often invaded by introduced weeds. Chenopods dominate the understorey in poorly drained areas. The woodlands are lower and more open on smaller channels (eg in NT); there, the shrub layer is generally sparse or absent, although after periods of heavy rains a dense understorey of *E. camaldulensis* regeneration may develop. These details are from Neldner (1984, 1991), Wilson (1990) and Neagle (2003). More details on the floristics and structure of the

component sub-communities are included in Attachment 16-1, and the South Australian biological surveys provide further detail on regional communities.

The structure of these communities range from open forest to low open woodland. Soils are variable, and include deep, alluvial, grey and brown cracking clays with or without some texture contrast soils in the Mulga Lands of Queensland; very deep, coarse sands, silty clays, sandy clay loams and gravely loams in the CHC, and alluvial sandy soils in the NT.

Table 1: Sub-communities of this NEC[1]

Sub-community / Regional Ecosystem name	Unit ID or source	State	IBRA region (subregion)	Conservation status (=EPA for Qld)
River red gum communities	Millthorpe	NSW	CHC, ML, SSD, BHC	
Eucalyptus camaldulensis woodland	NSW_IDs 21900003 - 5 (all P&N11)	NSW	ML	
Eucalyptus camaldulensis ± *Melaleuca* spp. woodland on levees and banks of major rivers.	RE 5.3.1	QLD	CHC (most of 2, all of 4)	No concern at present
Eucalyptus camaldulensis ± *E. coolabah* open woodland on levees and banks of drainage lines.	RE 5.3.2	QLD	CHC (some or all of: CHC 2,4,3,5,7,8,9, 11, SSD5)	No concern at present
Eucalyptus camaldulensis ± *Atalaya hemiglauca* ± *Acacia georginae* ± *A. cyperophylla* woodland on drainage lines within ranges.	RE 5.3.3	QLD	CHC (1)	No concern at present
Eucalyptus camaldulensis ± *Atalaya hemiglauca* ± *Acacia cambagei* ± *A. cyperophylla* woodland on drainage lines within ranges.	RE 5.3.4	QLD	CHC (some or all of: CHC 2, 4,3,5,7,8,9, 11, SSD5)	No concern at present
Eucalyptus camaldulensis ± *E. coolabah* ± *Acacia cambagei* woodland on major drainage lines/rivers.	RE 6.3.2 (part)	QLD	MUL (9,10)	Of concern
Eucalyptus camaldulensis ± *E. coolabah* ± *E. populnea*, *Acacia stenophylla* woodland on alluvium.	RE 6.3.3	QLD	MUL (1,2,4,5,6,7,11,8 ,9,10)	Of concern
Eucalyptus camaldulensis (River Red Gum) Woodland on levees and channel banks of regularly inundated floodplains	Neagle (2003)	SA	STP, FIN, CHC	Of concern
E. camaldulensis (River Red Gum) open woodland with *A. murrayana, A. estrophiolata, Atalaya hemiglauca* tall sparse shrubland and *Themeda triandra* sparse tussock grassland understorey	DVT117 source: The Land Resources of Watarrka NP, in Brocklehurst and Gibbons 2003.	NT	CHC1	
E. camuldulensis (River Red Gum) open woodland with a sparse tussock grassland understorey	DVT80 source: The Land Resources of Watarrka NP, in Brocklehurst and Gibbons (2003).	NT	CHC1	
E. camaldulensis (River Red Gum) open woodland with a *Macrozamia macdonnellii, Acacia macdonnellensis* sparse shrubland/open hummock grassland understorey	DVTs 44 & 73. source: The Land Resources of Watarrka NP, in Brocklehurst and Gibbons (2003).	NT	MAC2, GSD2	
E. camaldulensis (River Red Gum) open woodland	MU27a & DVT 111	NT	? Not mapped in NVIS	

1 There are numerous other records of *E. camaldulensis* woodlands – e.g., Westbrooke *et al* (2003). These could be accessed for a more complete record.

Riparian woodlands often support a diverse fauna. Sattler and Williams (1999) comment that the CHC bioregion is relatively rich in fauna species compared with other arid zone regions of Australia. Sattler and Williams (1999, pg 5/6) provide further comments about temporal variations in the fauna, and list

relevant fauna surveys (their Table 5.5, p 5/26) which could provide more detail. Morton *et al*'s (1995) analysis of refugia for biological diversity in arid and semi-arid Australia also refers to a number of the wetlands associated with the rivers and creeks of these IBRA regions, and gives important details of the refuge value, listed and other important species, key threats, and further references. For example, their refuge reference numbers SA 9, 10 and 11 (their pages 98 and 99) are relevant for South Australia. They also nominate the Queensland Channel Country as an extremely significant refuge (their pg 122). These records could add substantial information to this section.

There are also relevant references from NSW which could add data – see Smith *et al* (1995) on birds, and Lunney *et al* (2000). Part of Smith et al's (1995) data are presented in Attachment 16-2 – these emphasise the dependence of birds on the riparian woodlands, and detail the threatening processes relevant to the birds of particular conservation concern. Scott (1997) presents some data relevant to the NSW red gum woodlands:

- Many species of waterbirds, such as cormorants, herons and egrets, build stick nests next to lakes or wetlands. Often these nests are built in branches that overhang open water. The most common species of tree used is the river red gum. Many of these birds will only nest in live river red gums although a few, such as the Darter, Great Cormorant, and Pacific Heron also use dead trees. The floodplain forests along the Murray and Murrumbidgee rivers provide extensive and valuable nesting sites in river red gums (note, though, that these forests are excluded from this NEC).
- Trees hollows: many ducks (but not all) nest in hollows of trees near water. The more common tree species include coolibah, black box and river red gum, although river red gums generally provide the best hollows. Following flood producing rains on the Paroo River in January 1984, Maher (1991) reported that every accessible river red gum hole had either Grey Teal, Pacific Black Duck or Maned Duck laying or incubating within it. Although many species of waterfowl use hollows, only the Maned Duck is confined to hollows for nesting.

Natural distribution

Known natural distribution (including bioregions, conservation areas)

The inhabited IBRA regions are shown in Table 1 and Figure 1. Mapping is not available for the more westerly Qld REs (see Figure 3, Introduction), for the NT communities (not available from NVIS, but see Wilson et al. (1990)), or for the SA community.

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of the communities are listed under the EPBC Act. The two Qld communities in the Mulga Lands are "of concern" (EPA Biodiversity status) (Table 2). The SA community is "of concern" in their informal listing (Neagle 2003). NT does not list threatened ecological communities.

Decline in geographic distribution

Mapping is not available to assess areas, but riparian communities are not usually threatened by decline in geographic distribution.

Threats to the national ecological community

See Table 2. The Queensland communities in the Mulga Lands are rated "Of concern" (EPA Biodiversity status), whereas the more westerly occurrences in the CHC and SSD are currently not of concern. Sattler and Williams (1999) comment that

> "the Mulga Lands is widely recognised as the most extensively degraded landscape in Queensland… more than two-thirds of Mulga Lands properties west of the Warrego River showed signs of serious land degradation in the form of soil erosion, increase in abundance of unpalatable shrubs and decrease in abundance of palatable perennial grasses. This degradation occurs across most land types but is particularly severe within mulga and alluvial land zones. The causes of the degradation are complex… Artificial watering points

> supplied by the Great Artesian Basin, and the ability of the ubiquitous mulga *Acacia aneura* tree to provide fodder, allow higher (sheep) stocking rates than the semi-arid climate and poor soils would normally support… (leads to) self-reinforcing cycle of reduced perennial grass cover, decreased fire frequency, increased woody shrub cover and increased soil erosion".

They identify a link between increased land degradation and decreased economic viability of pastoral enterprises that perpetuates the degradation cycle.

The bird data in Attachment 16-2 also provide insight into threatening processes. For instance, over the whole Western Division, common threats to eucalypt woodlands and forests that line major creeks and rivers, and to the birds in them, include clearing of river red gum woodlands; poor river red gum regeneration due to overgrazing and changed flooding patterns; decline of remnant trees in previously cleared areas; habitat degradation from timber harvesting and overgrazing; and predation by foxes and feral cats. Changes in flooding patterns are always a potential threat for riparian systems, where tree germination and establishment is dependent on flooding regimes. It is a threat in rivers that are used for irrigation or that are otherwise regulated; this tends to be more prevalent in communities of the Murray Darling Basin and neighbouring regions, but less so for the more inland communities.

The terrestrial biodiversity assessment (Sattler and Creighton 2002) identified few threats in the NT, but since then the reports of Woinarski (2002) add some information (Table 2; Attachment 16-3). These identify grazing, feral animals, exotic weeds and changed fire regimes as threatening processes in the NT.

Loss or decline of functionally important species

Data may exist but has not been identified

Reduction in ecological community integrity

The indications are that overgrazing is one of the major threats to these communities; this has modified the communities both structurally and floristically.

Rate of detrimental change

It appears that the threatening processes have been in place over the long term. Data on trends may exist but have not been identified.

Summary and recommendation regarding category of threat under the EPBC Act

Despite sometimes extensive and long-term impacts from grazing, these communities do not appear to be eligible for listing.

Outstanding issues

It is likely that other sub-communities exist that belong to this NEC. These need to be identified and added to the NEC. Riparian woodlands are usually rich in fauna and faunal records need to be added to the description of this NEC.

The current sub-division of the riparian woodlands into the NECs defined in this consultancy is not without some difficulties. Other categorisations could also be justified. Adjustments may be suggested by state experts. In particular, issues about whether these are all properly considered as communities of "major drainage lines" is open to question, as is the separation of the SA communities. Parts of the NSW communities probably fit better with NEC 1.18, but there was insufficient time to contact experts to make suitable separations.

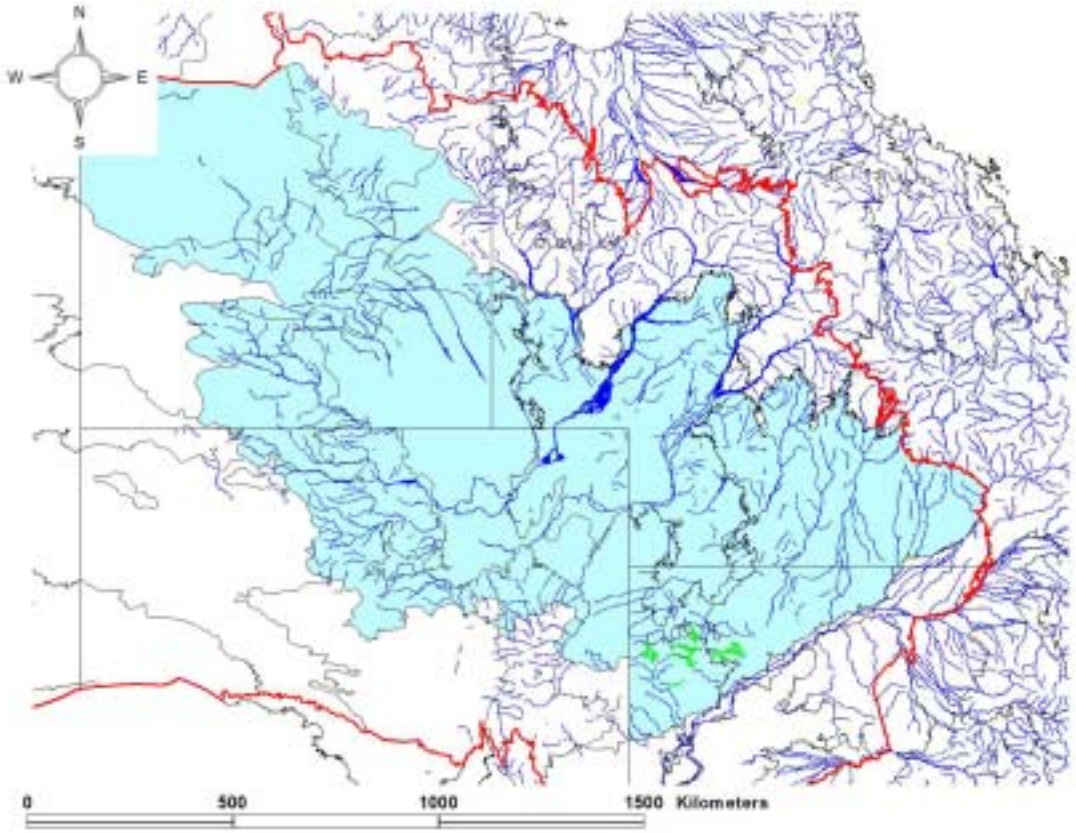

Figure 1: IBRA regions in which this NEC occurs *(aqua colour). The arid / semi-arid zone is within the red boundary; black lines outline IBRA regions. Rivers are shown in blue, and will indicate likely areas where the communities are. The NSW communities are mapped in green.*

Table 2: Sub-communities: percent remaining, reservation and threatening processes. *From EPA (2003b), Neagle (2003 and references indicated.)*

Unit ID or source	% of pre-European remaining	Extent reserved	Protected areas	Threatening processes
Millthorpe				
NSW_IDs 21900003 - 5 (all P&N11)				In the Wn Division as a whole, threats include clearing, changed water regimes, overgrazing (Smith et al 1995). The first two are more prevalent in the Riverina and DRP regions, which have been excluded from this NEC
RE 5.3.1	>30%	Low	Bladensburg NP, Diamantina NP, Welford NP.	Heavily impacted by total grazing pressure. Habitat for feral pigs.
RE 5.3.2	>30%	Low	Bladensburg NP, Diamantina NP, Welford NP.	Heavily impacted by total grazing pressure. Habitat for feral pigs.
RE 5.3.3	>30%	None		
RE 5.3.4	>30%	Low	Diamantina NP, Goneaway NP, Welford NP.	
RE 6.3.2 (part)	>30%	low (<1%)	Welford NP, Currawinya NP	Highly modified structural and floristic composition as a result of high total grazing pressure. Wind and water erosion has caused scalding and erosion.
RE 6.3.3	>30%	low (3.3%)	Welford NP, Currawinya NP	Highly modified structural and floristic composition as a result of high total grazing pressure.
Neagle 2003	no data	no data	Witjira National Park; Innamincka Regional Reserve (a NPWSA reserve, but also a working cattle station and therefore subject to cattle grazing)	While the overstoreys are usually intact the understoreys are generally heavily modified by heavy long term total grazing pressure and, to a lesser extent, tourism
MU27a & DVT 111	no data	The biodiversity summaries of Woinarski (2002) (Attachment 16-3) suggest generally inadequate reservation. Details of communities in National Parks and reserves have not been collected.		Threats not identified by Sattler and Creighton (2002), but Woinarski (2002) makes a number of pertinent comments (Attachment 16-3). These identify grazing, feral animals, exotic weeds and changed fire regimes as threatening processes

Attachment 16-1: Details of species composition and structure of sub-communities.

Note that these records are largely unedited versions of the source data.

Unit	Source	Description	Frequent species	Notes
5.3.1	Neldner (1991) FA 60	*Eucalyptus camaldulensis* dominates the streamlines forming a fringing woodland (10-18 m high). *E. coolabah* is frequently present on the top of the river banks. *Melaleuca argentea* is present in the bed of major channels in the north [note: out of this NEC], while *M. trichostachya* occupies this habitat further south. *M. bracteata* occurs along minor channels in the north [note: out of this NEC], while *Lophostemon grandiflorus* ssp. *riparius* is occasionally present on the banks of major northern rivers [these out of this NEC]. Shrubs are usually sparse in the streamlines, but *Acacia farnesiana* and *Parkinsonia aculeata* may occur in dense stands above the river banks. The ground layer is dense and dominated by tussock grasses, with *Bothriochloa* spp., *Cenchrus pennisetiformis, Dichanthium fecundum* and *Themeda* spp. usually dominating. Sedges are frequent on the channel floors and banks. Tree/tall shrub layer: Ht. 3-18 m; Cover 10-30%; Density 100-250 trees/ha.	Upper*: Eucalyptus camaldulensis, Atalaya hemiglauca, Eucalyptus coolabah, Lophostemon grandiflorus* ssp*. riparius, Melaleuca argentea, M. bracteata, M. trichostachya.* Mid*: Acacia farnesiana, A. hemsleyi* (in north), *A. holosericea* (in north), *A. salicina* (in places), *Amyema sanguineum* var*. sanguineum, Gossypium australe, Parkinsonia aculeata.* Forbs*: Acanthospermum hispidum, Achyranthes aspera, Aeschynomene indica, Argemone ochroleuca* ssp*. ochroleuca, Bonamia media* var*. media, Chamaesyce mitchelliana, Cleome viscosa, Crotalaria novae-hollandiae, Cullen patens, Evolvulus alsinoides, Heliotropium ovalifolium, Hibiscus meraukensis, Ipomoea muelleri, Malvastrum americanum, Mukia maderaspatana, Phyllanthus maderaspatensis* var*. angustifolius, Sida rohlenae, Tephrosia brachyodon, Trichodesma zeylanicum, Wahlenbergia gracilis, Waltheria indica, Xanthium occidentale.* Graminoids*: Aristida biglandulosa, Bothriochloa decipiens* var*. cloncurrensis, B. ewartiana, Brachiaria subquadripara, Cenchrus pennisetiformis, Chrysopogon fallax, Cyperus conicus, C. dactylotes, C. victoriensis, Dichanthium fecundum, Enteropogon acicularis, E. ramosus, Eragrostis elongata, E. speciosa, Eriochloa procera, Eulalia aurea, Fimbristylis littoralis, Iseilema vaginiflorum, Juncus continuus, Leptochloa digitata, Panicum decompositum, Paspalidium jubiflorum* (on clays), *Themeda avenacea, T. triandra.*	Open-forest to open-woodland. Widespread along sandy or gravelly drainage lines, channels and inter-channel areas of north-western river systems. Soils very deep, coarse sands, silty clays, sandy clay loams and gravelly loams. Tree height and the width of this association reduced on minor streamlines draining Mount Isa highlands. Exotic weed species occur in disturbed sandy areas. Mapped as unit 1a, grades into unit 2a in places.

Unit	Source	Description	Frequent species	Notes
5.3.2	Neldner (1991) FA 59	*Eucalyptus camaldulensis* predominates in the gravelly and sandy major channels, while *E. coolabah* usually predominates on the clayey plains and banks adjacent to the major channels. A distinct but discontinuous, canopy is formed, with both *E. camaldulensis* and *E. coolabah* sometimes being present. Scattered shrubs may occur, but rarely form a well defined layer. The ground layer is open and dominated by perennial grasses. Scattered forbs are present, and disturbed sandy areas are often invaded by introduced weeds. Tree/tall shrub layer: Ht. 8-13 m; Cover <10-50%; Density 25-225 trees/ha.	Upper*: Eucalyptus camaldulensis, E. coolabah, Acacia holosericea, A. salicina, A. stenophylla.* Mid*: Acacia farnesiana, A. tetragonophylla, Capparis lasiantha, Eremophila bignoniiflora* Forbs*: Achyranthes aspera, Alternanthera nodiflora, Argemone ochroleuca* ssp*. ochroleuca, Centipeda thespidioides, Chamaesyce drummondii, Cleome viscosa, Cullen cinereum, Heliotropium ovalifolium, Indigofera colutea, Ipomoea muelleri, Malvastrum americanum, Phyllanthus maderaspatensis* var*. angustifolius, Salsola kali, Sclerolaena anisacanthoides, Trichodesma zeylanicum, Xanthium occidentale.* Graminoids*: Aristida holathera* var*. holathera* (sandy areas), *A. latifolia, Arundinella nepalensis, Bothriochloa decipiens* var*. cloncurrensis, B. ewartiana, Cenchrus pennisetiformis, Chrysopogon fallax, Cyperus conicus, C. dactylotes, C. victoriensis, Dichanthium fecundum, Echinochloa colona, Enteropogon acicularis, Fimbristylis littoralis, Iseilema vaginiflorum, Leptochloa digitata, Panicum decompositum, Paspalidium jubiflorum, Themeda avenacea, T. triandra.*	Open-forest to open-woodland. Widespread along sandy or gravelly drainage lines, channels and inter-channel flats of northern river systems. Also occurs as low woodland in drainage lines of some residuals. Soils variable and include deep, loose coarse sands, silty clays, sandy clay loams and very gravelly loams. Mapped as unit 1b, but may grade into unit 2a.
5.3.3 & 5.3.4	Neldner (1991) FA 58	*Eucalyptus camaldulensis* usually predominates, but a number of *Acacia* species may be present and form part of the open canopy. Scattered low shrubs are usually present, but do not form a distinct layer. The ground layer is sparse to open, and dominated by tussock grasses. Tree/tall shrub layer: Ht. 6-12 m; Cover 8-20%; Density 50-200 trees/ha.	Upper*: Eucalyptus camaldulensis, Acacia aneura, A. cambagei, A. cyperophylla* var*. cyperophylla, A. ensifolia* (in places), *A. shirleyi, Eucalyptus coolabah* (in places), *E. normantonensis* (in places), *Grevillea striata, Santalum lanceolatum.* Mid*: Acacia ligulata, A. cowleana, A. farnesiana, A. tetragonophylla, Capparis lasiantha, Carissa lanceolata, Eremophila latrobei, Gossypium sturtianum, Petalostylis cassioides, Senna artemisioides* ssp*. oligophylla* Forbs*: Einadia nutans* ssp*. linifolia, Scaevola* sp*.* Graminoids*: Bothriochloa ewartiana, Chrysopogon fallax, Enteropogon acicularis, Eragrostis elongata, E. setifolia, Eriachne mucronata, Eulalia aurea, Themeda triandra, Triodia longiceps* (in places).	Limited in extent. Restricted to streamlines and channels draining dissected residuals and plateaus in east and south-east. Soils gravelly loams to sandy clay loams. Mapped as unit 1d (=**RE 5.3.4**) and grades into 1a on major streams. In Toko Ranges, a related association is dominated by Eucalyp*tus camaldulensis, Acacia georginae, A. cyperophylla* var. *cyperophylla* and *Atalaya hemiglauca*. *Senna artemisioides* ssp. *oligophylla* and *Eremophila freelingii* are most frequent shrubs. This association is mapped as unit 1c (=**RE 5.3.3**).

Unit	Source	Description	Frequent species	Notes
6.3.2 (part)	Neldner (1984) FA 26 (all)	*Eucalyptus camaldulensis, E. microtheca* or occasionally *Acacia cambagei* can predominate and form a distinct but discontinuous canopy layer. Other scattered trees may occur and a tall shrubby layer is frequently developed. Low shrubs are present, but rarely form a distinct layer. Ground cover is variable composed of grasses, sedges and forbs with any one predominating, depending on seasonal conditions. Tree/tall shrub layer: Ht. 5-13 m; Cover 5-20%; Density 100-400 trees/ha.	Upper: *Eucalyptus camaldulensis, E. microtheca*, *Acacia cambagei, A. stenophylla, A. tetragonophylla, A. victoriae*, *Eremophila bignoniiflora*, *Eucalyptus populnea, E. terminalis*, *Lysiphyllum gilvum* (in places), *Melaleuca linariifolia* var. *trichostachya* (in places). Mid: *Acacia farnesiana, Cassia nemophila* var. *nemophila, C. nemophila* var. *zygophylla, C. phyllodinea*, *C. sturtii, Chenopodium auricomum, Eremophila mitchellii*, *E. polyclada, E. sturtii*, *Exocarpos aphylla* (in places), *Muehlenbeckia florulenta, Myoporum deserti.* Forbs: *Abutilon otocarpum, A. oxycarpum, Alternanthera nodiflora*, *Atriplex muelleri, A. spongiosa, A. vesicaria, Boerhavia* spp., *Calotis hispidula, C. inermiss, Centipeda thespidioides*, *Indigofera linnaei, Maireana villosa, Malvastrum americanum, Marsilea* spp. *Minuria integerrima*, *Portulaca* sp. aff. P. *oleracea, Psoralea cinerea,* P. *eriantha, Ptilotus macrocephalus, Salsola kali, Sclerolaena* spp., *Sida* spp., *Solanum ellipticum, S. esuriale*, *S. sturtianum, Tetragonia tetragonioides*, *Trichodesma zeylanicum.* Graminoids: *Aristida contorta, A. jerichoensis, Chloris pectinata, Chrysopogon fallax, Cyperus exaltatus, C. iria, C. victoriensis*, *Dactyloctenium radulans*, *Dichanthium affine, D. sericeum, Digitaria brownii, D. coemicola, Eleocharis pallens*, *Eragrostis cilianensis*, *E. dielsii, E. elongata, Eriochloa pseudoacrotricha*, *Eulalia fulva, Leptochloa digitata, Panicum whitei, Paspalidium jubiflorum, Themeda australis*, *Tripogon loliiformis.*	This association is widespread on the levees and banks of major drainage channels of recent alluvial origin throughout the region. The soils are either alluvial soils intermixed with texture contrast soils or brown and grey clays. Floristically and structurally, this association varies considerably with seasonal conditions. This association forms mapping unit 12c. All of this is part of 6.3.2 is included in this NEC. The other part, FA 34, which is dominated by *E. coolabah*, is included in NEC 14.

Unit	Source	Description	Frequent species	Notes
6.3.3	Neldner (1984) FA 25	*Eucalyptus camaldulensis* and/or *E. microtheca* predominate depending on local habitat conditions and form a distinct but discontinuous canopy. An open to sparse, tall shrub layer is frequently present. Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses. Structural formation: Woodland, rarely open-forest. Tree/tall shrub layer: Ht. 10-12 m; Cover 15-30% (rarely 40%); Density 100-125 trees/ha.	Upper: *Eucalyptus camaldulensis, E. microtheca, Acacia salicina*, *A. stenophylla, Capparis mitchellii*, *Melaleuca linariifolia* var. *trichostachya* Mid: *Chenopodium auricomum, Enchylaena tomentosa, Eremophila bignoniiflora, Muehlenbeckia florulenta, Myoporum deserti.* Forbs: Frequently occurring spp: *Alternanthera denticulata, A. nodiflora*, *Atriplex eardleyae, A. muelleri, A. spongiosa, Bulbine* spp., *Calostemma luteum, Centipeda thespidioides*, *Haloragis aspera*, *Malvastrum americanum, Marsilea drummondii*, *M. hirsuta, Medicago denticulata, Minuria integerrima, Plantago drummondii*, *Psoralea eriantha, Sclerolaena bicomis, Tetragonia tetragonioides*, *Xanthium pungens* (in central and eastern area). Graminoids: Frequently occurring spp: *Bothriochloa bladhii, B. ewartiana, Chrysopogon fallax, Cyperus dactylotes*, *C. difformis, C. exaltatus, C. gracilis*, *C. iria, C. rigidellus*, *C. victoriensis*, *Dichanthium sericeum, Eragrostis dielsiis E. leptocarpa, E. parviflora*, *E. setifolia, E. tenellula, Eriochloa pseudoacrotricha*, *Eulalia fulva, Leptochloa digitata, Lomandra longifolia, Panicum whitei, Paspalidium jubiflorum, Sporobolus mitchellii.*	This association is widespread on the levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast soils. Minor areas are associated with sandhill drainage lines. This association is floristically rich with more than 100 species known to occur in favourable seasons. It is the dominant association in map unit 12a.
SA: *Eucalyptus camaldulensis* (River Red Gum) Woodland on levees and channel banks of regularly inundated floodplains	Neagle (2003)	*Eucalyptus camaldulensis* (River Red Gum) Woodland on levees and channel banks of regularly inundated floodplains (Department for Environment and Heritage SA in progress) occupies a similar riverine and floodplain land system as *E. coolabah* woodland (see NEC15) , an ecosystem with which it may often intergrade, and generally occurs in lineaments along watercourses. Associated vegetation is similar to that of the *E. coolabah* woodland ecosystem with *Acacia salicina*, *Muehlenbeckia florulenta* and *Atriplex nummularia* ssp. *nummularia* being common. This ecosystem occurs in association with major drainage channels throughout the semi-arid and arid rangelands of central Australia. *Distribution in SA Rangelands Bioregions:* • In the Stony Plains Bioregion this ecosystem is found surrounding waterholes and lining sandy channels of watercourses of the Lake Eyre Basin, particularly those that are better watered (Purdie 1984, Brandle and Hudspith 1998, Brandle 2000). • In the Finke Bioregion this ecosystem is limited in extent and found only in association with the main channels of the Alberga River and Hamilton Creek. • CHC: This ecosystem is an uncommon component of the Diamantina and Cooper Creek systems. It is most evident adjacent to the more permanent waterholes of Cooper Creek near Innamincka (Marree Soil Conservation Board 1997, Nicolle 1997).		

Unit	Source	Description	Frequent species	Notes
NT: MU 27a	Wilson (1990)	(Note that this description refers to occurrences all throughout NT, including the tropics. Some parts of the description may be most applicable to the tropical areas) *E. camaldulensis* dominates the upper layer, although the floristic composition and structure of the community varies with the size of the stream channel. …Channels less than 25m wide are often vegetated by *E. camaldulensis* and *Acacia estrophiolata* low open woodland. A shrub layer is generally sparse or absent, although after periods of heavy rains a dense understorey of *E. camaldulensis* regeneration may develop. The ground layer is generally characterized by a sparse cover of perennial tussock grasses, such as *Enteropogon acicularis*, although other speceies including *Zygochloa paradoxa* and *Triodia pungens* may predominate. Other species in other of decreasing frequency: • trees: *Erythrina vespertilio, Acacia coriacea* • graminoids: *Chrysopogon fallax, Enteropogon acicularis, Botriochloa ewartiana, Eulalia aurea, Cenc hrus ciliata* • forbs: *Brassica tournefortii, Tephrosia brachycarpa, Citrullaus lanatus, Vigna lanceolata, Heliotropium bacciferum, Crotolaria eremaea, Myriocephalus stuartii* *E. camaldulensis* is particularly prominent south of Tenant Creek, along major watercourses in deep alluvial sandy soils (but extends almost to coast).		
NSW: Map unit 11	Pickard and Norris (1990)	This map unit includes all *E. camaldulensis* woodlands in NW NSW, ranging from forests along major rivers to woodlands along intermittent creeks. The forest component is excluded from this NEC (see introduction to riparian NECs). “Where the community occurs in channels on broad creeks, it is usually restricted to the active and not-long inactive channels. Whenever a new channel is formed, it is quickly colonised by a single or double row of *E. camaldulensis*. Whether these ever survive to form open-forest is a function of the stabitlity of the landforms. .. short lived channels frequently show lines of dying *E. camaldulensis*..”.		

Attachment 16-2: Records of occurrences of birds of particular conservation concern of Western Division of NSW that are associated with riparian eucalypt woodlands and forests (*from Smith et al 1995;* these records in many cases are taken directly from the source data.

Scientific name	**Common name**		**Habitat**	**Threats**
Lophoictinia isura	square-tailed kite		Various, but favours eucalypt forests and woodlands, especially ones on fertile soils and rich in nesting passerines. Recorded inland mostly along eucalypt-fringed watercourses, less often mallee scrub. A specialised predator of small birds and their eggs in the canopy. Builds nests in branches of live tree, usually a eucalypt.	Declines recorded in Qld and SA. In Western NSW, substantial decline inferred from extent of clearing of eucalypt forest and woodland within the species' distribution. Future threats in Wn NSW: (1) clearing, especially that focussed on more fertile ground, where prey species are at higher densities; (2) any form of habitat degradation that results in decreases in prey densities; (3) suppression of tree regeneration by overgrazing
Geophaps scripta	squatter pidgeon		Generally associated with eucalypt woodlands with a grassy understorey near permanent water. Diet: seeds gathered from ground. Nest: scrape in ground.	Has declined substantially in numbers, probably because of clearing of eucalpyt woodlands. Other contributing factors in the Western Division may be overgrazing by sheep, prevalence of feral cats, and hunting.
Calyptorhynchus lathami	glossy black cockatoo		Eucalypt forests and woodlands with abundant casuarinas and suitable tree hollows for nesting. In inland NSW, favours eucalypt-pine-acacia-casuarina woodland on or near stony ridges. Nests in large hollows in eucalypts. Feeds on casuarina seeds eg *Allocasuarina verticillata* and *Casuarina cristata* / *C. pauper*.	Declined in SA and Qld. In Wn NSW, extensive areas of suitable habitat have been cleared in the Riverina. Other threats in the Western Division of NSW include: failure of regeneration of food and nest trees through overgrazing; decline of remnant trees in cleared agricultural areas; occupation of hollows by feral honey bees; habitat degradation through fires; predation of nestlings by feral cats; trapping for the bird trade
Polytelis anthopeplus anthopeplus	regent parrot		Nests in hollows in eucalypts (mature, senescent or dead trees). Breeding habitat is riparian woodland dominated by river red gum (*Eucalyptus camaldulensis*); also nests in *E. largiflorens,* large mallees and hollows in cliffs.	Breeding range has contracted during this century and there has been a general decline in numbers within the current breeding range since the 1920s. Threats: (1) Clearing of mallee scrub that is considered to have been the most important factors in the subspecies' decline.(2) Logging of the river red gum stands has reduced the numbers of older, hollow-bearing trees in the stands. (3) Other threats: loss of food plants through overgrazing or altered fire regimes and inhibition of eucalypt regeneration.
Polytelis swainsonii **EPBC status: Vulnerable**	superb parrot		Breeds in red gum and box woodlands in Sn NSW and Nn Vic, outside the Western Division. Part of the population migrates to north-central NSW in autumn and winter, with some birds reaching the eastern fringes of the Wn Division. Nest in hollows in both live and dead eucalypts. In north-central NSW, they forage in *E. camaldulensis* woodland and box-pine woodland; in the Riverina, they forage in *E. camaldulensis* woodland, box-pine woodland, box woodland, pine woodland and *Acacia pendulata* woodland.	There has been a substantial reduction in the breeding distribution during this century, especially in Vic - attributed to clearing and degradation of eucalypt woodlands in the wheatbelt. In the Western Division of NSW, the chief threat in future is likely to be gradual degradation of foraging habitats through overgrazing by stock, rabbits and feral goats (including suppression of shrub and tree regeneration). Other threats: further clearing of woodlands; decline of remnant trees in previously cleared areas; predation by foxes and feral cats; illegal trapping for the aviary trade; road kills of birds feeding on split grain

Scientific name	Common name		Habitat	Threats
Neophema pulchella	turquoise parrot		Associated with eucalypt and cypress pine woodlands and open forests, often in rough, rocky country, and often favouring partially cleared areas. The birds forage on the ground for seeds, typically in woodland with an open grassy understorey or in grassy clearings or nearby pastureland. Nest in hollows in live and dead eucalypts, stumps, fence posts or logs on ground	History of dramatic population fluctuations - reasons for fluctuations not well understood (therefore considered threatened). In Western Division, perceived threats are: habitat degradation through overgrazing by stock and rabbits (including suppression of eucalypt regeneration); predation by foxes and feral cats; further clearing of woodlands; decline of remnant trees in agricultural areas; habitat degradation through altered fire regimes.
Tyto novaehollandiae novaehollandiae	masked owl		Most numerous in eucalypt forest and woodland, particularly in areas with a diversity of structural vegetation types and/or a mosaic of dense and sparse ground cover. Main prey: terrestrial mammals up to rabbit size; some arboreal prey including possums, birds. Prefers to roost and nest in tree hollows; also uses caves if tree hollows are in short supply.	Rarely recorded in the Wn Division of NSW - this probably related to the massive losses of small native terrestrial mammals post European settlement. Threatening processes: loss of hollows through clearing of eucalypts, gradual loss of remnant trees in previously cleared areas, timber harvesting, and occupation of hollows by feral honeybees; suppression of eucalypt regeneration by overgrazing
Xanthomyza phrygia **EPBC status: Endangered**	regent honeyeater		Usually a species of eucalypt woodland and open forest. In Wn Division used to frequent sand hills with *Banksia*. No *Banksia* species now occur in Wn Division. Important nectar sources include eucalypts, mistletoes and banksias. Nests are built in trees or shrubs.	One of Australia's most threatened bird species. Presumed to be extinct in Wn Division of NSW - apparently linked to loss of *Banksia* from the region, which probably was result of overgrazing of their former sandhill habitats by sheep and rabbits.
Grantiella picta	painted honeyeater		A breeding migrant to NSW. Feeds chiefly on mistletoe fruits.. these usually found in association with heavy mistletoe infestations in eucalypt woodland and various other types of woodland and scrub vegetation. Nests are built among the foliage of trees and tall shrubs, often in mistletoes.	An uncommon and declining species in NSW - probably because of clearing of eucalypts, acacias, and other mistletoe hosts. Other threatening processes: suppression of tree regeneration through overgrazing; decline of remnant trees in agricultural areas
Ixobrychus flavicollis	black bittern		Usually found along watercourses and wetlands where there are fringing trees. The fringing vegetation is typically dense but narrow in width. The birds rest by day in dense waterside vegetation, coming out at dusk to hunt for fish, frogs and aquatic invertebrates. The stick nest is usually built in the branches of a tree near water.	Only known in Wn Division from records in 1840s. Now seldom recorded in any inland regions of Australia - decline probably because: habitat degradation through overgrazing, and predation by foxes and feral cats.
Elanus scriptus	letter-winged kite		The main breeding range of the species is centred on the Georgina Diamantina Cooper Warburton river systems of Qld and SA. The birds nest and roost colonially in the trees along the watercourses. Crepuscular and nocturnal; feed mainly of small terrestrial mammals.	In Wn Division, very few records over last 25 years; known to have been more abundant in the past - decline likely to be because of drastic decline of small native mammals in the Wn Div.

Scientific name	Common name		Habitat	Threats
Hamirostra melanosternon	black-breasted buzzard		Inhabits various types of open country, from eucalypt woodland to shrub steppes, grassy plains and sandy deserts. A generalist, it preys on a wide range of mammals, birds, reptiles, some insects and carrion. Most prey is taken from the ground in the open. It is also a nest robber. Its own nest is built in a tall tree usually located in the narrow belts of eucalypt woodland fringing inland watercourses.	Formerly occurred much more widely and commonly as a breeding species in NSW. Its breeding distribution in NSW and Qld has contracted greatly; in NSW only recent breeding records are in far NW. Reasons for the decline are unclear - possible cause is decreasing availability of prey in areas that have always only been marginal breeding habitat.
Calyptorhynchus banksii	red-tailed black cockatoo		In the Wn Division, closely associated with riverine eucalypt woodland dominated by *E. camaldulensis*. Eucalypt seeds form the staple diet of some populations of red-tailed black cockatoos, but in the Wn division they regularly feed on the ground rather than in eucalypts. Their dependence on river red gum is for shelter and nesting rather than for food. They nest in tree hollows and these need to be very large to accommodate them; usually only found in *E. camaldulensis* in the Wn Division.	Populations trends for different subspecies of this species vary across Australia. Details in Smith et al 1995. Overall, the future of the species is of some concern in NSW, particularly because massive outbreaks of toxic blue-green algae have developed along the Darling River and its tributaries (a result of nutrient pollution). The distribution of the species closely follows these rivers; it needs to drink regularly; sensitivity to blue-green algae needs to be assessed. Other possible threats in Wn Div: loss of important food resources from overgrazing by stock, rabbits and kangaroos; clearing of river red gums; poor regeneration of river red gums through overgrazing and reduced flooding frequency due to river regulation; predation by foxes and feral cats; occupation of nest hollows by feral honeybees; road kills of birds feeding on spilt grain; lowered breeding success through ingestion of pesticides.
Pardalotus rubricatus	red-browned Pardalote		A widespread species in the lower, shrubbier, drier eucalypt woodlands of northern Australia, extending south along the narrow bands of eucalypt woodland fringing inland watercourses, including those in the NW of the Wn Division. The birds forage mainly in eucalypt foliage and their principal prey is lerp-forming psyllid insects. They nest in tunnels dug into earth banks, often in the sides of watercourses.	No major changes in its distribution and abundance known since European settlement. In NSW, however, a rare species that is dependent on eucalypts and restricted to the north-west of the state, where suppression of eucalypt regeneration by overgrazing is a major problem.
Ninox connivens	barking owl		Eucalypt woodland and open forest. In SW NSW, appears to be restricted to *E. camaldulensis* riparian woodlands. Prey consists of mammals, birds and insects. Nests in large tree hollows.	Major threat is clearing of its woodland habitat for agriculture. May now be extinct in SE SA because of clearing. In Wn Division, rate of clearing a serious concern, especially in the higher rainfall areas in the east and south. Other threats: widespread suppression of eucalypt regeneration by overgrazing; decline of remnant trees in previously cleared areas; loss of nest hollows through timber harvesting or occupation by feral honeybees; reduced availability of prey through decline of small native mammals in Wn Division.

Scientific name	**Common name**		**Habitat**	**Threats**
Falcunculus frontatus	crested shrike-tit		Inhabits eucalypt forests and woodlands. In the Wn Division, closely associated with *E. camaldulensis* riparian woodlands along the major rivers. The birds feed on insects and spiders, mainly in the bark of eucalypts. Nests are built high up in the foliage.	Known to have declined in WA and SA. In the Wn Division, threatened by clearing of its habitat, poor river red gum regeneration due to overgrazing and changed flooding patterns; decline of remnant trees in previously cleared areas; habitat degradation from timber harvesting
Philemon corniculatus	noisy friarbird		Inhabits eucalypt forests and woodlands, especially where there are flowering eucalypts or other nectar-rich plants. Diet nectar; also insects and fruit. Nests built high up in trees or shrubs.	Declined in Rutherglen district of Victoria (replaced by little friarbird, *Philemon citreogularis,* as district was cleared and developed. In Wn Division, threatened by continuing clearing of eucalypt woodlands; decline of remnant trees in previously cleared areas; and widespread suppression of eucalypt regeneration by overgrazing.
Melithreptus gularis	black-chinned honeyeater		Inhabits eucalypt woodlands in NSW, and a wider range of habitats in northern Australia. On the inland margins of its distribution in NSW, typically found in *E. camaldulensis* riparian woodland. Feeds mainly in eucalypts: nectar, honeydew and insects. Nest is built in eucalypt or other foliage.	Habitat depleted by extensive clearing of eucalypt woodlands in south-eastern Australia. The species has declined in SA and in the Sydney region. There are also indications of decline in Wn NSW. In Wn Division, threatened by clearing of river red gum woodlands; poor river red gum regeneration due to overgrazing and changed flooding patterns; decline of remnant trees in previously cleared areas; and habitat degradation from timber harvesting. As a species that needs to drink regularly, may also be threatened by massive outbreaks of toxic blue-green algae that have developed along the Darling R and its tributaries.
Stagonopleura guttata	diamond finch		In SW NSW, recorded as occurring in all types of timbered country, but associated primarily with *E. camaldulensis* riparian woodland. In Cobar region, associated with bimble box (*E. populnea* ssp *bimbil*) and white cypress pine (*Callitris glaucophylla)* woodlands. Diet: chiefly seeds collected from ground. Nests: bulky structures built in shrubs or trees.	Declines reported in 20th century in Qld, Vic, SA and NSW in Sydney region. Threats in Wn Division are further clearing of its woodland habitat; habitat degradation through overgrazing; predation by foxes and feral cats.
Oriolus sagittatus	olive-backed oriole	Wn Div P	Generally associated with eucalypt forest and woodland. In Cobar district, mostly found near water. Diet: mainly fruit and insects. Nests built amongst foliage of trees and branches.	Declined in SA with extensive clearing of its habitat for agriculture. In Wn Division, threatened by continuing clearing of eucalypt woodlands; decline of remnant trees in previously cleared areas; and suppression of eucalypt regeneration by overgrazing.

Attachment 16-3: Comments on riparian systems from Woinarski (2002).

In many cases these records are taken directly from the source data (see: http://www.nt.gov.au/ipe/pwcnt/index.cfm?attributes.fuseaction=open_page&page_id=2113)

1. Burt Plain (BRT)

- A range of generally small swamps, ephemeral rivers and rockholes are present in the bioregion. Many of these are being degraded by a combination of factors including feral animals, livestock, weeds and/or unfavourable burning regimes.
- The bioregion contains some ephemeral watercourses, which are generally in fair to good condition, but are afforded little protection from a range of threatening processes, including grazing and trampling by feral animals and livestock and weed infestation. The major river systems occurring in the bioregion include parts of the Plenty, Hanson, Sandover and Lander Rivers.

2. Davenport-Murchison Ranges (DMR)

- An important feature of the bioregion is the relative diversity of aquatic and semi-aquatic plants, associated with the large number of permanent or semi-permanent waterholes within the ranges.
- There are some permanent waterholes in the ranges which have allowed the persistence of a biogeographically significant fish fauna. A series of watercourses flow intermittently, and provide contrasting habitat to the dominant environmental matrix. Kurundi Creek, Gosse River, Frew River and its associated floodout swamps, and the upper Elkedra River, are the most important of these (irregular) wetland areas.
- Parts of the Gosse, Frew and Elkedra River systems flow through this bioregion. Riparian areas are in fair to good condition, but are being adversely affected by feral animals (especially donkeys), weeds, altered fire regimes, and generally unrestricted access by livestock.
- No ecosystems in this bioregion have been formally listed as threatened. The highest risk is probably associated with the region's wetlands (rockholes, riparian areas and flood-outs), because of degradation by livestock and feral animals.
- The moderately large Davenport Range NP and small Devil's Marbles NP provide reasonable representation of the Range environments, but **do not sample the flood-out areas and valley floors**, which are largely included within pastoral land use. A more comprehensive reserve system should include some representation of these more fertile lowland environments.

3. Finke bioregion (FIN)

- Over-grazing by livestock and/or feral animals (principally rabbits, camels and horses) has degraded many areas, and especially riparian areas, natural waterholes, and fertile lowlands. Foxes and feral cats are widespread and have taken a heavy toll on the native fauna, especially critical-weight range mammals and ground-dwelling birds such as the night parrot. There are major weed infestations, most notably of buffel and couch grass, and of athel pine in riparian systems. Fire regimes have probably changed considerably since European settlement, resulting in broad-scale changes in floristics and vegetation patterning, with declines especially of fire-sensitive species. Many of these detrimental factors were probably most pernicious and had most explosive impacts in the first few decades following European settlement, and some may have now improved or stabilised (e.g. vegetation change caused by rabbits; some improvements in land husbandry within the pastoral industry), such that there may be some reversals in the general pattern of decline.
- The bioregion is currently very poorly reserved (<1% of bioregional extent), and most ecosystems are not represented in the reserve network. Additional reservation would be necessary to achieve a regional CAR reserve system.
- The Karinga Creek palaeodrainage system occurs in the far west of this bioregion. It comprises a series of permanent springs, ephemeral seepage creeks and ephemeral lakes formed by discharge from the central Australian groundwater basin, supplemented occasionally by irregular heavy rainfall events. When full, the lakes are important for waterfowl and some shorebirds, especially as stop-over points for the latter during their dispersal across Australia. The system is also important as a research and reference site for hydrogeology and palaeoclimate.
- A range of wetlands of subregional significance have been identified. Most of these are near permanent waterholes in the major intermittent/ephemeral river systems, and the broad reaches of the river systems themselves.
- The bioregion includes most of the catchment of the Finke River, other than its headwaters. A range of pervasive factors degrade riparian zones across this bioregion. Most riparian areas are unfenced and

trampled or grazed by livestock and feral animals. There are at least localised patches of serious weed infestation in the bioregion, most notably of buffel grass and athel pine.

- No ecosystem has formally been listed as threatened, but wetland and riparian environments are at risk from ongoing degradation by livestock, feral animals and weeds. Other ecosystems are being altered by changed fire regimes, but there is insufficient information currently available to assess the significance of such risks.
- There are no major reserves in the bioregion. The existing small reserves fall well short of the ideal comprehensive, adequate and representative system. Most vegetation types in the bioregion are unreserved, and the few reserved vegetation types are protected to only a very small extent. The main priorities are for increased reservation of chenopod shrublands (NT vegetation types 108, 109, 110 and 111), coolabah (*Eucalyptus microtheca*) woodlands (NT vegetation type 27), and *Acacia* shrublands and woodlands.

4. MacDonnell Ranges

- These ranges enclose some broad plains and watercourses. Soils are generally skeletal or shallow sands on the rocky hills, with earthy sands and deep loamy alluvium on the lowlands. The dominant vegetation types are spinifex hummock grassland, sparse acacia shrublands and woodlands along watercourses.
- This bioregion includes the small (10 ha) but nationally significant wetland of the Finke River headwater gorge system (NT002: wetland type B1), an important set of perennial waterholes within the rugged ranges. Most of this system is within the West MacDonnnell National Park, and is in good condition. Tourism may be having minor local effects.
- There are many other waterhole and gorge systems within the mountain systems of this bioregion which are of local and regional significance in this arid system. The ranges form the headwaters of many ephemeral or intermittent river systems. There are also floodout and swamp areas, notably including Ilparpa Swamp near Alice Springs. Well-protected moist areas are especially significant as refuge areas, with the most notable of these being Palm Valley.
- Major river systems arising in this bioregion include the Finke, Todd, Hugh and Hale Rivers. Riparian condition is variable. The lowland sections of many riparian areas are subject to substantial invasion by weeds (particularly buffel grass), and trampling and other damage by livestock or feral animals. Within the mostly reserved ranges, the upper reaches of most river systems are well protected and in good condition.
- No ecosystems in this bioregion have been formally designated as threatened, but there has been decline in many environments which are fire-sensitive (e.g. some mulga woodlands), or vulnerable to exotic animals (e.g. wetlands, riparian areas).

5. Tanami

- Most of the bioregion is generally in good condition, with little intensive use. However, feral predators (foxes, cats) and other factors have caused the regional extinction of 13 mammal species (including central rock-rat and mala), and the decline of many other mammals. Fire regimes have changed substantially over the last century, following less intricate Aboriginal management over large areas, leading to broad-scale detriment in many vegetation communities. Some weeds are also increasing, with at least localised impacts of buffel grass and *Parkinsonia*.
- The bioregion includes two nationally significant wetlands: Lake Surprise (Yinapaka) (NT019: wetland type A6) and the Lake Gregory system (WA096: wetland types B7, B8 and B2). Parts of the Lake Gregory system have been degraded by livestock, but management may be expected to improve as the area has recently been included within the large (4,346 km^2) Paruku IPA.
- The bioregion also contains many smaller ephemeral wetlands and watercourses, which are intermittently of at least regional significance.
- The largest river system in the bioregion is Sturt Creek (which flows into Lake Gregory). Other ephemeral watercourses include the Lander and Hanson Rivers and Winnecke Creek. Condition is generally good, although there are at least localised impacts from feral animals and livestock, and from weeds.
- There has been no formal assessment of the conservation status of ecosystems across most of the bioregion. At least parts of some wetland communities (e.g. Lake Wilson, Lake Gregory) have been degraded by livestock and/or feral animals. Changed fire regimes have led to floristic changes and/or demographic changes for some plant species in many communities across much of the bioregion.

NEC 1.17: Inland eucalypt open woodlands on floodplains and minor drainage lines.

This NEC description is not fully developed because priority was given to completing NECs where there were definite indications of threat. Explanation of the membership of this community, some general notes and references to relevant data are provided; the information indicates that these woodlands are not threatened, although there are processes impacting on them in some areas.

Description and natural distribution

This NEC is distinct from the other coolibah and river red gum communities of inland Australia because, rather than occurring around major river or creeks or permanent water holes, its component communities occur on floodplains, open depressions and minor drainage lines. One difference between this NEC and the floodplain component of NEC 1.14 is that this one is inland; it occurs in different bioregions that face different threatening processes.

One unfinished aspect of this NEC is that is unclear whether all the subcommunities listed in Table 1 truly belong in it as the original data sources for some of the subcommunities have not been accessed. It is also unclear whether the whole NT map unit 27 is on floodplains and minor drainage lines; it is likely that some of them are on the levees and banks of more major creeks and rivers; these parts would belong in NEC 1.15. Expert advice is needed to clarify this. It is also possible that some of the communities in NEC 1.16 belong here, but some of the data have insufficient detail to assess this.

As currently defined, this NEC includes sub-communities in the CHC and SSD of Qld, NSW and SA, and in a number of bioregions of NT. These areas are shown in Figure 1. Precise mapped data are not available for Qld because mapping for those regions is still being completed (see Introduction, Figure 3); the SA community is a composite of some mapped and unmapped communities.

The sub-communities are generally dominated by coolibahs; *E. coolabah* ssp *arida* in SA, NSW and southern NT; *E. coolabah* ssp *arida* or *coolabah* in Qld, and *E. victrix* further north in NT (see Figure 1 in the Introduction to the riparian NECs). Some occurrences of the SA community are dominated by *Acacia salicina,* but coolibahs are still present. One of the variants in Qld has *E. camaldulensis* as a dominant eucalypt (part of 5.3.6; Table 1; Attachment 17-1). Other components of the upper storey include *Acacia coriacea, A. cambagei, A. salicina, A. stenophylla, E. camaldulensis ssp. obtusa, Eremophila bignoniiflora, and Lysiphyllum gilvum.* Tall shrubs may be conspicuous but rarely form a distinct layer. The low shrub layer is more variable. In a number of the Qld REs, low shrubs sometimes occur but rarely form a well defined layer. In others they form a distinct layer (1-2 m tall) – these may be dominated by *Muehlenbeckia florulenta* and *Chenopodium auricomum*, and tend to occur in the wetter channels and swamps. In the SA community, low shrubs are present and include *Muehlenbeckia florulenta* (Lignum), *Atriplex nummularia* ssp. *nummularia* (Old-man Saltbush), *Chenopodium auricomum* (Golden Goosefoot) and, to a lesser extent, *Solanum oligacanthum* (Desert Nightshade). The NSW communities include these shrubs, but the shrub layer is sparse: *Rhagodia spinescens, Muehlenbeckia florulenta, Maireana aphylla, Chenopodium auricomum, M. appressa, Enchylaena tomentosa, Crotalaria eremaea ssp. eremaea, Salsola tragus ssp. tragus.* In the NT, the shrub layer is often absent and is sparse when present. However, *Carissa lanceolata* is common north of Alice Springs. The seasonally variable ground layer is open (sometimes close to absent) to dense, and is usually dominated by perennial grasses (in Qld and NT – eg *Chrysopogon fallax*), or in favourable seasons by ephemeral herbs. In wetter areas, sedges may be present. This information is from Environmental Protection Agency Qld (2003b), Neldner (1991), Boyland (1984), Wilson (1990), Benson (in prep) and Neagle (2003). Further details are in Attachment 17-1.

The upper storey is 5 to 13m high, with cover ranging from 2 to 13%. These are low open woodlands to woodlands. Soils are highly variable, and include deep alluvial soils, calcareous loams or whitish, coarse sand to sandy loams, red earths and silty clays, and deep, grey and brown cracking clays (Attachment 17-1).

Riparian woodlands often support a diverse fauna. Sattler and Williams (1999) comment that the CHC bioregion is relatively rich in fauna species compared with other arid zone regions of Australia. Sattler and Williams (1999, pg 5/6) provide further comments about temporal variations in the fauna, and list relevant fauna surveys (their Table 5.5, p 5/26) which could provide more detail. Morton *et al*'s (1995) analysis of refugia for biological diversity in arid and semi-arid Australia also refers to a number of the wetlands associated with the rivers and creeks of these IBRA regions, and gives important details of the refuge value, listed and other important species, key threats, and further references. For example, their refuge reference numbers SA 9, 10 and 11 (their pages 98 and 99) are relevant for South Australia. They also nominate the Queensland Channel Country as an extremely significant refuge (their pg 122). These records could add substantial information to this section. Attachment 16-3 of NEC 1.16 also provides relevant information on the faunal value of the NT riparian communities.

For information on conservation areas, see table 2.

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of the communities are listed under the EPBC Act. The SA community is "of concern" in their informal listing (Neagle 2003). Neither of the Queensland communities are threatened at present. NT do not list ecological communities. Benson (in prep) gives them his "least concern" threat status.

Decline in geographic distribution

Mapping is not available to assess areas, but riparian communities are not usually threatened by decline in geographic distribution.

Threats to the national ecological community

See Table 2. The major threat is from grazing pressure from introduced herbivores; this has had impacts over the long term.

Loss or decline of functionally important species

Data may exist but has not been identified

Reduction in ecological community integrity

The indications are that overgrazing is one of the major threats to these communities; this has modified the communities both structurally and floristically.

Rate of detrimental change

It appears that the threatening processes have been in place over the long term. Data on trends may exist but have not been identified

Summary and recommendation regarding category of threat under the EPBC Act

Despite sometimes extensive and long-term impacts from grazing, these communities do not appear to be eligible for listing.

Outstanding issues

- The current sub-division of the riparian woodlands into the NECs defined here is not without some difficulties (see introduction to riparian woodlands). Other categorisations could also be justified. Adjustments may be suggested by state experts.
- Riparian woodlands are usually rich in fauna, and faunal records need to be added to the description of this NEC.
- One unfinished aspect of this NEC is that is unclear whether all the subcommunities listed in Table 1 truly belong in it; original data sources for some of the subcommunities have not been accessed. It is also unclear whether the whole NT map unit 27 is on floodplains and minor drainage lines; it is likely that some of them are on the levees and banks of more major creeks and rivers; these parts would belong in NEC 1.15. Expert advice is needed to clarify this. It is also possible that some of the communities in NEC 1.16 (*E. camaldulensis* woodlands on levees and banks of major channels…) belong in here, but some of the data have insufficient detail to assess this. Also, given the distribution of the communities included here, there may be similar communities in western NSW. We have not found relevant data.

Table 1: Subcommunity details

Sub-community / Regional Ecosystem name	Unit ID or source	Update names / other comments	State	IBRA region (subregions)	Threat status (EPA for Qld)	Comments
E. microtheca-barklyensis-helenae (Coolibah) low open-woodland with *Chenopodium auricomum* (Bluebush) sparse-shrubland understorey.	DVT58	Source: The Land Resources of Lucy Creek Station, in Brocklehurst and Gibbons (2003). Not mapped in NVIS.	NT	CHC1		Included here because a low open woodland and may not be on major channels; source data not accessed.
E. coolabah (Coolibah) low open woodland with a tussock grassland understorey	DVT91	Source: The Land Resources of Lucy Creek Station, in Brocklehurst and Gibbons (2003). Not mapped in NVIS.	NT	CHC1		Included here because a low open woodland and may not be on major channels; source data not accessed.
E. coolabah (Coolibah) low open woodland with *Aristida holathera* open tussock grassland understorey	DVT92	Source: The Land Resources of Lucy Creek Station, in Brocklehurst and Gibbons (2003). Not mapped in NVIS.	NT	CHC1		Included here because a low open woodland and may not be on major channels; source data not accessed.
E. microtheca (Coolibah) low open-woodland with open-grassland understorey	MU27 & DVT110	*E. victrix, E. coolabah* ssp *arida*	NT	BRT, CHC, DMR, FIN, GSD, MAC, MGD, SSD, TAN		"Found in periodically flooded drainage lines or basins" (Table 2), so fits in this NEC. The other NT coolibah communities are in NEC19
Eucalyptus coolabah open woodland on alluvial plains.	RE 5.3.6	Prov 2,4,6	QLD	CHC (some or all of: CHC 2,4,5,7,8,9, 11, SSD5)	No concern at present	3 floristic associations included here (Table 2); one has *E. camaldulensis* dominant. Associated with braided channels and alluvial plains. Seems to fit here.
Eucalyptus coolabah ± *Lysiphyllum gilvum* ± *Acacia cambagei* low open woodland on drainage lines.	RE 5.3.7	Neldner (1991), 17a,c; Boyland (1984), 8	QLD	CHC (some or all of: CHC 2,4,5,7,8,9, 11, SSD 2, 5) (=Province 1, 2,4,5,6)	No concern at present	
Acacia salicina (Willow Wattle), *Eucalyptus coolabah* ssp. *arida* (Coolibah), +/- *Lysiphillum gilvum* (Bauhinia) Woodland of drainage lines and floodplains		These aren't mapped but are summaries of group in the rangelands by DEH (Neagle 2003)	SA	SSD, CHC	Of concern	This is a broader entity than has been mapped in NVIS, and incorporates floristic groups described by others (see Neagle 2003). The nearest match within NVIS data is probably a community coded CG0022 called "*E. coolabah, Muehlenbeckia florulenta* Woodland".

Coolabah woodland of intermittent watercourses in arid zone, mainly in the Channel Country Bioregion	Benson ID 230	Benson (in prep)	NSW	CHC (CHC9, CHC11) SSD (SSD6)
Coolabah open woodland dunefield depressions of the arid zone	Benson ID 231	Benson (in prep)	NSW	SSD (SSD5)

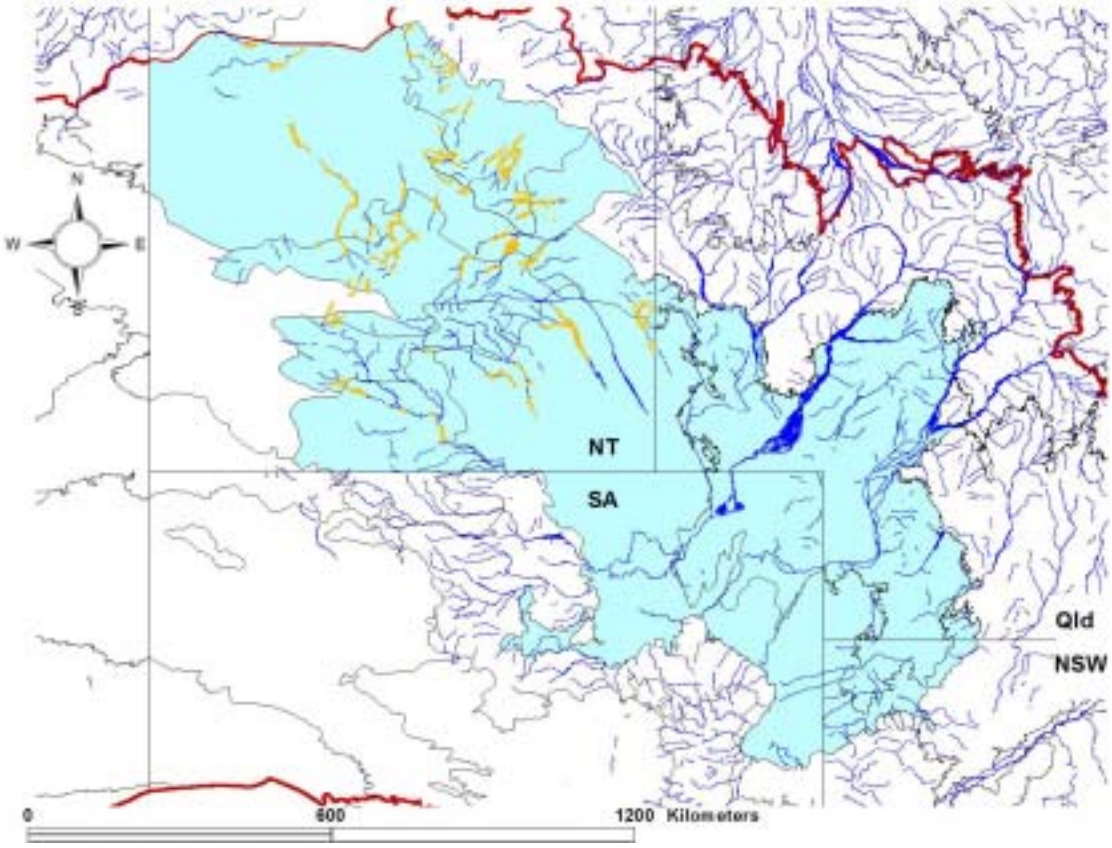

Figure 1: IBRA regions in which this NEC occurs *(aqua colour). The arid / semi-arid zone is within the red boundary; black lines outline IBRA regions. Rivers are shown in blue, and will indicate likely areas where the communities are. The NT community is mapped in orange.*

Table 2: Sub-communities: percent remaining, reservation and threatening processes. *From Environmental Protection Agency Qld (2003b), Neagle (2003), Benson (in prep).*

State: Unit ID or source	% of pre-European remaining	Extent reserved	Protected areas	Threatening processes
NT: MU27 & DVT110	No data; see Attachment 16-3 of NEC 1.16 for some relevant comments from Woinarski (2002)			See comments of Woinarski (2002) in Attachment 16-3, NEC 1.16. These identify grazing, feral animals, exotic weeds and changed fire regimes as threatening processes
Qld: RE 5.3.6	> 30% remains	Low	Diamantina NP	Heavily impacted by total grazing pressure. Habitat for feral pigs.
Qld: RE 5.3.7	> 30% remains	Low	Astrebla Downs NP, Diamantina NP, Simpson Desert NP	Highly modified floristic composition of ground layer. Feral pig habitat.
NSW: Benson 230	50-100% remains	1050± 300ha	Sturt NP 1000ha Pindera Downs AA 50ha	Localised clearing and over-grazing are the main threats to this community.
NSW: Benson 231	46-100% remains	1000± 600ha	Sturt NP 1000ha	Compared to most ofher woodlands in inland areas this community is in reasonable condition but may be degraded outside conservation reserves by concentrations of domestic stock. Pigs may be a management problem throughout.

State: Unit ID or source	% of pre-European remaining	Extent reserved	Protected areas	Threatening processes
SA	Limited data. Occurs within Innamincka Regional Reserve in CHC, but much of this is still subject to cattle grazing (Neagle 2003)			While the overstoreys are usually intact the understoreys are generally heavily modified by total grazing pressure from introduced herbivores. This also limits regeneration and establishment of seedlings; therefore the long-term survival of a number of species may be threatened. Tourists also contribute to vegetation loss (through off road driving, trampling and firewood collection), soil compaction and accelerated erosion.

Attachment 17-1: Details of species composition and structure of sub-communities Note that these records are largely unedited versions of the source data

Unit	Source	Description	Frequent species	Notes
5.3.6	FA 64 in Neldner (1991)	*Eucalyptus coolabah* open-woodland: *Eucalyptus coolabah* predominates forming a distinct but discontinuous upper layer. Tall shrubs may be conspicuous but rarely form a distinct layer. Low shrubs sometimes occur, but rarely form a well defined layer. The ground flora is variable with either grasses or forbs conspicuous depending on seasonal conditions. In places there is little or no ground layer present. Tree/tall shrub layer: Ht. 5-13 m; Cover 2.5-12.5%; Density 60-140 trees/ha.	Upper: *Eucalyptus coolabah, Acacia stenophylla, Eremophila bignoniiflora, Lysiphyllum gilvum.* Mid: *Acacia farnesiana, A. victoriae, Eremophila maculata.* Forbs: *Aeschynomene indica, Alternanthera nodiflora, Boerhavia* spp*., Centipeda thespidioides, Commelina ensifolia, Cullen cinereum, Malvastrum americanum, Marsilea* spp*., Phyllanthus maderaspatensis* var*. angustifolius, Portulaca oleracea, Salsola kali, Sclerolaena muricata, Sida filiformis, Teucrium integrifolium, Tribulus terrestris, Xanthium occidentale.* Graminoids*: Astrebla lappacea, A. squarrosa, Brachyachne convergens, Chrysopogon fallax, Cynodon dactylon, Cyperus bifax, C. tuberosus, C. victoriensis, Chloris pectinata, Dactyloctenium radulans, Dichanthium fecundum, D. sericeum, Eragrostis setifolia, E. tenellula, Eulalia aurea, Iseilema membranaceum, I. vaginiflorum, Leptochloa digitata, Panicum decompositum, Paspalidium jubiflorum, Sporobolus actinocladus, S. mitchellii.*	Restricted to drainage lines on *Astrebla* spp. undulating plains and braided channels on alluvial plains, particularly in north-east (of the central west survey area). Soils deep, grey and brown cracking clays. Sand and silt bands may occur in profile. Floristics variable. Forms map unit 2b.
5.3.6	Association 1b, Boyland (1984)	*E. coolabah* open-woodland. *E. coolabah* predominates, forming a distinct but discontinuous upper layer. Other scattered trees may be present. Tall shrubs may be present but rarely form a distinct layer. Ground flora is variable with either grasses or forbs conspicuous depending on seasonal conditions. In places there is little or no ground layer present. Tree/tall shrub layer: Ht. 5-13 m Cover 2.5-12.5%; Density 60-140 trees/ha.	Upper: *Eucalyptus coolabah, Acacia stenophylla, Eremophila bignoniiflora, Lysiphyllum gilvum.* Mid: *Acacia farnesiana, A. victoriae, Chenopodium auricomum, Eremophila maculata, Maireana aphylla, Muehlenbeckia florulenta.* Forbs: *Aeschynomene indica, Alternanthera nodiflora, Bassia quinquecuspis, Boerhavia diffusa, Centipeda thespidioides, Commelina cyanea, Malvastrum americanum, Marsilea* spp*, Portulaca* spp*, Salsola kali* Graminoids: *Astrebla lappacea, Brachyachne convergens, Cyperus betchei, C. bifax, C. victoriensis, Chloris pectinata, Dactyloctenium radulans, Dichanthium* spp*, Eragrostis setifolia, E. tenellula, Iseilema membranaceum, I. vaginiflorum, Leptochloa digitata, Panicum decompositum, Sporobolus actinocladus, S. mitchellii.*	Widespread but not as extensive as association 1a, which is the community on levees and banks. Associated with braided channels on alluvial plains. Soils are deep, grey and brown craking clays, and silt bands are common in the profile. Floristics are variable.
5.3.6	Association 1c, Boyland (1984)	*E. camaldulensis* open woodland. *E. camaldulensis* forms a distinct but discontinuous upper canopy layer. Other scattered trees, tall	Upper: *Eucalyptus camaldulensis, Acacia salicina* (in places), *Acacia stenophylla* Mid: *Acacia farnesiana, Eremophila bignoniiflora, E. maculata*	Widespread, but not extensive, mainly in the west of south-west Qld. Associated with gravelly drainage lines, channels and interchannel

		shrubs and low shrubs may occur. Ground cover is variable with grasses and forbs present. Floristic composition is dependent on seasonal conditions. Tree/tall shrub layer: Ht. 8-12 m Cover 2.5-10%; Density 25-200 trees/ha.		areas of the western river systems. Noticeable on the drainage lines though the western undulating downs. Soils are deep, loose coarse sands, silty clays, sandy clay loams or gravelly loams
5.3.7	FA65 in Neldner (1991)	*Eucalyptus coolabah* ± *Lysiphyllum gilvum* ± *Acacia cambagei* low open-woodland: *Eucalyptus coolabah* predominates forming a well defined but discontinuous canopy with scattered tall shrubs and low trees occurring beneath it. Low shrubs are present, and may form a distinct layer (1-2 m tall) dominated by *Muehlenbeckia florulenta* and *Chenopodium auricomum* in the wetter channels and swamps. The seasonally variable ground layer is open to dense, and usually dominated by perennial grasses, or in favourable seasons by ephemeral herbs. *Astrebla* spp., and *Eulalia aurea* and *Chrysopogon fallax* (sandier clays), usually dominate the interchannel flats, while *Paspalidium jubiflorum, Cyperus victoriensis, Dichanthium fecundum, Leptochloa digitata* and *Sporobolus mitchellii* dominate on the channel banks. Tree/tall shrub layer: Ht. 5-11 m (3-4 m in infrequently flooded areas); Cover <5-10% (occasionally 30%); Density <25-150 trees/ha.	Upper: *Eucalyptus coolabah, Acacia cambagei* (in places), *A. salicina, A. stenophylla, Eremophila bignoniiflora, Lysiphyllum gilvum.* Mid: *Acacia farnesiana, A. victoriae, Chenopodium auricomum, Eremophila maculata, Maireana aphylla, Muehlenbeckia florulenta.* Forbs: *Aeschynomene indica, Alternanthera nodiflora, Ammannia multiflora, Boerhavia* spp*., Calotis hispidula, Centipeda thespidioides, Chamaesyce drummondii, Commelina ensifolia, Corchorus trilocularis, Cullen cinereum, Daucus glochidiatus, Epaltes cunninghamii, Eryngium supinum, Goodenia fascicularis, G. lunata, Haloragis glauca, Hibiscus trionum, Ipomoea lonchophylla, Malvastrum americanum, Marsilea drummondii, Minuria integerrima, Neptunia gracilis f. gracilis, Phyllanthus maderaspatensis* var*. angustifolius, Plantago cunninghamii, Polymeria longifolia, Portulaca oleracea, Ptilotus exaltatus* var*. exaltatus, Pycnosorus* spp*., Rhodanthe stricta, Salsola kali, Sclerolaena muricata, Sida fibulifera, Tribulus terrestris, Trigonella suavissima.* Graminoids*: Aristida latifolia, Astrebla elymoides, A. pectinata, A. squarrosa* (in depressions), *Bothriochloa ewartiana, Brachyachne convergens, Chloris pectinata, Chrysopogon fallax, Cyperus bifax, C. victoriensis, Dactyloctenium radulans, Dichanthium fecundum, D. sericeum, Eleocharis pallens, Elytrophorus spicatus, Enneapogon avenaceus, Enteropogon acicularis, Eragrostis microcarpa, E. setifolia, E. tenellula, Eriachne benthamii, Eulalia aurea, Iseilema* spp*; Leptochloa digitata, Leptochloa fusca* ssp*. fusca, Panicum decompositum, P. laevinode, Paspalidium jubiflorum, Sporobolus mitchellii.*	Widespread on alluvial plains of south-western flowing rivers, where it occurs along seasonally flooded drainage lines and on flat plains inundated by high level general floods. Soils very deep, alkaline, grey, red or brown cracking clays with some alluvial texture contrast soils. Low woodland may develop along larger channels, while wooded tussock grasslands occur on drier areas of flat plains. Tree height decreases in less frequently flooded areas. Ground layer most frequently dominated by perennial grasses, with species dominance changing with position (which determines flooding frequencies and intensities) and minor differences in soil type. Mapped as unit 17a. Where *Muehlenbeckia florulenta* becomes prominent grades into unit 18. In limited area east of Toko Range, *Eucalyptus coolabah* forms low open-woodland in swales between low sand dunes. Shrub and ground layers contain similar species to association 108, with *Eremophila obovata, E. macdonnellii, Crotalaria eremaea* and *Triodia basedowii* conspicuous. This association is mapped as 17c.

NSW Benson 230	Benson (in prep)	Mid-high woodland dominated by Coolabah (*Eucalyptus coolabah ssp. arida*) sometimes with Gidgee (*Acacia cambagei*) with a very sparse shrub layer including River Coobah (*Acacia stenophylla)* and Thorny Saltbush (*Rhagodia spinescens*). The ground cover may be dense after rain or sparse in dry periods. The sedge *Cyperus bifax* may dominate in places. Contiguous stands with high connectivity with >60% extent remaining and low edge to area ratio	Trees: *Eucalyptus coolabah ssp. arida, Acacia cambagei, Eucalyptus camaldulensis ssp. obtusa* Shrubs, vines, epiphytes: *Acacia stenophylla, Rhagodia spinescens, Muehlenbeckia florulenta, Maireana aphylla* Groundcover: *Cyperus bifax, Eragrostis parviflora, Leptochloa digitata, Astrebla lappacea, Eragrostis setifolia, Enteropogon acicularis, Tetragonia eremaea, Einadia nutans ssp. eremaea, Haloragis aspera, Sclerolaena bicornis var. bicornis, Goodenia fascicularis, Sclerolaena diacantha, Marsilea drummondii, Cullen australasicum, Bulbine alata, Swainsona greyana, Minuria leptophylla, Leiocarpa leptolepis, Goodenia fascicularis, Frankenia serpyllifolia, Swainsona swainsonioides, Swainsona campylantha*	Occurs on sandy loam soil in dry creek beds that occasionally flood. These creek beds may be stony. These drainage lines occur in a low hills or rises (rolling down) landscape mainly in the Channel Country Bioregion, in the arid climate zone of far north western NSW and extending into Queensland. Some areas are in Sturt National Park. Grades into River Red Gum communities in more substantial watercourse in the region and into Gidgee (*Acacia cambagei*) woodland on the slopes adjacent to the creek beds. Not threatened but restricted in extent in NSW. Not mapped.
NSW Benson 231	Benson (in prep)	Mid-high open woodland domianted by Coolabah (*Eucalyptus coolabah* ssp. *arida*) with a very sparse layer of shrubs that may include *Chenopodium auricomum, Maireana appressa, Enchylaena tomentosa, Salsola tragus* ssp. *tragus* and *Sclerolaena lanicuspis* with a sparse ground cover of forbs Naturally fragmented stands of variable patch sizes with >50% extent remaining	Trees: *Eucalyptus coolabah ssp. arida* Shrubs, vines, epiphytes: *Chenopodium auricomum ; Maireana appressa ; Muehlenbeckia florulenta ; Enchylaena tomentosa ; Crotalaria eremaea ssp. eremaea ; Salsola tragus ssp tragus* Groundcover: *Sclerolaena lanicuspis ; Calotis hispidula ; Eragrostis setifolia ; Tetragonia eremaea ; Tragus australianus ; Triraphis mollis ; Erodium crinitum ; Harmsiodoxa brevipes var. brevipes ; Rhodanthe moschata ; Ptilotus exaltatus var. exaltatus ; Bulbine alata ; Nicotiana simulans ; Sida cunninghamii ; Plantago drummondii ; Gnephosis arachnoidea ; Einadia nutans ssp. eremaea ; Atriplex stipitata ; Trachymene glaucifolia ; Calandrinia eremaea ; Omphalolappula concava ; Calotis plumulifera ; Calotis ancyrocarpa*	Occurs on alluvial or aeolian light sandy clay hardpans in playa depressions that are intermittently flooded after rains. These depressions occur in dunefields of the arid zone in far north-west NSW mainly in the Simpson-Strzelecki Dunefield Bioregion extending into Queensland. this is a restricted community with a different species compositon than riparian or floodplain Coolabah communities to the east (IDs 39 and 40). It grades into Sandhill Wattle - Mulga open shrubland (ID124) on adjoining sand-dunes. Regeneration of Coolabah has occurred but there is dieback during drought. Not threatened and well conserved in Sturt National Park. Not mapped.
NT MU 27	Wilson (1990)	*E. microtheca* (Coolibah) low open-woodland with open-grassland understorey: The tree layer is dominated by *E. microtheca* in monospecific stands or is present in combination with *Acacia coriacea* and other low tree species. Shrub layer is often absent and is sparse when present. *Carissa lanceolata* is common north of Alice Springs. Ground layer is variable, usually dominated by tussock grasses eg. *Chrysopogon fallax*. On sandier sites Triod*ia pungens* is dominant. At Lake Surprise the ground layer is dominated by a rare variant *Cyperus vaginatus*. This community occurs extensively from the northern Tanami Desert to the southern border of NT. Found in periodically flooded drainage lines or basins. Soils are highly variable, ranging from deep alluvial soils to red earths and clays. *A. estrophiolata* low open-woodland (MU 59) and *Melaleuca flomerata* low shrubland (MU 52) occur		

		sporadically within this mapping unit (particularly on the Lander and Sandover Rivers). Average height of trees = 7m, average height of shrubs = 1.7m and average height of grasses = 0.3m. Average Cover trees = 8%, average Cover shrubs = 8% and average Cover grasses = 25%. Note that the status of MU27a needs to be confirmed, as it has a different description tp MU 27.
SA	Neagle (2003)	*Acacia salicina* (Willow Wattle), *Eucalyptus coolabah* ssp. *arida* (Coolibah), +/- *Lysiphillum gilvum* (Bauhinia) Woodland of drainage lines and floodplains fringes minor river channels and extends out onto adjacent floodplains. The ecosystem occurs on heavy textured soils, in particular grey cracking and self-mulching clays and calcareous loams. *Muehlenbeckia florulenta* (Lignum), *Atriplex nummularia* ssp. *nummularia* (Old-man Saltbush), *Chenopodium auricomum* (Golden Goosefoot) and, to a lesser extent, *Solanum oligacanthum* (Desert Nightshade) may be common in the shrub layer, while the groundcover consists almost entirely of ephemerals. This community is most evident in the Channel Country of north eastern South Australia. In this area it (or a closely related plant association) has been described from several biological surveys. Distribution in SA Rangelands Bioregions: • In the SA portion of the Simpson-Strzelecki Dunefields Bioregion this ecosystem occurs in association with the Warburton Creek • CHC: This ecosystem is a major feature of the Cooper and Warburton land systems, and is found fringing channels of the Cooper, Strzelecki and Warburton Creeks and extending out onto the adjacent floodplains

NEC 1.18: *Eucalyptus camaldulensis* woodland on levees and banks of drainage lines in semi-arid parts of the Flinders and Olary Ranges

Description

Introduction

This NEC separates these *E. camaldulensis* woodlands from others in eastern and central Australia because:

- they face particular threats of a type and severity not faced by similar communities elsewhere
- the landform and water regimes are different to those river red gum woodlands on large, inland, major drainage channels and waterholes

The information provided here relies heavily on a recent report by Neagle (2003). Some of the text is quoted directly from that report and is acknowledged throughout. This NEC is incomplete in the sense that further consultation with state experts is required – see "Outstanding issues", below, for recommendations about its completion.

Key flora and fauna, and abiotic elements

These woodlands occur in and around the Flinders and Olary Ranges. They are described in the biological surveys of the Flinders Ranges (Brandle 2001), North Olary Plains (Playfair and Robinson 1997) and South Olary Plains (Forward and Robinson 1996). They are grouped into this community at the state level by Neagle (2003), who names the community "*Eucalyptus camaldulensis* (River Red Gum) Woodland on levees and banks of drainage lines (in semi-arid areas)".

These woodlands are dominated by *E. camaldulensis*. Neagle (2003) states:

> "Associated vegetation is variable. Where it occurs in moist areas in the Flinders Ranges there is often a degraded understorey of rushes and sedges (Brandle 2001). In places on the middle to lower reaches of the main watercourses running east from the ranges to Lake Frome *Melaleuca glomerata* (Inland Paperbark) dominates the understorey, often in quite dense patches (Hyde and Playfair 1997)."

Further details of the floristics are summarised in Table 1.

Neagle (2003) further describes this as:

> "the major community occurring in association with significant drainage channels emanating in the ranges of the southern rangelands of South Australia (Forward 1996, Hyde and Playfair 1997, Hudspith and Brandle 2001). It generally occurs in lineaments along watercourses, but may also form dense forest communities in floodout areas (Hyde and Playfair 1997). In the higher rainfall areas of the Flinders Ranges it occurs on a variety of loam soils (Brandle 2001), while in outwash areas from ranges it is found on clays (Brandle 1998)."

Note that, even though these drainage channels are described as significant, they are often ephemeral. These communities grade into coolabah-dominated communities to the north.

Riparian woodlands often support a diverse fauna. Records of reptiles and birds that have been recorded in the floristic groups that form the map units in the Flinders Ranges are presented in Attachment 18-1. Brandle (2001) notes that red gum creekline communities can have some of the highest species diversities for birds. The surveys of the North and South Olary Plains also contain fauna records; the South Olary Plains records appear to be more relevant to more southern communities, and are not presented here. The records in the North Olary Plains are sparse. Morton *et al*'s (1995) analysis of refugia for biological diversity in arid and semi-arid Australia lists the Northern Flinders Ranges a refuge of "extremely significant" quality. Its chief refuge value is that it provides habitat for ANZECC-listed species, and habitat for endemic and relict species. One of the endemic

reptiles (*Ctenophorus vadnappa*, the red-barred dragon) occurs within the mapped *E. camaldulensis* communities but is not restricted to it.

Table 1: Details of floristic groups that contribute to NEC 1.18.

Group #	Survey	Descriptions and frequent species
15	Flinders Ranges	This woodland group occurs along the better watered depressions and stream channels of drainage lines scattered across the northern Flinders. The wetter conditions of these areas are indicated by the presence of sedges and rushes. Trees: *Eucalyptus camaldulensis, Melaleuca glomerata,* Shrubs*: Acacia victoriae*, *Senecio magnificus* , *Enchylaena tomentosa*, *Solanum sturtianum* Sedges: *Cyperus gymnocaulos* Graminoids: *Cymbopogon ambiguus*
50	Flinders Ranges	This drainage line woodland association occurs on a variety of loam soils along the central spine of the northern and southern Flinders. The presence of rushes and sedges at many sites indicate that these might represent severely degraded moist areas, particularly in the northern Flinders. Trees: *Eucalyptus camaldulensis, Callitris glaucophylla* Shrubs: *Myoporum montanum* Sedges: *Carex tereticaulis, Juncus kraussii, Cyperus vaginatus* Graminoids: *Typha domingensis*
18	North Olary	Open forest or woodland formation dominated by *Eucalyptus camaldulensis*. The understorey is often composed of sparse shrubs and tussock grasses in the hills and ranges, or annual and introduced species on the plains. The red gums form lines along watercourses and sometimes form dense forest communities in floodout areas. As these relatively moist and shady areas form a focus for stock to shelter, the ground story is often severely impacted and consists mainly of introduced species such as *Sisymbrium erysinoides* (Smooth Mustard). Isolated groves of *Acacia salicina* (Broughton Willow) and *Atriplex nummularia* (Old Man Saltbush) are associated with this community close to southern margin of Lake Frome. On the plains, and often in quite dense patches, *Melaleuca glomerata* (Inland Paperbark) dominates the understorey in the stream channels, particularly in the middle to lower reaches of the major drainage lines running east from the Flinders Ranges into Lake Frome. In the south west of the study area around Erudina and Wilippa, large stands of dead or dying saplings of *Eucalyptus camaldulensis* can occur on floodplains where flood events have stimulated germination, but rainfall in subsequent seasons has not been high enough to sustain continued growth. Native species recorded as frequent: *Eucalyptus camaldulensis, Melaleuca glomerata , Acacia salicina, Acacia victoriae* ssp *victoriae, Enchylaena tomentosa* var *tomentosa, Rhagodia spinescens, Tetragonia eremaea, Tetragonia tetragonoides, Malvastrum americanum.*
Minor group; map unit N	South Olary	Throughout the South Olary Plains, sandy ephemeral creeklines and major drainage lines are lined with river red gums. River box (*E. largiflorens*) also often occurs, particularly in the south near the Murray R. This unit covered 0.3% of the study area. A variety of understorey species are found, depending on the surrounding vegetation type, but generally include *Maireana pyramidata, Rhagodia spinescens, Acacia victoriae* spp *victoriae*, other shrubs, grasses and sometimes other eucalypts. Low woodland.

Table 2: Relevant mapped data occurring in NVIS, showing links between mapping and floristic groups

Map unit	Source surveys	Name	Floristic groups[1]
FR0003	Flinders Ra	*Eucalyptus camaldulensis* over +/- Melal*euca glomerata, Acacia victoriae, Maireana pyramidata, Enchylaena tomentosa*, Herb spp., *Cymbopogon ambigus* Woodland	14, **15**, 22, **50**
NO0018	North Olary	*E. camaldulensis* woodland	na
SP0014	South Olary	*Eucalyptus camaldulensis* low woodland	na

[1] Map units are interpreted on aerial photographs and linked to floristic groups. Floristic groups are not mapped directly. The groups in bold are those with *E. camaldulensis* dominant.

Natural distribution

Known natural distribution (including bioregions, conservation areas)

This NEC is defined as occurring within the arid / semi-arid subregions of the FLB (#3,4,5) and the SA BHC subregions (BHC1&4). The mapped units that include these floristic groups are shown in Figure 1.

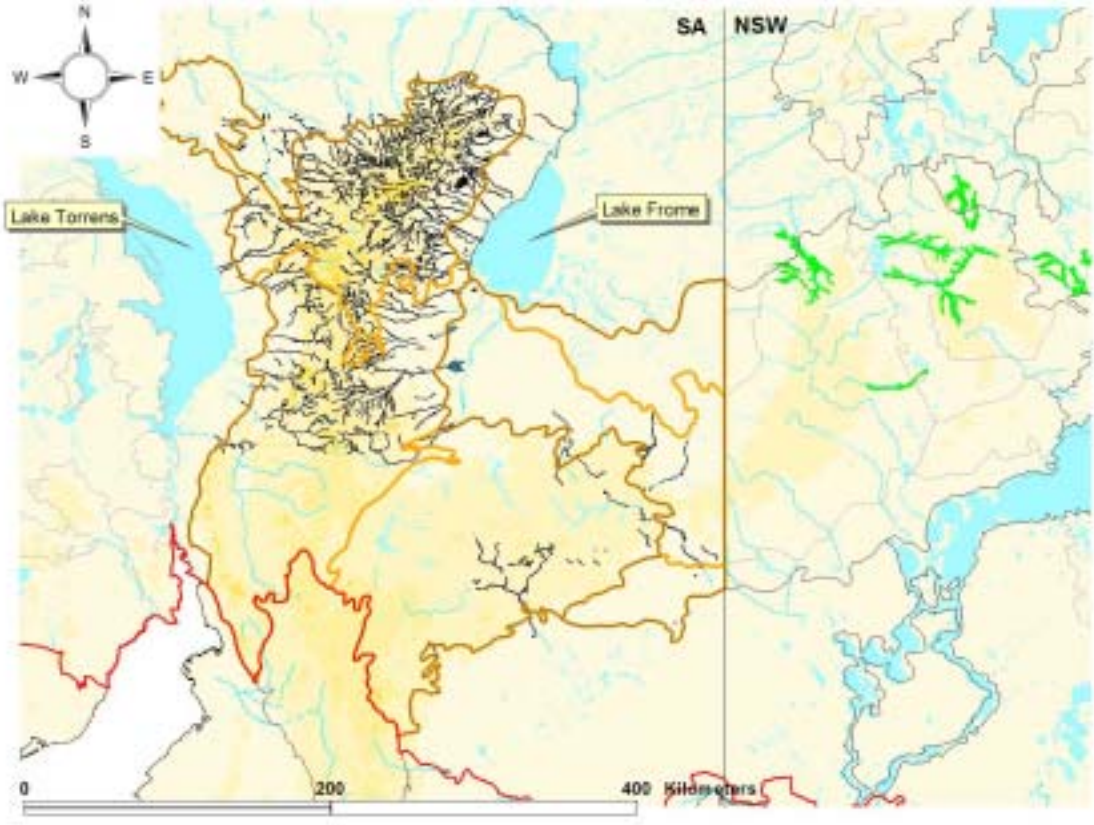

Figure 1: ***Map units that include the E. camaldulensis woodlands*** *(in black). Subregions are outlined in orange where inhabited and grey elsewhere. Semi-arid areas are north of the red line. River and lakes or seasonally inundated areas are in aqua. The green communities are NSW* E. camaldulensis *woodlands mapped by Pickard & Norris (1994). The background shading indicates elevation, with higher areas darker shades of orange.*

Neagle (2003) notes the conservation reserves that include this community:

> "In the rangelands of SA occurrences of this ecosystem are conserved in the Gammon Ranges, Flinders Ranges and Mount Remarkable National Parks, and The Dutchmans Stern, Mount Brown and Telowie Gorge Conservation Parks. It is not conserved in any conservation reserves in the SA portion of the Broken Hill Complex Bioregion."

The last four of these are small and in the SW of FLB4 (closest to Adelaide); none of the mapped communities (Figure 1) occur in them. Presumably there are some unmapped occurrences there.

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of the communities are listed under the EPBC Act. On an informal level, SA consider this community to be "vulnerable".

Decline in geographic distribution

No information could be identified. SA are currently mapping pre-European distributions of communities, so mapped data may become available. However, riparian communities are not usually threatened by decline in geographic distribution.

Threats to the national ecological community

From Neagle 2003:

- While the overstorey is usually intact the understorey is generally heavily modified by a long history of grazing by domestic stock and feral herbivores. On occasions grazing may also have severely restricted *E. camaldulensis* recruitment. The shade and moisture associated with this ecosystem has made it a focus for large herbivores.
- High stock and feral use has also exposed this ecosystem to soil disturbance and weed invasion, and consequently the understorey often has a high proportion of introduced herbaceous species (Hyde and Playfair 1997).
- While there are a number of occurrences within existing conservation reserves most of these are degraded and limited in extent.

Tourists also contribute to vegetation loss and degradation (through off road driving, trampling and firewood collection), soil compaction and accelerated erosion. Tourist activities particularly impact on limited habitats such as wetlands (Brandle 2001)

Loss or decline of functionally important species

The presence of large trees, in a landscape where these are uncommon, has made this ecosystem a focus for woodcutting and thus significantly impacted the overstorey component (Neagle 2003).

Reduction in ecological community integrity

This NEC is often severely impacted by introduced herbivores as the shade and moisture provides a focus for stock. As a result, the understorey in these instances often consists mainly of introduced herbaceous species (Neagle 2003). For example, *Marrubium vulgare, Cotula coronopifolia, Cynodon dactylon, Polypogon viridis, Nicotiana glauca, Schinus areira, Aster subulatus* are weed species that were recorded regularly in the Flinders Ranges surveys of these communities (Brandle 2001). Where modification has been less severe *Acacia victoriae* (Elegant Wattle), *Maireana pyramidata* (Black Bluebush) and *Enchylaena tomentosa* (Ruby Saltbush) form an open shrubland understorey (Neagle 2003).

Rate of detrimental change

It appears that the threatening processes have been in place over the long term. Data on trends may exist but have not been identified.

Summary and recommendation regarding category of threat under the EPBC Act

If this NEC can truly be regarded as different to other related NECs, then there is evidence under Criterion 4 (reduction in community integrity) that this community is threatened. In addition, the fact that it is poorly reserved across its distribution contributes to the threat to its long-term persistence. Recommendation: this community, once confirmed and supported by state experts, could be nominated for listing as a threatened ecological community.

Outstanding issues

- It is likely that there are comparable communities in Western NSW with respect to floristics and structure, and position in the landscape (on largely intermittent creeks and drainage lines). Currently, these are included in NEC 1.16. If relevant communities can be identified by discussion with experts, they could be added to this NEC if they face similar threats. The current division into NECs is based on the observation that the South Australian communities face different threats because:
    - there is a different land use history in the Flinders and Olary Ranges compared with Western NSW, that has resulted in more extreme alteration from overgrazing
    - there is extra pressure on the SA occurrences from tourism.

  This need to be checked with experts.

- Once confirmed, the mapped communities need to be checked: is other mapping available? Extent and tenure details could then be added.

- The data on occurrences of plant species within floristic units has not been accessed; it may reveal occurrences of significant plants in these communities.

Attachment 18-1: Details of reptile and bird species recorded in these communities from the Flinders Ranges Survey (Brandle 2001)*: reptiles and birds identified in mapping unit 3*

Species name	**Common name**
	REPTILES
Tiliqua rugosa	Sleepy Lizard
Gehyra variegata	Tree Dtella
Ctenotus sp.'saltbush'	Saltbush Ctenotus
Heteronotia binoei	Bynoe's Gecko
Pogona vitticeps	Central Bearded Dragon
Nephrurus milii	Barking Gecko
Diplodactylus vittatus	Eastern Stone Gecko
Rhynchoedura ornata	Beaked Gecko
Ctenotus robustus	Eastern Striped Skink
Cryptoblepharus plagiocephalus	Desert Wall Skink
Ctenophorus vadnappa	Red-barred Dragon
Diplodactylus tessellatus	Tessellated Gecko
Morethia boulengeri	Common Snake-eye
Egernia stokesii	Gidgee Skink
Lerista muelleri	Dwarf Three-toed Slider
Eremiascincus richardsonii	Broad-banded Sandswimmer
Ctenotus regius	Eastern Desert Ctenotus
Strophurus intermedius	Southern Spiny-tailed Gecko
Ctenophorus decresii	Tawny Dragon
Menetia greyii	Dwarf Skink
Gehyra sp.'2n=44'	Southern Rock Dtella
Pseudonaja nuchalis	Western Brown Snake
Gehyra purpurascens	Purple Dtella
Lerista punctatovittata	Spotted Slider
Suta suta	Curl Snake
Demansia psammophis	Yellow-faced Whipsnake
Egernia striolata	Eastern Tree Skink
Amphibolurus nobbi	Nobbi Dragon
Ctenotus saxatilis	Centralian Striped Skink
Delma australis	Barred Snake-lizard
Egernia margaretae	Masked Rock Skink
Lerista bougainvillii	Bougainville's Skink
Lerista desertorum	Great Desert Slider
Lerista labialis	Eastern Two-toed Slider
Lialis burtonis	Burton's Legless Lizard
Pseudechis australis	Mulga Snake
	BIRDS
Acanthagenys rufogularis	Spiny-cheeked Honeyeater
Acanthiza apicalis	Inland Brown Thornbill
Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Acanthiza uropygialis	Chestnut-rumped Thornbill
Acanthorhynchus	Eastern Spinebill tenuirostris
Accipiter fasciatus	Brown Goshawk
Acrocephalus stentoreus	Clamorous Reedwarbler
Aegotheles cristatus	Australian Owlet-nightjar
Anas gracilis	Grey Teal,
Anas superciliosa	Pacific Black Duck
Anthochaera carunculata	Red Wattlebird
Anthus novaeseelandiae	Richard's Pipit
Aphelocephala leucopsis	Southern Whiteface
Aquila audax	Wedge-tailed Eagle
Ardea alba	Great Egret
Artamus cinereus	Black-faced Woodswallow
Artamus cyanopterus	Dusky Woodswallow
Artamus minor	Little Woodswallow
Barnardius zonarius	Port Lincoln Parrot
Cacatua galerita	Sulphur-crested Cockatoo
Cacatua roseicapilla	Galah
Cacatua sanguinea	Little Corella
Cacomantis flabelliformis	Fan-tailed Cuckoo
Chenonetta jubata	Australian Wood Duck,
Chrysococcyx basalis	Horsfield's Bronze-cuckoo
Chrysococcyx osculans	Black-eared Cuckoo
Cinclosoma cinnamomeum	Cinnamon Quail-thrush
Climacteris picumnus	Brown Treecreeper

Species name	**Common name**
Colluricincla harmonica	Grey Shrike-thrush
Coracina novaehollandiae	Black-faced Cuckoo- shrike
Corvus bennetti	Little Crow
Corvus coronoides	Australian Raven
Cracticus torquatus	Grey Butcherbird
Cuculus pallidus	Pallid Cuckoo
Dacelo novaeguineae	Laughing Kookaburra
Daphoenositta chrysoptera	Varied Sittella
Dicaeum hirundinaceum	Mistletoebird
Dromaius novaehollandiae	Emu
Egretta novaehollandiae	White-faced Heron
Elanus axillaris	Black-shouldered Kite
Elseyornis melanops	Black-fronted Dotterel
Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel
Falco longipennis	Australian Hobby
Geopelia cuneata	Diamond Dove
Geopelia placida	Peaceful Dove
Grallina cyanoleuca	Magpie-lark
Gymnorhina tibicen	White-backed Magpie
Hamirostra melanosternon	Black-breasted Buzzard
Hieraaetus morphnoides	Little Eagle
Hirundo neoxena	Welcome Swallow
Lichenostomus penicillatus	White-plumed Honeyeater
Lichenostomus plumulus	Grey-fronted Honeyeater
Lichenostomus virescens	Singing Honeyeater
Malurus lamberti	Purple-backed Wren
Malurus leucopterus	White-winged Fairy- wren
Manorina flavigula	Black-eared Miner
Megalurus gramineus	Little Grassbird
Melithreptus brevirostris	Brown-headed Honeyeater
Melopsittacus undulatus	Budgerigar
Merops ornatus	Rainbow Bee-eater
Myiagra inquieta	Restless Flycatcher
Neophema elegans	Elegant Parrot
Ninox novaeseelandiae	Boobook Owl
Ocyphaps lophotes	Crested Pigeon
Pachycephala rufiventris	Rufous Whistler
Pardalotus striatus	Striated Pardalote
Passer domesticus	House Sparrow
Petrochelidon ariel	Fairy Martin
Petrochelidon nigricans	Tree Martin
Petroica goodenovii	Red-capped Robin
Phalacrocorax melanoleucos	Little Pied Cormorant
Phaps chalcoptera	Common Bronzewing
Phaps elegans	Brush Bronzewing
Phylidonyris albifrons	White-fronted Honeyeater
Platycercus elegans	Yellow Rosella
Podargus strigoides	Tawny Frogmouth
Pomatostomus superciliosus	White-browed Babbler
Psephotus varius	Mulga Parrot
Psophodes cristatus	Chirruping Wedgebill
Pyrrholaemus brunneus	Redthroat
Rhipidura albiscapa	Grey Fantail
Rhipidura leucophrys	Willie Wagtail
Smicrornis brevirostris	Weebill
Taeniopygia guttata	Zebra Finch
Todiramphus pyrrhopygia	Red-backed Kingfisher
Todiramphus sancta	Sacred Kingfisher
Zosterops lateralis	Silvereye

NEC 1.19: River red gum and / or coolibah woodlands of the Mitchell Grass Downs and Mount Isa Inlier bioregions (and neighbouring areas)

This NEC description is not fully developed because priority was given to completing NECs where there were definite indications of threat, and because this NEC may be better included with tropical woodlands. Explanation of the proposed membership of this community, some relevant information, and references to further data are provided; the information indicates that these woodlands are not threatened, although there are processes impacting on them in some areas.

General comments

This NECs includes the more tropical woodlands, and separates them from those further south. It is a diverse group and could be divided - for example, on the basis of dominant species. The included sub-communities are listed in Table 1, with floristic details in Attachment 19-1. These communities have been summarised in the tropical savannas mapping (Fox *et al* 2001) as two communities (Table 1). One is mainly woodland in these bioregions, can be dominated by *E. camaldulensis* and / or coolibahs, and occurs in Queensland. The other is mainly low open woodlands in these bioregions, can be dominated by coolibahs, and occurs in the NT (Table 1). The communities mapped in the tropical data also extend well into areas outside the semi-arid boundary; therefore, this NEC may be more appropriately combined with riparian NECs in the tropics.

Further details of the component communities are presented in Attachment 19-1.

Riparian woodlands often support a diverse fauna. Sattler and Williams (1999) note that all the Qld REs tabled here are areas of high fauna diversity; two of them (RE 1.3.2 and 4.3.11) are habitat for waterbirds. There has been little systematic survey for fauna in the MGD; Sattler and Williams (1999, pg 4/7) note relevant works and comment that "wooded communities, particularly those along watercourses, support the highest number of bird, amphibian and mammal species." Details have not been collected for this NEC.

Summary and recommendation regarding category of threat under the EPBC Act

Despite sometimes extensive and long-term impacts from grazing, this NEC does not appear to be eligible for listing. However, components of it are threatened (Table 2) and if there is evidence that these face particular threatening processes unique to them, or if they respond differently to these threats compared with other sub-communities, arguments could be developed to separate some or all of them into separate NECs.

Table 1: Sub-communities of NEC 1.19. Note that components from the tropical mapping are summaries of others, so they are not independent records.

Name	Unit code	Source, update names, comments	State	IBRA region (subregion)	Comments / EPA status for Qld REs
Eucalyptus camaldulensis and/or *Eucalyptus microtheca* woodland or *Dichanthium* spp. grassland on channels and levees	C13	Tropical savannas mapping			Only two units of C13 are relevant: Q100, Q102 (Table 2)
Eucalyptus microtheca or *Eucalyptus gymnoteles* or *Eucalyptus acroleuca* +/- *Excoecaria parvifolia* +/- grassy low woodland	C21	Tropical savannas mapping			Only these units are relevant: N25, 26 and 28 (Table 2) N24 is shown in Figure 1, but is excluded because it is primarily outside the arid / semi-arid zone.
Eucalyptus microtheca (Coolibah) low open-woodland with *Eulalia aurea* (Silky browntop), *Dichanthium* (Bluegrass) grassland understorey	MU25 & DVT 108	*E. cyanoclada*	NT	MGD (and also to north)	
E. microtheca low open-woodland with *Eulalia aurea* (Silky Browntop), *Astrebla* (Mitchell Grass) grassland understorey	MU26 & DVT 109	*E. barklyensis*	NT	MGD (minor amts in TAN, DMR)	
E. microtheca (Coolibah) low open-woodland with *Chenopodium auricomum* (Bluebush) sparse-shrubland understorey	MU28 & DVT58	probably *E. barklyensis* or *E. helenae*	NT	MGD (and minor amts in DMR)	
Coolibah (*Eucalyptus microtheca*) low open woodland on alluvial floodplains and channels.	RE 1.3.2	Prov 1	QLD	MII (1)	Of concern
Red gum (*Eucalyptus camaldulensis*) woodland on channels and levees (south).	RE 1.3.7	Prov 3. This also occurs in Prov 4, but that is now GFU bioregion	QLD	MII (3)	Endangered
Eucalyptus camaldulensis ± *Melaleuca* spp. woodland on drainage lines.	RE 4.3.1	Prov1,2,3,5	QLD	MGD (3,4,5,7)	No concern at present
Eucalyptus coolabah ± *E. camaldulensis* open woodland on alluvium, billabongs and permanent waterholes.	RE 4.3.11	Prov 1,2,3,5,7	QLD	MGD (3,4,5,7,2)	Of concern
Eucalyptus camaldulensis ± *E. coolabah* woodland on drainage lines.	RE 4.3.2	Prov 1,2,4	QLD	MGD (3,4,8)	No concern at present
Eucalyptus coolabah, E. camaldulensis ± *Lysiphyllum gilvum* open woodland on drainage lines.	RE 4.3.3	Prov 1,2,4,5,7	QLD	MGD (3,4,8,7,2)	Of concern
Eucalyptus coolabah open woodland on drainage lines/plains.	RE 4.3.4.	Prov 1,2,6	QLD	MGD (3,4,6)	No concern at present
Eucalyptus coolabah ± *E. camaldulensis* ± *Acacia georginae* open woodland on drainage lines/plains.	RE 4.3.5	Prov 1	QLD	MGD (3)	No concern at present

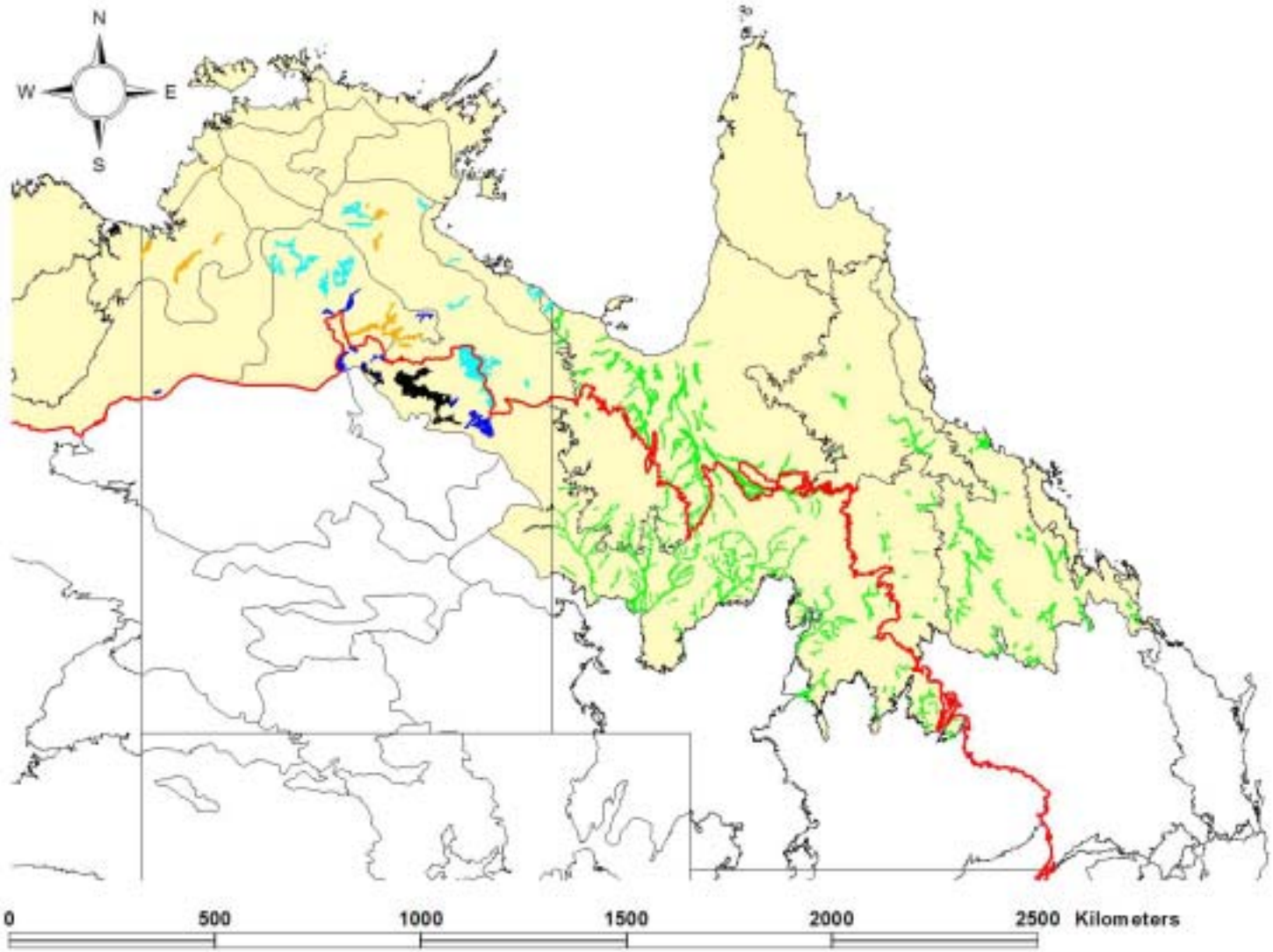

Figure 1: Mapping of riparian vegetation from the tropical savannas mapping (Fox et al 2001). *The arid / semi-arid zone is inland of the red line; black lines bound the IBRA regions. The communities are: C13 where it is also Q100 (green); C21 where it is N24 (orange), N25 (aqua), N26(royal blue), N28 (black). The tropical savanna zone is shaded buff. None of these communities are mapped further west.*

Table 2: Sub-communities: percent remaining, reservation and threatening processes. *From Environmental Protection Agency Qld (2003b, Woinarski (2002).*

Unit ID or source (EPA Qld status)	% of pre-European remaining	Extent reserved	Protected areas	Threatening processes
RE 1.3.2 (Of concern)	>30%	Low	Camooweal Caves NP	High total grazing pressure leading to degradation along watercourses. Outlier of Mitchell Grass Downs bioregion.
RE 1.3.7 (Endangered)	>30%	None		Severely degraded by high total grazing pressure. Survey required to verify condition and faunal values.
RE 4.3.1 (No concern)	>30%	Low	Diamantina NP	Highly modified floristic and structural composition due to total grazing pressure.
RE 4.3.2 (No concern)	>30%	Low	Outlier in Welford NP (CHC)	Highly modified structural and floristic composition. Subject to buffel grass (*Cenchrus ciliaris*) invasion.
RE 4.3.3 (Of concern)	>30%	Low	Idalia NP	Highly modified floristic and structural composition due to total grazing pressure.
RE 4.3.4 (No concern)	>30%	None		
RE 4.3.5 (No concern)	>30%	None		
RE 4.3.11 (Of concern)	>30%	None		Highly modified floristic and structural composition due to total grazing pressure.
NT communities	The biodiveristy summaries of Woinarski (2002) (Attachment 16-3, NEC 1.16) suggest generally inadequate reservation in the bioregions that are wholly within NT. No details for MGD. Details of communities in National Parks and reserves have not been collected.			Woinarski (2002) makes a number of pertinent comments – (Attachment 16-3, NEC 1.16). These identify grazing, feral animals, exotic weeds and changed fire regimes as threatening processes in the bioregions that are wholly within NT.

Attachment 19-1: Details of the component communities. *Note that much of this text is taken directly from the source references*

Unit	Source	Description	Frequent species	Notes
1.3.2	Neldner (1991) MU17 FA 65	*Eucalyptus coolabah* ± *Lysiphyllum gilvum* ± *Acacia cambage*i low open-woodland. *Eucalyptus coolabah* predominates forming a well defined but discontinuous canopy (7-11 m tall) with scattered tall shrubs and low trees occurring beneath it. Low shrubs are present, and may form a distinct layer (1-2 m tall) dominated by *Muehlenbeckia florulenta* and *Chenopodium auricomum* in the wetter channels and swamps. The seasonally variable ground layer is open to dense, and usually dominated by perennial grasses, or in favourable seasons by ephemeral herbs. *Astrebla* spp., and *Eulalia aurea* and *Chrysopogon fallax* (sandier clays), usually dominate the interchannel flats, while *Paspalidium jubiflorum, Cyperus victoriensis, Dichanthium fecundum, Leptochloa digitata* and *Sporobolus mitchellii* dominate on the channel banks. Tree/tall shrub layer: Ht. 5-11 m (3-4 m in infrequently flooded areas); Cover <5-10% (occasionally 30%); Density <25-150 trees/ha.	Upper*: Eucalyptus coolabah, Acacia cambagei* (in places), *A. salicina, A. stenophylla, Eremophila bignoniiflora, Lysiphyllum gilvum.* Mid: *Acacia farnesiana, A. victoriae, Chenopodium auricomum, Eremophila maculata, Maireana aphylla, Muehlenbeckia florulenta.* Forbs*: Aeschynomene indica, Alternanthera nodiflora, Ammannia multiflora, Boerhavia* spp*., Calotis hispidula, Centipeda thespidioides, Chamaesyce drummondii, Commelina ensifolia, Corchorus trilocularis, Cullen cinereum, Daucus glochidiatus, Epaltes cunninghamii, Eryngium supinum, Goodenia fascicularis, G. lunata, Haloragis glauca, Hibiscus trionum, Ipomoea lonchophylla, Malvastrum americanum, Marsilea drummondii, Minuria integerrima, Neptunia gracilis f. gracilis, Phyllanthus maderaspatensis* var*. angustifolius, Plantago cunninghamii, Polymeria longifolia, Portulaca oleracea, Ptilotus exaltatus* var*. exaltatus, Pycnosorus* spp*., Rhodanthe stricta, Salsola kali, Sclerolaena muricata, Sida fibulifera, Tribulus terrestris, Trigonella suavissima.* Graminoids*: Aristida latifolia, Astrebla elymoides, A. pectinata, A. squarrosa* (in depressions), *Bothriochloa ewartiana, Brachyachne convergens, Chloris pectinata, Chrysopogon fallax, Cyperus bifax, C. victoriensis, Dactyloctenium radulans, Dichanthium fecundum, D. sericeum, Eleocharis pallens, Elytrophorus spicatus, Enneapogon avenaceus, Enteropogon acicularis, Eragrostis microcarpa, E. setifolia, E. tenellula, Eriachne benthamii, Eulalia aurea, Iseilema* spp*; Leptochloa digitata, Leptochloa fusca* ssp*. fusca, Panicum decompositum, P. laevinode, Paspalidium jubiflorum, Sporobolus mitchellii.*	**other surveys also relevant as Neldner only covers southern parts of MII. Widespread on alluvial plains of south-western flowing rivers, where it occurs along seasonally flooded drainage lines and on flat plains inundated by high level general floods. Soils very deep, alkaline, grey, red or brown cracking clays with some alluvial texture contrast soils. Low woodland may develop along larger channels, while wooded tussock grasslands occur on drier areas of flat plains. Tree height decreases in less frequently flooded areas. Ground layer most frequently dominated by perennial grasses, with species dominance changing with position (which determines flooding frequencies and intensities) and minor differences in soil type. Mapped as unit 17a. Where *Muehlenbeckia florulenta* becomes prominent grades into unit 18. In limited area east of Toko Range, *Eucalyptus coolabah* forms low open-woodland in swales between low sand dunes. Shrub and ground layers contain similar species to association 108, with *Eremophila obovata, E. macdonnellii, Crotalaria eremaea* and *Triodia basedowii* conspicuous. This association is mapped as 17c.
1.3.7	Neldner (1991) MU1c FA 58	*Eucalyptus camaldulensis* ± *Acacia aneura* ± *A. cambagei* ± *A. cyperophylla* var. *cyperophylla* fringing woodland.	Upper*: Eucalyptus camaldulensis, Acacia aneura, A. cambagei, A. cyperophylla* var*. cyperophylla, A. ensifolia* (in places), *A. shirleyi, Eucalyptus coolabah* (in places), *E. normantonensis* (in places), *Grevillea striata, Santalum lanceolatum.*	**other surveys also relevant as Neldner only covers southern parts of MII. Also see other FAs below

		Eucalyptus camaldulensis usually predominates, but a number of *Acacia* species may be present and form part of the open canopy. Scattered low shrubs are usually present, but do not form a distinct layer. The ground layer is sparse to open, and dominated by tussock grasses. Tree/tall shrub layer: Ht. 6-12 m; Cover 8-20%; Density 50-200 trees/ha.	Mid*: Acacia ligulata, A. cowleana, A. farnesiana, A. tetragonophylla, Capparis lasiantha, Carissa lanceolata, Eremophila latrobei, Gossypium sturtianum, Petalostylis cassioides, Senna artemisioides* ssp*. oligophylla.* Forbs*: Einadia nutans* ssp*. linifolia, Scaevola* sp*.* Graminoids*: Bothriochloa ewartiana, Chrysopogon fallax, Enteropogon acicularis, Eragrostis elongata, E. setifolia, Eriachne mucronata, Eulalia aurea, Themeda triandra, Triodia longiceps* (in places).	Limited in extent. Restricted to streamlines and channels draining dissected residuals and plateaus in east and south-east. Soils gravelly loams to sandy clay loams. Mapped as unit 1d and grades into 1a on major streams. In Toko Ranges, a related association is dominated by *Eucalyptus camaldulensis, Acacia georginae, A. cyperophylla* var. *cyperophylla* and *Atalaya hemiglauca*. *Senna artemisioides* ssp. *oligophylla* and *Eremophila freelingii* are most frequent shrubs. This association is mapped as unit 1c.
1.3.7 & 4.3.3 & 4.3.5 & 4.3.11	Neldner (1991) MU2a & 2c & 51a FA 63	*Eucalyptus coolabah* ± *E. camaldulensis* ± *Lysiphyllum gilvum* open-woodland. *Eucalyptus coolabah* usually predominates forming a distinct but discontinuous upper canopy layer. *E. camaldulensis* is conspicuous in sandy or gravelly channels. A lower tree understorey or tall shrub layer may be present in places. Low shrubs frequently occur and in places form a distinct layer. The ground layer is variable being composed of grasses and forbs with either predominating depending on seasonal conditions. Tree/tall shrub layer: Ht. 7-14 m; Cover 5-35%; Density 100-400 trees/ha.	Upper*: Eucalyptus camaldulensis, E. coolabah, Acacia cambagei* (in places), *A. salicina, A. stenophylla, Corymbia terminalis, Lysiphyllum gilvum, Melaleuca trichostachya* (in major channels). Mid*: Acacia tetragonophylla, A. victoriae, Capparis lasiantha, Chenopodium auricomum, Eremophila bignoniiflora, E. mitchellii, E. polyclada, Muehlenbeckia florulenta, Senna artemisioides* ssp*. coriacea.* Forbs*: Abutilon otocarpum, A. oxycarpum, Aeschynomene indica, Alternanthera nodiflora, Atriplex muelleri, A. spongiosa, A. vesicaria, Boerhavia* spp*., Calotis hispidula, C. inermis, Centipeda thespidioides, Cullen cinereum, C. patens, Goodenia fascicularis, Indigofera linnaei, Maireana villosa, Malvastrum americanum, Marsilea drummondii, M. hirsuta, Minuria integerrima, Neptunia dimorphantha, Portulaca oleracea, Salsola kali, Sclerolaena muricata, Sida* spp*., Solanum esuriale, Sphaeranthus indicus, Trianthema portulacastrum, Trichodesma zeylanicum.* Graminoids*: Aristida contorta, A. jerichoensis, Astrebla lappacea, A. squarrosa, Bothriochloa ewartiana, Chloris pectinata, Chrysopogon fallax, Cyperus bifax, C. dactylotes, C. difformis, C. victoriensis, Dactyloctenium radulans, Dichanthium sericeum* ssp*. humilius, D. sericeum* ssp*. sericeum, D. sericeum* ssp*. polystachyum, Digitaria brownii, D. coenicola, Eleocharis pallens, Eragrostis cilianensis, E. dielsii, E. elongata, E. tenellula, Eriochloa pseudoacrotricha, Eulalia aurea, Iseilema membranaceum, Leptochloa digitata, Panicum laevinode, Paspalidium jubiflorum, Sporobolus actinocladus, S. mitchellii, Themeda triandra, Tripogon loliiformis.*	****other surveys also relevant as Neldner 1991 only covers southern parts of MII. Neldner 84 also informs RE 4.3.3, but almost all outside MGD so not included Widespread throughout the region on levees and banks of major drainage channels on braided alluvial plains. Soils very deep, brown or grey clays with sand and silt bands common in profile. Floristically and structurally varies considerably. Asteraceae prevalent following favourable seasons. Forms mapping unit 2a. Lines the Georgina River, with *Acacia georginae* a frequent tall shrub, in this situation mapped as unit 2c. Also surrounds permanent waterholes in major rivers, in these situations mapped as unit 51a.
4.3.1 & 1.3.7	Neldner (1991)	*Eucalyptus camaldulensis* ± *E. coolabah* ± *Melaleuca* spp.	Upper*: Eucalyptus camaldulensis, Atalaya hemiglauca, Eucalyptus coolabah, Lophostemon grandiflorus* ssp*. riparius, Melaleuca argentea,*	Widespread along sandy or gravelly drainage lines, channels and inter-

	MU1a FA60	woodland. *Eucalyptus camaldulensis* dominates the streamlines forming a fringing woodland (10-18 m high). *E. coolabah* is frequently present on the top of the river banks. *Melaleuca argentea* is present in the bed of major channels in the north, while *M. trichostachya* occupies this habitat further south. *M. bracteata* occurs along minor channels in the north, while *Lophostemon grandiflorus ssp*. *riparius* is occasionally present on the banks of major northern rivers. Shrubs are usually sparse in the streamlines, but *Acacia farnesiana* and *Parkinsonia aculeata* may occur in dense stands above the river banks. The ground layer is dense and dominated by tussock grasses, with *Bothriochloa* spp., *Cenchrus pennisetiformis, Dichanthium fecundum* and *Themeda* spp. usually dominating. Sedges are frequent on the channel floors and banks. Tree/tall shrub layer: Ht. 3-18 m; Cover 10-30%; Density 100-250 trees/ha.	*M. bracteata, M. trichostachya.* Mid*: Acacia farnesiana, A. hemsleyi* (in north), *A. holosericea* (in north), *A. salicina* (in places), *Amyema sanguineum* var*. sanguineum, Gossypium australe, Parkinsonia aculeata.* Forbs*: Acanthospermum hispidum, Achyranthes aspera, Aeschynomene indica, Argemone ochroleuca* ssp*. ochroleuca, Bonamia media* var*. media, Chamaesyce mitchelliana, Cleome viscosa, Crotalaria novae-hollandiae, Cullen patens, Evolvulus alsinoides, Heliotropium ovalifolium, Hibiscus meraukensis, Ipomoea muelleri, Malvastrum americanum, Mukia maderaspatana, Phyllanthus maderaspatensis* var*. angustifolius, Sida rohlenae, Tephrosia brachyodon, Trichodesma zeylanicum, Wahlenbergia gracilis, Waltheria indica, Xanthium occidentale.* Graminoids*: Aristida biglandulosa, Bothriochloa decipiens* var*. cloncurrensis, B. ewartiana, Brachiaria subquadripara, Cenchrus pennisetiformis, Chrysopogon fallax, Cyperus conicus, C. dactylotes, C. victoriensis, Dichanthium fecundum, Enteropogon acicularis, E. ramosus, Eragrostis elongata, E. speciosa, Eriochloa procera, Eulalia aurea, Fimbristylis littoralis, Iseilema vaginiflorum, Juncus continuus, Leptochloa digitata, Panicum decompositum, Paspalidium jubiflorum* (on clays), *Themeda avenacea, T. triandra.*	channel areas of north-western river systems. Soils very deep, coarse sands, silty clays, sandy clay loams and gravelly loams. Tree height and the width of this association reduced on minor streamlines draining Mount Isa highlands. Exotic weed species occur in disturbed sandy areas. Mapped as unit 1a, grades into unit 2a in places.
4.3.2 & 1.3.7	Neldner (1991) MU1b FA 59	*Eucalyptus camaldulensis* ± *E. coolabah* woodland. *Eucalyptus camaldulensis* predominates in the gravelly and sandy major channels, while *E. coolabah* usually predominates on the clayey plains and banks adjacent to the major channels. A distinct but discontinuous, canopy	Upper*: Eucalyptus camaldulensis, E. coolabah, Acacia holosericea, A. salicina, A. stenophylla.* Mid: *Acacia farnesiana, A. tetragonophylla, Capparis lasiantha, Eremophila bignoniiflora.* Forbs*: Achyranthes aspera, Alternanthera nodiflora, Argemone ochroleuca* ssp*. ochroleuca, Centipeda thespidioides, Chamaesyce drummondii, Cleome viscosa, Cullen cinereum, Heliotropium ovalifolium, Indigofera colutea, Ipomoea muelleri, Malvastrum americanum, Phyllanthus maderaspatensis* var*. angustifolius, Salsola kali, Sclerolaena anisacanthoides, Trichodesma zeylanicum, Xanthium occidentale.*	Widespread along sandy or gravelly drainage lines, channels and inter-channel flats of northern river systems. Also occurs as low woodland in drainage lines of some residuals. Soils variable and include deep, loose coarse sands, silty clays, sandy clay loams and very gravelly loams. Mapped as unit 1b, but may grade into unit 2a.

		is formed, with both *E. camaldulensis* and *E. coolabah* sometimes being present. Scattered shrubs may occur, but rarely form a well defined layer. The ground layer is open and dominated by perennial grasses. Scattered forbs are present, and disturbed sandy areas are often invaded by introduced weeds. Tree/tall shrub layer: Ht. 8-13 m; Cover <10-50%; Density 25-225 trees/ha.	Graminoids*: Aristida holathera* var*. holathera* (sandy areas), *A. latifolia, Arundinella nepalensis, Bothriochloa decipiens* var*. cloncurrensis, B. ewartiana, Cenchrus pennisetiformis, Chrysopogon fallax, Cyperus conicus, C. dactylotes, C. victoriensis, Dichanthium fecundum, Echinochloa colona, Enteropogon acicularis, Fimbristylis littoralis, Iseilema vaginiflorum, Leptochloa digitata, Panicum decompositum, Paspalidium jubiflorum, Themeda avenacea, T. triandra.*	
4.3.4 & 1.3.7	Neldner (1991) MU2b MU 64	*Eucalyptus coolabah* open-woodland. *Eucalyptus coolabah* predominates forming a distinct but discontinuous upper layer. Tall shrubs may be conspicuous but rarely form a distinct layer. Low shrubs sometimes occur, but rarely form a well defined layer. The ground flora is variable with either grasses or forbs conspicuous depending on seasonal conditions. In places there is little or no ground layer present. Tree/tall shrub layer: Ht. 5-13 m; Cover 2.5-12.5%; Density 60-140 trees/ha.	Upper*: Eucalyptus coolabah, Acacia stenophylla, Eremophila bignoniiflora, Lysiphyllum gilvum.* Mid *Acacia farnesiana, A. victoriae, Eremophila maculata.* Forbs*: Aeschynomene indica, Alternanthera nodiflora, Boerhavia* spp*., Centipeda thespidioides, Commelina ensifolia, Cullen cinereum, Malvastrum americanum, Marsilea* spp*., Phyllanthus maderaspatensis* var*. angustifolius, Portulaca oleracea, Salsola kali, Sclerolaena muricata, Sida filiformis, Teucrium integrifolium, Tribulus terrestris, Xanthium occidentale.* Graminoids*: Astrebla lappacea, A. squarrosa, Brachyachne convergens, Chrysopogon fallax, Cynodon dactylon, Cyperus bifax, C. tuberosus, C. victoriensis, Chloris pectinata, Dactyloctenium radulans, Dichanthium fecundum, D. sericeum, Eragrostis setifolia, E. tenellula, Eulalia aurea, Iseilema membranaceum, I. vaginiflorum, Leptochloa digitata, Panicum decompositum, Paspalidium jubiflorum, Sporobolus actinocladus, S. mitchellii.*	Restricted to drainage lines on *Astrebla* spp. undulating plains and braided channels on alluvial plains, particularly in north-east. Soils deep, grey and brown cracking clays. Sand and silt bands may occur in profile. Floristics variable. Forms map unit 2b.
Q100	Fox et al (2001)	*Eucalyptus camaldulensis* and/or *E. microtheca +/- Melaleuca argentea +/- M. leucadendra +/- Corymbia* spp. *+/- Acacia* spp. *+/- Eucalyptus* spp.*+/- Lysiphyllum* spp. *+/- Excoecaria parvifolia* woodland to open woodland along river channels and levees. (Mapped as the major component of all green polygons in Fig 1)		
Q102	Fox et al (2001)	Ephemeral lakes with *Eucalyptus microtheca +/- E. camaldulensis* (or claypans with sparse herblands) and/or open succulent shrubland. (Mapped as a secondary component of some green polygons in Fig 1)		
NT MU 25 = N25 in	Wilson (1990)	Name: *Eucalyptus microtheca* (Coolibah) low open-woodland with *Eulalia aurea* (Silky browntop), *Dichanthium* (Bluegrass) grassland understorey Upper: *Eucalyptus microtheca, Terminalia platyphylla, Ventilago viminalis* Mid: *Carissa lanceolata, Excoecaria parvifolia, Hakea chordophylla*		

tropical mapping		Ground: *Chrysopogon fallax, Aristida latifolia, Eulalia aurea* On heavy grey clay alluvial soils Note: this community is also to the north; only the mapped component within the semi-arid boundary is included here
NT MU 26 = N26 in tropical mapping	Wilson (1990)	*E. microtheca* low open-woodland with *Eulalia aurea* (Silky Browntop), *Astrebla* (Mitchell Grass) grassland understorey The tree canopy is low and sparse and dominated by *E. microtheca* and *Lophostemon grandiflorus* may co-domiante at some sites. Shrub layer is sparse or absent. Ground layer dominated by *Eulalia aurea, Astrebla pectinata* or *Astrebla elymoides* (in slightly wetter areas). Occurs on low lying flat plains on the Barkly Tableands, fringing watercourses and swamps which receive intermittent flooding. Soils are light to heavy grey and brown clays with some loamy soil along watercourses. This community merges with MU 25 (*E. microtheca* low open-woodland) which occurs on heavier soils and along drainage lines to the north. It intermixes with *Astrebla* grasslands (MU 96) on the Barkly Tablelands. Average height of trees = 5m average height of shrubs = 1.7m and average height of grasses = 0.5m. Average Cover trees = 9%, shrubs = 7% and grasses = 52%.
NT MU 28 = N28 in tropical mapping	Wilson (1990)	*E. microtheca* (Coolibah) low open-woodland with *Chenopodium auricomum* (Bluebush) sparse-shrubland understorey Overstorey domianted by *E. microtheca* with occasional *Acacia stenophylla*. Understorey is sparse, often discontinuous shrub layer of *Chenopodium auricomum*, *Atriplex nummularia* and *Muehlenbeckia cunninghamii*. Grass layer is occasionally present with species such as *Zygochloa paradoxa*, *Eulalia aurea, Dichanthium fecundum, Astrida latifolia* and *Panicum* spp. Occurs mainly in the broad intermittent drainage depressions in the lower half of the Barkly Tablelands which may be flooded for several months of the year. Soils are generally heavy grey clays. Minor occurrences of MU 27 may occur in this map unit on the river floodouts to the south.

NEC 1.20: Yapunyah woodlands

Description

Key flora and fauna, and abiotic elements

These woodlands are dominated by *Eucalyptus ochrophloia* (Yapunyah). They are proposed as a separate NEC because they are a distinct community. They are distinguished from the NEC that they are most closely related to (NEC 1.14: Coolibah woodlands and open woodlands of the Mulga Lands and Darling Riverine Plains) by the presence of different threatening processes and occurrence over a much broader region.

The sub-communities comprising this NEC are mapped and / or described in various places (Table 1). In summary, this community is dominated by Yapunyah (*Eucalyptus ochrophloia*) that, in NSW, often occurs in monospecific stands, or is mixed with *E. coolabah* and / or *E. largiflorens*. There is often an understorey of shrubs such as *Acacia victoriae*, *A. stenophylla*, *A. cambagei* and *Eremophila* spp; these are usually sparse, but *A. cambagei* is conspicuous in some of the Queensland communities. The shrub layer is not well defined in the Queensland low-open woodlands of this NEC (Boyland 1984). The ground cover is seasonally variable, composed of annual and / or perennial grasses and ephemeral herbs, and varies in cover from sparse to open (Benson in prep, Neldner 1984, Boyland 1984; Attachment 20-1).

Structure ranges from open forest to low open woodland, with tree projective foliage cover ranging from 5 to 25%, and tree height from 6 to 15m.

Table 1: Sources of information and mapping for NEC 1.20

Sub-community / Regional Ecosystem name	Unit id or source	State	IBRA region (subregions)	Threat category and comments
Eucalyptus ochrophloia ± *Acacia cambagei* ± *E. coolabah* woodland on alluvium.	RE 6.3.5	QLD	MUL (7,11,8,9)	Not of concern (VMA), No concern at present (EPA)
Eucalyptus ocrophloia open woodland	NVIS mapping NSW_ID 20500043	NSW	MUL	
Eucalyptus ocrophloia open forest	NVIS mapping NSW_ID 21900045 (P&N3)	NSW	MUL	
Yapunyah communities	Millthorpe (1991)	NSW	MUL?	
Eucalyptus ochrophloia open forest	Pickard & Norris (1994), unit 3	NSW	MUL	These are included in Benson's group ID67
Yapunyah woodland of Cuttaburra-Paroo River system, Mulga Lands Bioregion	Benson (in prep), ID 67	NSW	MUL	Benson's threat category = Least concern, but notes that it could become threatened if if the flooding regimes of the Paroo River were to change in the future.

In NSW this community occurs on compact brown clays, red texture-contrast soils, and stony beds of streams (Benson in prep). In south-west Queensland it has been recorded on deep cracking grey soils and texture contrast soils (Boyland 1984), and further east on neutral to alkine, deep to very deep grey or brown alluvial craking clays and occasionally on associated texture contrast soils (floristic

association 28); and complexes of red and brown alluvial texture contrast soils and brown and grey heavy alluvial clays (floristic association 29) (Neldner 1984).

In the landscape it occupies floodplains and associated channels, and pans and sandy rises subject to periodic (but not frequent) inundation (Benson, in prep; Boyland 1984; Figure 1).

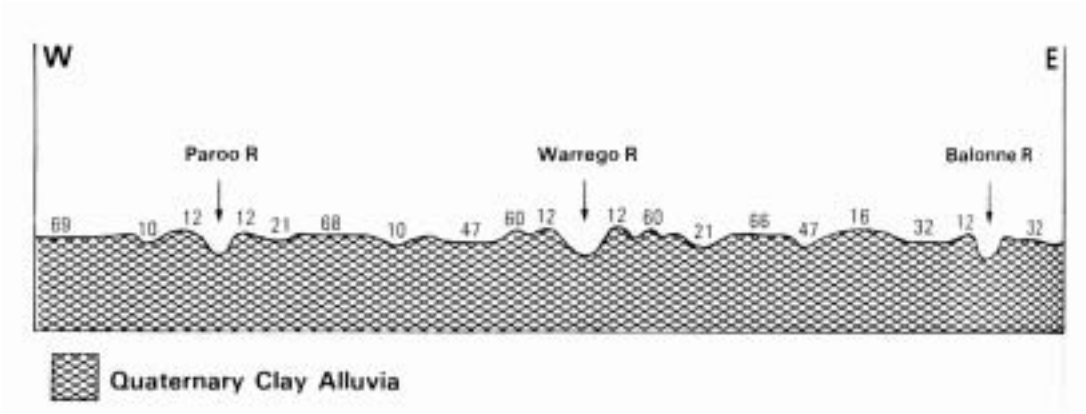

Figure 1: Position in the landscape of vegetation of south central Queensland around the Warrego River *(from Neldner 1984). Map units are the numbers along the landscape profile. The woodlands in this NEC are part of map unit 21; other neighbouring units are* E. camaldulensis ± E. coolabah *woodlands (map unit 12),* E. coolabah *communities (map units 47 and 32) and* Acacia victoriae ± Eucalyptus *spp. tall open woodland (map unit 60)*

In NSW, this community grades into River Red Gum in some areas along watercourses and into Mulga shrubland upslope distant from the watercourses (Benson, in prep). In Queensland, *E. largiflorens* woodlands are in similar situations further to the south. *Acacia*– dominated shrublands and *E. coolabah* or *E. camaldulensis* woodlands may be nearby (Figure 1).

In common with other riparian NECs, this community is rich in fauna. We have not identified records that clearly link species with Yapunyah woodlands specifically, but at a more general level it is clear that the riparian woodlands in this area provide important habitat for a range of species. For example, the Nocoleche Nature Reserve is on the Paroo River system. Its management plan (National Parks and Wildlife Service NSW 2000) details birds observed in the reserve that are listed:

> "Fourteen species of birds recorded on the Nocoleche are listed under the [NSW] *Threatened Species Conservation Act 1995*. These include the Australian bustard (*Ardeotis australis)*, brolga (*Grus rubicundus)*, freckled duck (*Stictonetta naevosa)*, blue-billed duck (*Oxyura australis)*, pink cockatoo (*Cacatua leadbeateri)*, grey falcon (*Falco hypoleucos)*, black-breasted buzzard (*Hamirostra melanosternon)*, square-tailed kite (*Lophoictinia isura)*, Hall's babbler (*Pomatostamus halli)*, Bourke's parrot (*Neophema bourkii)*, red-browed pardalote (*Pardalotus rubricatus)*, pied honeyeater (*Certhionyx variegatus)* and brown quail (*Coturnix yspilophora)*".

Waterbirds use floodplain trees for nesting (Kingsford and Porter 1999), so it is likely that at least some of these may be part of this NEC. The management plan also records other fauna, but there is no data on links to specific vegetation. The Nocoleche Nature Reserve also contains, in one small wetland, the only known NSW occurrence of an aquatic plant listed as endangered under the NSW *Threatened Species Conservation Act 1995*. The listing advice (National Parks and Wildlife Service NSW 2003b) includes the following (with parts pertaining to the woodland in bold):

> "In Nocoleche, *Aponogeton queenslandicus* occurs in an ephemeral swamp of lignum (*Muehlenbeckia florulenta*) with **fringing *Eucalyptus ochrophloia* (Yapunyah)** and *E. largiflorens* (black box) trees, on the edge of the Paroo River floodplain…. Threats to the species involve changes to the flooding regime of the Paroo River and associated floodplain… **Increased salinity levels caused by floodplain clearing** and irrigation are

also a **potential threat**. Due to the small population size and extent the species is susceptible to catastrophic events and localised extinction".

This species is not directly a part of this NEC, but is clearly dependent on its persistence.

The National Parks and Wildlife Service NSW (2003) comment, regarding the Paroo Overflow at the southern edge of the Paroo Catchment, that "Lignum, black-box, Yapunyah, canegrass and expanses of grasses on the Overflow provide important habitat for waterbirds and other fauna". Sattler and Williams (1999) comment that it has a high diversity, particularly of bird species.

Morton *et al*'s (1995) analysis of refugia for biological diversity in arid and semi-arid Australia also refers to a number of the wetlands associated with the rivers and creeks of these IBRA regions, and gives important details of the refuge value, listed and other important species, key threats, and further references. They identify the Paroo wetlands as a significant refuge, because they provide a wide range of habitats and a major drought refuge for waterbirds.

In Queensland, regional ecosystem 6.3.5 is in the Mulga Lands. Sattler and Williams (1999) report that there has been little systematic fauna survey in this bioregion; they list those surveys that have been done (their Table 6.5, page 6/31). They comment that, in the Mulga Lands, the eucalypt woodlands associated with riparian areas show the highest species richness per unit area, particularly in the bird and plant taxonomic groups. Wilson (1997) details numbers of species in the riparian eucalypt woodlands. He records the following numbers of species in each group: 339 plant, 234 bird, 41 mammal, 51 reptile and 20 amphibian.

Processes by which the biotic and abiotic elements interact

Riparian eucalypt woodlands are reliant on the maintenance of suitable flooding regimes for their persistence. Flooding initiates germination and establishment, and mature trees rely on ground water and widespread flooding at least once every ten years (Cassanova 1999).

Other distinguishing features

The NEC is identified as an unusual community and of particular interest by, e.g., National Parks and Wildlife Service NSW (2000) and Kingsford and Porter (1999). Sattler and Williams (1999) comment that it is highly valued for honey production.

Natural distribution

Known natural distribution (including bioregions, conservation areas)

In NSW, Benson (in prep) describes the distribution of Yapunyah woodlands as:

> "restricted to the Paroo River reaching as far south as Peery Lake, the lower reaches of Purnanga and Dingo Creeks and the channels of Cuttabutta Creek in the Cuttaburra-Paroo Province of the Mulga Lands Bioregion, far north western NSW".

He lists the proportional occurrences in the subregions as: Cuttaburra-Paroo (MUL7) (>70%); White Cliffs Plateau (MUL14) (1 - 30%); Urisino Sandplains (MUL11) (1 - 30%); Paroo Overflow (MUL15) (1 - 30%); Kerribee Basin (MUL13) (1 - 30%); Tablelands and Downs (MUL8) (1 - 30%); Warrego Plains (MUL5) (1 - 30%); Warrego Sands (MUL12) (1 - 30%). These subregions are shaded in Figure 2.

In Queensland, Sattler and Williams (1999) place it in Provinces 7, 8 and 9 of the Mulga Lands, which equates to subregions 7, 11, 8 and 9 (Appendix 3 to Introduction). These subregions are indicated in Figure 2. More specifically, Boyland (1984) records it as "generally confined to alluvial plains of the Bulloo and Wilson Rivers and to those of Cooper Creek to a much lesser degree"; Neldner (1984) places his floristic association 28 (*E. ochrophloia* woodlands) "on alluvial plains associated with the

Warrego, Paroo, and Bulloo Rivers", and floristic association 29 (*E. ochrophloia* shrubby woodland) on "flat alluvial plains along the Bulloo River and Blackwater Creek". These records, and the maps that accompany them, extend the occurrences into the MUL10 and CHC8 subregions. These latter occurrences are minor in extent.

The community is reserved in four parks or reserves (Table 2; Figure 3). In NSW, 10800 ± 330 ha is reserved, which is estimated to be 5-15% of its total area (Benson, in prep). In Queensland, the extent reserved is regarded as low (2%) (Sattler and Williams 1999). Benson (in prep) regards the reservation as inadequate across its distribution, and suggests that larger stands of this community could be protected on the upper Paroo River and Cuttaburra Creek floodplains.

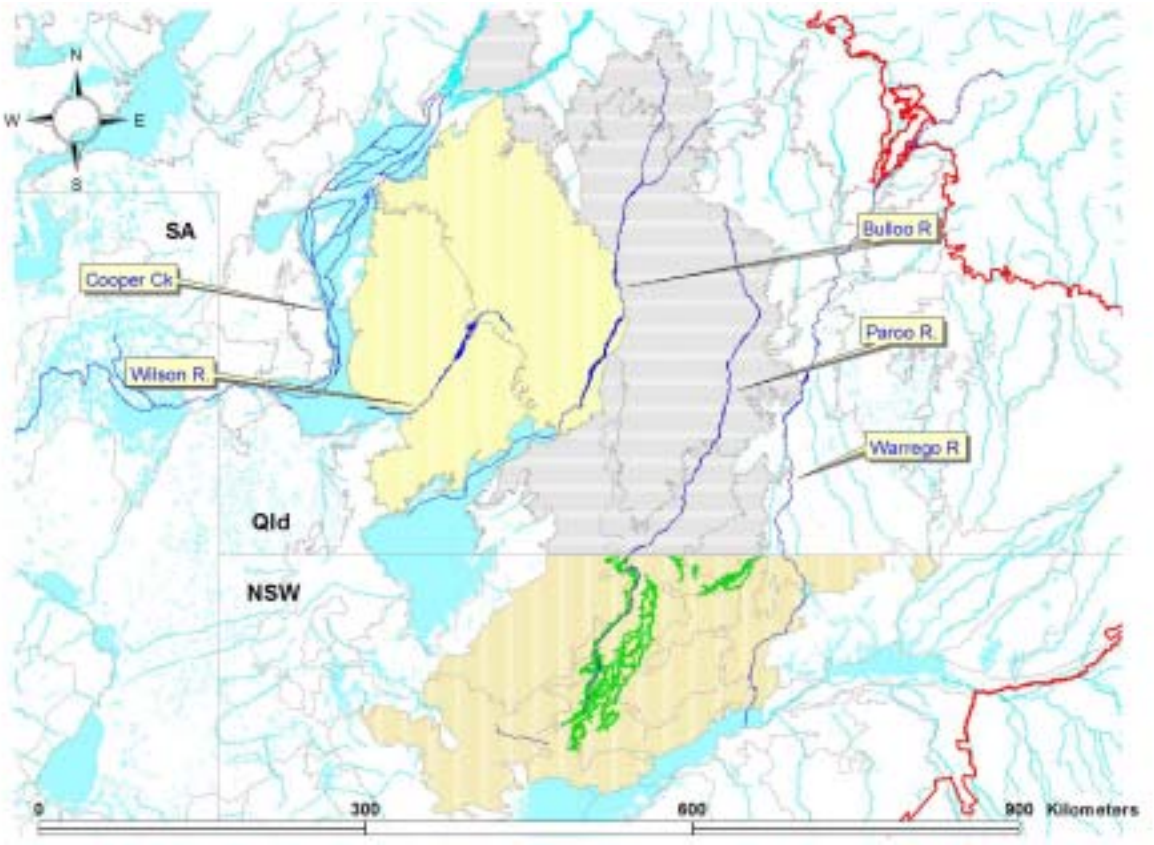

Figure 2: Location of Yapunyah woodlands. *The shaded regions indicate: grey: subregions indicated in Sattler and Williams (1999), yellow: additional subregions indicated in Neldner (1984) and Boyland (1984), orange: subregions indicated by Benson (in prep). The green areas are those mapped by Pickard and Norris (1994), which = the NSW NVIS data. The rivers that are mentioned in the literature are coloured royal blue; the other water features are rivers and creeks, and areas prone to inundation[1]. The red line indicates the arid / semi-arid boundary.*

Table 2: Parks and Reserves in which the community occurs

Name	Comments	Source
Nocoleche Nature Reserve	Estimate of 10,000ha reserved here	Benson (in prep.)
Paroo-Darling National Park	Estimate of 800ha reserved here; formerly named Peery Reserve.	Benson (in prep.)
Currawinja National Park	Comment that the extent reserved is low (2%)	Sattler and Williams (1999)

[1] The water features are from the GIS data: "major rivers" and waterbodies derived from the topo250K set.

Hell Hole Gorge		Sattler and Williams (1999)

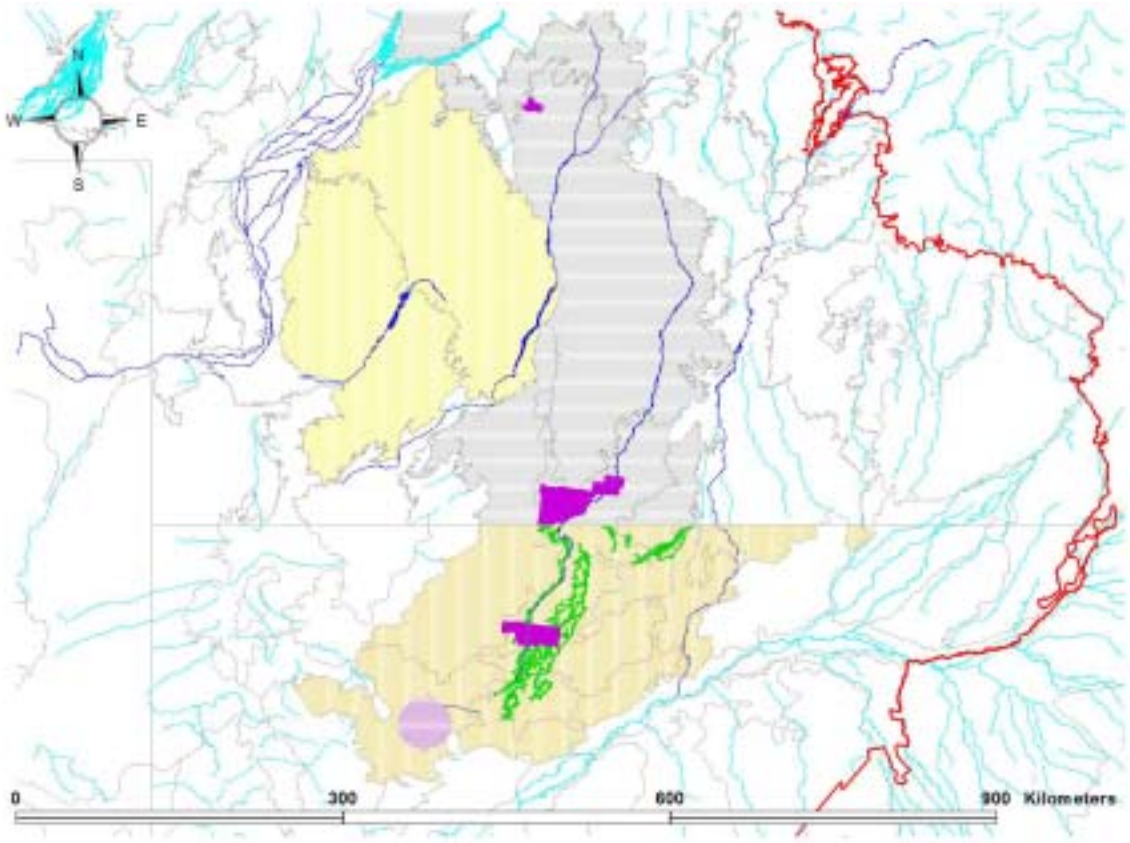

Figure 3: Location of National Parks and Nature Reserves. *The parks are shown in purple, with the hatched one showing the general vicinity in which the Paroo-Darling NP occurs (no mapping available). Other features are mapped as in Figure 2.*

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of the sub-communities are listed under the EPBC Act, or under any state legislation. The fauna records presented earlier detailed some species listed at state level in NSW; there is insufficient data to ascertain whether they are components of this NEC.

Decline in geographic distribution

For Queensland, Sattler and Williams (1999) estimate that >30% of the pre-European extent remains, and for NSW, Benson (in prep) estimates that ~90% remains (with ±20% accuracy).

Threats to the national ecological community

In Queensland, **clearing** is occurring in the more eastern parts (Sattler and Williams 1999).

In NSW, **grazing** is the main current threatening process: excessive grazing, especially during drought, causes major alterations to the understorey (Benson, in prep). This has particular impact since all of the non-reserved portion of the community is on leasehold land (Benson, in prep). Grazing is also a threat in Queensland. The Western Region Land Use studies (Parts 1, 2 and 3) record, for the land units on which the woodlands predominate:

- (land unit 41) grazing; good to fair condition; trend stable to slightly downwards (Division of Land Utilization, 1974)
- (land unit 84) grazing; usually in a degraded state; potential woody weed problem; condition poor to mediocre, trend downwards (Division of Land Utilization, 1980)
- (land unit 5) "Considerable grazing pressure is concentrated on these lands but a long-term decline in condition is not readily apparent" (Mills *et al*, 1990)

Note that these records are not recent and may not reflect the current situation.

The Yapunyah woodlands will be affected by **changes in flooding regime**; whilst this is not a current threat, it has the potential to become one. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands has been listed as a threatening process in NSW under Schedule 3 of the *Threatened Species Conservation Act 1995* (National Parks and Wildlife Service NSW 2003a). In relation to this, note the information under "Other information" on the draft Paroo River Agreement, below.

The data collected for the Terrestrial Biodiversity Assessment (Sattler and Creighton 2002) indicate threats that have been recorded for any ecosystem on a sub-regional basis (Table 3). These can be used to get a broad picture of the processes within the sub-regions, but will not all be applicable to these woodlands and are biased by survey effort. Nevertheless, they add information to an otherwise data-poor environment. They show that grazing pressure, changed hydrology, broad-scale vegetation clearing and feral animals are the most common threats in these subregions. This is largely consistent with the data presented above.

Table 3: Summary of threats to any ecosystems within the subregions (from data developed for Sattler and Creighton 2002). " y" indicates that the threat has been recorded as present.

	CHC8	MUL5	MUL7	MUL8	MUL9	MUL10	MUL11	MUL12	MUL13	MUL14	MUL15
Broad scale vegetation clearing		y	y	y				y		y	y
Changed fire regimes					y						
Changed hydrology - other		y	y	y			y	y	y	y	y
Changed hydrology - salinity											
Exotic weeds		y									
Feral animals			y	y						y	y
Firewood collection											
Grazing pressure	y	y	y	y	y	y	y			y	y
Increasing fragmentation											

Other			y								
Pathogens											
Pollution											

Loss or decline of functionally important species

No data identified.

Reduction in ecological community integrity

Westbrooke et al (2003) records weeds in the community at Paroo-Darling National Park: *Centaurea meitensis* and *Schismus barbatus*. Benson (in prep) provides an assessment for NSW of generally low weediness (<5%), with < 10 % cover.

Rate of detrimental change

No data were identified.

Other information

The NSW and Queensland governments are currently working on an agreement to manage the Paroo River Catchment area on a cooperative basis. The principles of the draft agreement (Qld NSW 2003) include:

> "(c) that naturally variable flow regimes and the maintenance of water quality are fundamental to the health of the aquatic ecosystems in the Paroo River Catchment Agreement Area; and
> (d) that the water requirements for ecological processes, biodiversity and ecologically significant areas within the Paroo River Catchment Agreement Area should be maintained, especially by means of flow variability and seasonality".

Summary and recommendation regarding category of threat under the EPBC Act

This NEC is currently "not under threat". It would, however, be threatened by changes in water regime in the region if these occur in the future.

Attachment 20-1: Details of the component communities. *Note that much of this text is taken directly from the source references*

Unit	Source	Description	Frequent species	Notes
Part of 6.3.5 Floristic association 28: *Eucalyptus ochrophloia* woodland.	Neldner (1984)	*Eucalyptus ochrophloia* predominates forming a well-defined but discontinuous canopy. Scattered *Acacia cambagei* and *E. microtheca* trees and *Eremophila bignoniiflora* tall shrubs frequently occur below this canopy. There are scattered low shrubs, sometimes forming a distinct layer. The ground layer is seasonally variable composed of perennial grasses and ephemeral herbs, and varies in cover from sparse to open. Tree/tall shrub layer: Ht. 9-12 m; Cover 5-20%	Upper: *Eucalyptus ochrophloia* dominant; also *Acacia cambagei, Eremophila bignoniiflora*, *Eucalyptus coolabah* Mid: *Chenopodium auricomum, Eremophila polyclada, Muehlenbeckia cunninghamii, Myoporum deserti.* Forbs*:* Frequently occurring spp: *Alternanthera nodiflora, Atriplex muelleri*, *A. spongiosa, Calotis multicaulis*, *Hibiscus brachysiphonius*, *H. trionum, Malvastrum americanum, Marsilea* spp., *Portulaca* sp. aff. P. *oleracea, Sclerolaena bicornis, S. calcarata, S. divaricata, S. muricata, Sida trichopoda, Solanum ellipticum, Tetragonia tetragonioides* Graminoids: *Astrebla elymoides, A. lappacea*, *Brachyachne convergens, Chloris pectinata, Cyperus fulvus, C. gilesii, Dactyloctenium radulans, Dichanthium sericeum, Eleocharis pattens, Enteropogon acicutaris, Eragrostis dietsii, E. leptocarpa, E. setifolia, E. tenellula, Eriochloa pseudoacrotricha*, *Iseilema membranaceum, Panicum whitei, Paspalidium jubiflorum, Sporobotus caroli, S. mitchellii.*	This association occurs on infrequently flooded, broad drainage lines on the alluvial plains associated with the Warrego, Paroo, and Bulloo Rivers. Soils are usually neutral to alkaline, deep to very deep, grey or brown alluvial cracking clays, and occasionally on associated texture contrast soils. Low shrubs are scattered in the drier areas, but form a prominent layer in wetter habitats. This is the dominant association in unit 21b.
Part of 6.3.5 Floristic association 29: *Eucalyptus ochrophloia* shrubby woodland.	Neldner (1984)	*Eucalyptus ochrophloia* predominates and forms a distinct but discontinuous canopy (8-11 m high). *Acacia cambagei* is conspicuous and other scattered trees may also occur. *Eremophila mitchellii* often forms a well-defined shrubby layer. Scattered low shrubs are present and sometimes form a distinct layer. The ground cover is variable with either grasses or forbs predominating depending on seasonal conditions. Tree/tall shrub layer: Ht. 9-12 m; Cover 5-20%;	Upper: *Eucalyptus ochrophloia*, *Acacia cambagei*, *Eremophila mitchellii.* Mid: *Cassia nemophila, Eremophila maculata, E. mitchellii*, *Myoporum deserti.* Forbs: *Abuliton otocarpum, A. oxycarpum, Boerhavia* spp.. *Hibiscus trionum, Justicia procumbens, Malvastrum americanum*, *Maireana villosa, Marsilea drummondii, Portulaca* sp. aff. P. *oleraoea, Salsola kali, Sclerolaena birchii, S. convexula, S. divaricata, S. tricuspis*, *Solanum ellipticum, S. quadriloculatum*. Graminoids**:** *Aristida latifotia, Astrebla lappacea, Chloris pectinata, Dactyloctenium radulans*, *Enteropogon acicularis, Eragrostis setifolia, Eriochloa pseudoacrotricha, Sporobolus aotinocladus, S. caroli*, *Tragus australianus, Tripogon loliiformis.*	This association is limited in extent to the flat-alluvial plains along the Bulloo River and Blackwater Creek in the north-west. The soils are a complex of deep, red and brown alluvial texture contrast soils, and brown and grey, heavy, alluvial clays.This association is mapped as mapping unit 21 a.
Eucalyptus ochrophloia ± *Acacia cambagei* low open-woodland	Boyland (1984) Association 7a	This is also relevant and contributes to RE 6.3.5; details have not been entered because the above records largely cover the variation.		

NEC 1.21: Black box woodlands

This NEC description is not fully developed because priority was given to completing NECs where there were definite indications of threat. Explanation of the membership of this community, some relevant information, and references to further data are provided; the information indicates that these woodlands are not threatened, although there are processes impacting on them in some areas.

Description and natural distribution

This is a large alliance. It could be split – for example, by separating off the most easterly (Riverina) communities, which may be more properly considered with other, temperate, communities. Other bases for splitting will be more evident once the work of Benson (in prep) is complete. At the small mapping scale available for many of these communities, the mapped areas include many mosaics, some of which will not be black box; conversely, black box woodlands will occur in unmapped areas.

The following overview is largely from Beadle (1981). *Eucalyptus largiflorens* (black box) occurs along watercourses or on low-lying areas subject to flooding, eg floodplains, seasonally flooded internal drainage basins or dry lakes (Figure 1). It occupies similar landscape positions to the coolibah communities, generally replacing *E. coolabah* in south-eastern Australia. It is mixed with *E. coolabah* in some situations - eg along the Darling River in NSW, and also forms ecotonal associations with *E. camaldulensis*. Black box communities are most common in NSW, but are also in Victoria, SA and in southern Queensland (Figure 2). They often occur on grey cracking clays that are alkaline throughout the profile. Black box can tolerate moderately saline soils; in these situations there is a halophytic understorey. It also occurs on red-brown, sandy soils that are about 1-2m deep, and lie above the clays of the river flats.

Black box is tolerant of flooding and of drought. Mature trees differ from *E. camaldulensis* in being less tolerant of flooding but more tolerant of prolonged dry conditions. Therefore, black box woodlands occur higher on the floodplain than river red gums (Roberts and Marston 2000; Figure 1a).

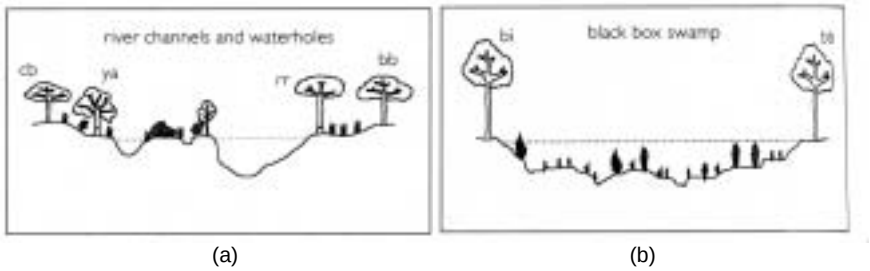

Figure 1: Position of black box (bb) in northern NSW (Paroo and Warrego Rivers) on river channels (a) and swamps (b). *Other species are coolibah(cb), yapunyah (ya), river red gum (rr) and bimble box (bi). From Kingsford and Porter (1999).*

The structure of these communities is very variable. At maximum development they form an open forest, but more generally are open woodland or low open woodland. Trees are typically bent (with the form dependent on water regime (Roberts and Marston 2000)), and often occur as a single line around the contour of a previous high flood line (Pickard and Norris 1994).

Beadle (1981) notes that:

> "In the virgin condition the halophytic shrubs *Atriplex nummularia* and / or *A. vesicaria* dominated the lower layers over much of the areas, with some 100 associated herbaceous species, which occur also in the treeless *Atriplex* shrublands. Towards the north, where the rain falls mainly in summer, grasses were more abundant and may have dominated the ground layer to the exclusion of *Atriplex*. The main grasses are: *Dichanthium sericeum, Eragrostis setifolia, Eulalia fulva, Paspalidium jubiflorum* and, in waterlogged areas, the

> semi-aquatic *Diplachne fusca.* This sward has been modified considerably by heavy grazing, leading to the dominance of the less permanent *Eragrostis parviflora.* …Local variations in microtopography lead to variations in the understorey species: (i) in gilgai depressions, which are periodically waterlogged, societies of *Marsilea drummondii, Scleroblitum atriplicinum, C. auricomum* (north) and *Muehlenbeckia florulenta* occur; (ii) saline patches .. support societies of *Disphyma australe* and / or *Pachycornia tenuis* or *Nitraria billardieri.* Since the woodlands lie near permanent or semi-permanent water, they have been heavily grazed by domestic stock. The perennial salt bushes have been killed out over large areas; the dominants now are commonly ephemeral species [eg chenopods, grasses]… the perennial *Bassia quinquecuspis* often becomes dominant following heavy grazing."

The communities of the arid / semi-arid zone are the only ones considered here. This means that those that are most threatened by clearing or already largely cleared in the temperate zone are excluded, e.g. the communities in the NSW wheatbelt and the Riverina (Siversten and Metcalfe 1991; Eardley 1999).

The sub-communities that contribute to this community are listed in Table 1, and further details of their structure and floristics are in Attachment 21-1. These are not exhaustive; examples of other data relevant to *E. largiflorens* woodlands include Kingsford et al (1994) (a survey of 30 wetlands in northwestern NSW; their records included fringing vegetation which included *E. largiflorens*, *E. camaldulensis*, *E. coolabah* and *E. ochrophloia* in varying proportions); Briggs *et al* (2000) and Westbrooke *et al* (2003).

Fauna

Black box woodlands often support high fauna diversity. For example, Briggs *et al* (2000) reported on the species of small mammals, reptiles and birds in the range of habitats on and around dry lakes of western NSW. They found that some reptile species were mainly confined to the black box woodlands, namely: *Gehyra variegata* and *Cryptoblepharus carnabyi,* which are arboreal, and *Morethia boulengeri* and *Ramphotyphlops bituberculatus,* which shelter under fallen timber, leaf litter and bark, and feed on ants and termites (Briggs *et al* 2000). Also, birds were most abundant and most speciose in the black box woodland compared with the other habitats (these were blue bush shrubland, lake edge and lake middle) (Table 2). The authors conclude that, because each habitat within the dry lake system has its own, relatively distinct fauna, there is a need to conserve mosaics of habitat.

Kingsford and Porter (1999), in their study of the Paroo River system, commented that:

> "Trees, lignum and islands in the channels and overflow swamps of the Cuttaburra Creek system and the small black box swamps and lignum swamps which fill predominantly from local rainfall were the favoured areas for breeding waterbirds. Fourteen waterbird species used lignum, 11 nested on the ground, eight used trees and a further three built floating nests".

These black box swamps have fringing *E. largiflorens* and *E. populnea* ssp *bimbil* with a ground cover of grasses (Figure 1).

In SA, Playfair and Robinson (1997) record the following birds as having a preference for riverine eucalypt woodland (including black box woodlands but also other eucalypt woodlands – eg *E. camaldulensis*): *Gymnorhina tibicen (*australian magpie), *Manorina flavigula (*yellow-throated miner), *Hirundo nigricans (*tree martin), *Pachycephela rufiventris (*rufous whistler), *Pardalotus striatus (*striated pardalote), *Meliphaga penicillata (*white-plumed honeyeater), *Artamus leucorhynchus (*white-breasted woodswallow), *Geopelia placida (*peaceful dove), *Colluricincla harmonica (*grey strike-thrush), *Pardalotus rubricatus (*red-browned pardalote), *Ninox novaseelandiae (*boobook owl).

Roberts and Marston (2000) report that, on the Chowilla floodplain (SE SA, just on the semi-arid border), black box woodlands are significant for ground-foraging and hollow-nesting avifauna. They comment:

“Particularly under drier and less frequently flooded conditions, the form of black box trees is a summary of its history. Its twisted shape, with dead limbs and hollows provide refuge, breeding holes and crevices for birds, lizards and small mammals”.

Table 1: Sub-communities in NEC 1.21

Sub-community / Regional Ecosystem name	Unit ID or source	State	IBRA region (subregions)	Comments
Eucalyptus largiflorens open woodland	NSW_ID 20500006	NSW	CP, ML, DRP, RIV, MDD	
Eucalyptus largiflorens open forest ?	NSW_ID 20500028	NSW	MDD	Named *E. laevopinea* open forest in NVIS, but this is clearly wrong and approx same locations as *E. largiflorens* in Fox (1992)
Eucalyptus largiflorens low open forest	NSW_ID 21900013 (P&N15)	NSW	MDD, DRP, CP, ML, SSD, CHC, BHC	
Eucalyptus largiflorens open forest	NSW_ID 21900015 (P&N 15)	NSW		
Eucalyptus largiflorens Woodland	NSW_IDs 21700031, 21700065, 21700067, 21700068, 21700114, 21700118	NSW	RIV, DRP, MDD	21700114 & 217000118 "open woodland" at level 3
Black Box	Scott (1991) (Swan Hill – Balranald area)	NSW		These are mapped but it is unclear whether the mapping is included in NVIS. Details of some communities are in Table 2
Black Box woodland	Porteners (1993) (Hay Plain)	NSW		
Black Box Woodland	Fox (1991) (Mildura)	NSW	MDD	
Black box communities	Millthorpe (1991) (NW NSW)	NSW		
Black Box Woodland	Porteners et al (1997) (Pooncarrie)	NSW		
Eucalyptus largiflorens +/- Acacia cambagei woodland on alluvial plains	RE 11.3.16	QLD	DRP (1,3)	EPA status: No concern at present
Eucalyptus largiflorens ± *Acacia cambagei* on alluvium.	RE 6.3.8	QLD	MUL (1,3,7,11)	EPA status: Of concern
Eucalyptus largiflorens low open woodland	NO0017	SA		North Olary Plains Survey

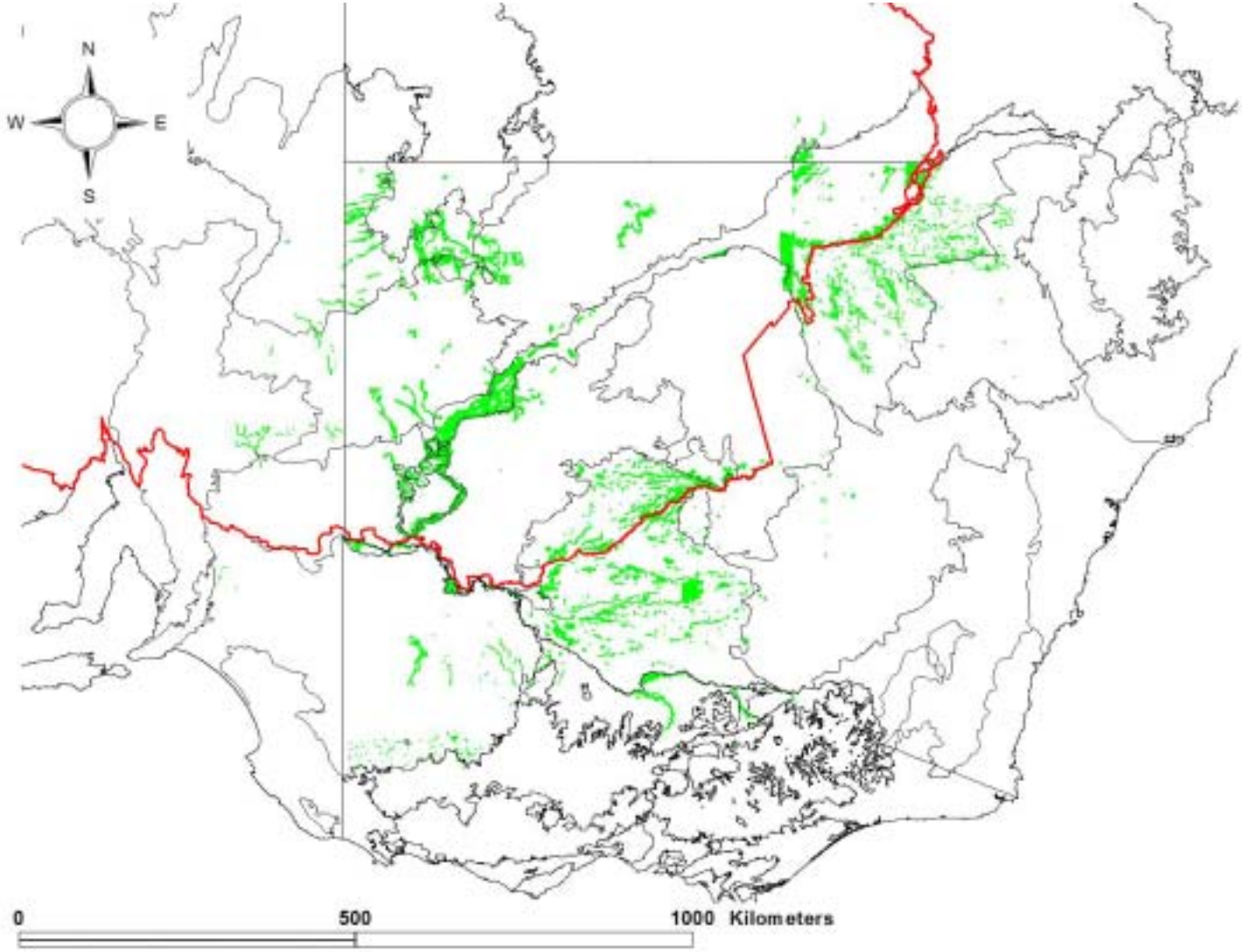
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Figure 1: Distribution of* E. largiflorens *communities from NVIS data. *The black box woodlands and forests are shown in green; the arid / semi-arid region is inland of the red line; the black lines outline IBRA regions.*

Table 2: Birds recorded as present ("P") in habitats on and around dry lakes of NSW *(Briggs et al 2000)*

Common name	Scientific name	Blue bush	Black box	Dry lake
Spiny-cheeked honeyeater	*Acanthagenys rufogularis*		P	
Inland thornbill	*Acanthiza apicalis*		P	
Yellow-rumped thombill	*Acanthiza chrysorrhoa*	P	P	
Yellow thornbill	*Acanthiza nana*		P	
Richard's pipit	*Anthus novaeseelandiae*	P		
Wedge-tailed eagle	*Aquila audax*	P	P	
Black-faced woodswallow	*Artamus cinereus*	P		
Australian ringneck	*Barnardius zonarius*		P	
Galah	*Cacatua roseicapilla*	P	P	
White-backed swallow	*Cheramoeca leucosternus*	P		
Brown treecreeper	*Climacteris picumnus*		P	
Grey shrike-thrush	*Colluricincia harmonica*		P	
Black-faced cuckoo shrike	*Coracina novaehollandiae*		P	
White-winged chough	*Corcorax melanoramples*		P	
Little crow	*Corvus bennetti*		P	
Australian raven	*Corvus coronoides*		P	P
Pied butcherbird	*Cracticus nigrogularis*		P	P
Grey butcherbird	*Cracticus torquatus*	P	P	
Pallid cuckoo	*Cuculus pallidus*		P	
Mistletoebird	*Dicaeum hirundinaceum*	P	P	
Emu	*Dromaius novaehollandiae*	P		
Wliite-fronted chat	*Epthianura albifrons*	P		
Magpie-lark	*Grallina cyanoleuca*	P	P	
Australian magpie	*Gymnorhina tibicen*	P	P	P
Welcome swallow	*Hirundo neoxena*		P	
Yellow-plumed honeyeater	*Lichenostomus ornatus*		P	
White-plumed honeyeater	*Lichenostomus penicillatus*		P	
Variegated fairy-wren	*Malurus lambertii*	P		
White-winged fairy-wren	*Malurus leucopterus*	P	P	P
Yellow-throated miner	*Manorina flavigula*	P	P	
Noisy miner	*Manorina melanocephala*		P	
Blue bonnet	*Northiella haetmatogaster*	P	P	P
Crested pidgeon	*Ocyphaps lophotes*	P	P	
Striated pardolote	*Pardolotus striatus*		P	
Red-capped robin	*Petroica goodenovii*	P		
Chestnut-crowned babbler	*Pomatostomus ruficeps*	P		
Red-rumped parrot	*Psephotlis haematonotus*		P	
Mulga parrot	*Psephotus varius*		P	
Willie wagtail	*Rhipidura leucophrys*		P	P
Weebill	*Smicrornis brevirostris*	P	P	
Grey currawong	*Strepera versicolor*		P	
Apostlebird	*Struthidea cinerea*		P	
Zebra finch	*Taeniopygia guttata*	P	P	P
Masked lapwing	*Vanellus miles*		P	P

Processes by which the biotic and abiotic elements interact

As with other riparian eucalypt woodlands, flooding regime is important in the persistence of the community. Flooding initiates germination and establishment, and mature trees rely on groundwater and widespread flooding at least once every ten years. Cassanova (1999) notes:

> "An example of the overriding influence of water regime on the establishment of vegetation in wetlands is in the fact that the margins of ephemeral lakes in the Paroo can be identified by distinct rings of black box, the ages of which can be related to particular floods".

Roberts and Marston (2000) also note:

> "Research on the Chowilla floodplain has found that black box is ecologically flexible and opportunistic in its water use. It can use water from throughout the soil profile, and can use water that is saline… in the absence of floods, i.e. during long interflood periods, black box trees must rely on water in the soil profile".

Critical aspects of water regime are flood frequency and flood duration, and their interdependence –for example, in SW NSW black box trees were healthy where they were flooded for 4-6 months every 4-5 years, but where water had been ponded twice, for 12-18 months, trees were dying. On the Chowilla floodplain (SE SA), the natural flood frequency was 1in 2 to 1 in 5 years, and flood duration was 2-4 months. The effect of river regulation has meant a 3-fold decrease in flood frequency. This has changed the salinity – hydrologic balance, and the resulting accumulation of salt in the soil profile and at the soil surface has resulted in tree deaths (Roberts and Marston 2000).

Conservation areas

Conservation areas in which this community is represented include:

- Currawinya NP (regional ecosystem 6.3.8)
- Culgoa Floodplain NP (regional ecosystem 11.3.16)
- Nearie Lake NP
- Kinchega NP
- Wilandra NP
- Nombinnie Nature Reserve
- Sturt NP

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of the sub-communities are listed under the EPBC Act. The Queensland Mulga Lands occurrence is "of concern" (EPA and VMA status), presumably because it provides valuable faunal habitat and occurs in small patches in a region that tends to be degraded from overgrazing. Details of threats were not available in Environmental Protection Agency Qld (2003b).

Decline in geographic distribution

No data identified, except for Queensland units: >30% remaining of both of these.

Threats to the national ecological community

The data collected for the Terrestrial Biodiversity Assessment (Sattler and Creighton 2002) indicate threats that have been recorded for any ecosystem on a sub-regional basis (Table 3). These can be used to get a broad picture of the processes within the sub-regions, but will not all be applicable to these woodlands and are biased by survey effort. Nevertheless, they add useful information. They show that broad-scale vegetation clearing, changed hydrology, grazing pressure, exotic weeds and feral animals are the prevalent threats for the subregions inhabited by this NEC.

This is consistent with other records. For example, cropping occurs on dry lakes that often have fringing black box woodlands, and needs to be managed so that the woodlands are not cleared (Briggs

and Jenkins 1997). Changed flood regimes have been shown to impact on *E. largiflorens* woodlands (see quote above from Roberts and Marston (2000)).

Table 3: Summary of threats to any ecosystems within the subregions (from data developed for Sattler and Creighton 2002). " y" indicates that the threat has been recorded as present. No threats were reported for subvregions CHC10 and SSD6

	BHC1	BHC2	BHC3	BHC4	CHC9	CP3	CP5	DRP1	DRP10	DRP2	DRP3	DRP4	DRP5	DRP6	DRP7	DRP8	DRP9	FLB3	MDD1	MDD6	MUL1	MUL11	MUL13	MUL14	MUL15	MUL16	MUL3	MUL5	MUL7	MUL8	RIV1	SSD5	SSD7
Broad scale vegetation clearing	y	y	y	y		y	y	y	y	y	y	y	y	y	y	y	y		y	y	y			y	y	y	y	y	y	y		
Changed fire regimes								y	y	y	y	y	y	y		y	y														y		
Changed hydrology - other	y	y	y	y		y	y	y	y	y	y	y	y	y		y	y		y	y		y	y	y	y		y	y	y	y	y		
Changed hydrology - salinity						y						y	y																				
Exotic weeds							y	y	y	y	y	y	y	y		y	y	y	y									y			y		
Feral animals	y	y	y	y	y	y	y		y					y		y	y		y	y				y	y				y	y	y	y	
Firewood collection													y																				
Grazing pressure	y	y	y	y	y	y	y	y	y	y	y	y	y	y		y	y	y	y	y	y	y		y	y		y	y	y	y	y	y	y
Increasing fragmentation						y	y	y		y	y	y	y						y	y	y						y				y		
Other											y	y									y								y			y	
Pathogens																																	
Pollution									y				y						y												y		

Loss or decline of functionally important species

No data have been identified.

Reduction in ecological community integrity

Most communities have been severely modified by grazing (see quote above from Beadle (1981).

Rate of detrimental change

No data have been identified.

Summary and recommendation regarding category of threat under the EPBC Act

Although many areas are affected by extensive and long-term impacts from grazing, the arid / semi-arid occurrences of black box woodlands do not appear to be eligible for listing. However, they will be susceptible to changed flooding regimes associated with irrigation, and therefore may be threatened over the long term.

Attachment 21-1: Details of sub-communities. Note that these records are largely unedited versions of the source data.

Unit	Source	Description	Species details	Comments
11.3.16 & 6.3.8	Neldner (1984), FA 27	*Eucalyptus largiflorens* woodland. *Eucalyptus largiflorens* forms a distinct but discontinuous canopy. Scattered *E. microtheca* or *E. populnea* low trees may be present and groves of *Acacia cambagei, A. harpophylla* or *A. omalophylla* occasionally occur. *Muehlenbeckia cunninghamii* low shrubs are often prominent, and the sparse ground layer is dominated by perennial grasses and locally abundant forbs. Tree/tall shrub layer: Ht. 8-13 m; Cover 20-30%, rarely < 10%; Density 75-250 trees/ha.	Upper: *Eucalyptus largiflorens, Acacia cambagei, A. harpophylla, A. omalophylla* (in places), *Eremophila bignoniiflora*, *Eucalyptus coolabah, E. populnea* Mid: *Cassia nemophila* (in the west), *Chenopodium auricomum, Eremophila sturtii* (in the west), *Muehlenbeckia cunninghamii* (in places), *Rhagodia parabolica* (in places). Forbs:: *Atriplex leptocarpa, A. muelleri, A. semibaccata, Boerhavia* spp., *Chenopodium cristatum, Craspedia* spp., *Cyperus difformis, C. squarrosus, Einadia nutans* ssp. *linifolia, Eleocharis dietrichiana, Helipterum strictum, Minuria integerrima, Psoralea cinerea, Sclerolaena calcarata, S. diacantha, S. muricata, S. tricuspis, Teucrium racemosum, Zygophyllum apiculatum.* Graminoids: *Dichanthium affine, D. sericeum, Diplachne fusca, Eragrostis pilosa, E, setifolia, E. tenellula, Eulalia fulva, Panicum decompositum, Paspalidium jubiflorum,* P. *gracile, Sporobolus caroli, S. mitchelii*, *Tripogon loliiformis*	This association is limited in extent occurring in the extreme south on the floodplains associated with the Narran, Culgoa, Bokhara (together form the Balonne River), Warrego and Paroo Rivers. It is a minor association in Queensland being replaced largely by *Eucalyptus coolabah* open-woodlands. It occurs on periodically, but irregularly flooded alluvial plains mainly on deep, alkaline, grey alluvial clay soils, but also on associated texture contrast soils. It occurs on the terraces away from the main watercourses, which are occupied by *E. camaldulensis* woodlands. On the Paroo River alluvia, *E. ochrophloia* replaces *E. largiflorens,* except in the extreme south.
SA: *E. largiflorens* low open woodland	Playfair and Robinson (1997)	• Confined to waterways and edges of inundated areas; usually found as narrow band around swamps and small lakes. In the cattle grazing region in the north-east, the understory is virtually non-existent due to trampling and browsing, whereas further south in the sheep grazing country, swamp species such as *Muehlenbeckia florulenta* (lignum), *Maireana aphylla* (cottonbush), *Eragrostis australasica* (canegrass) and *Marsilea drummondii* (Nardoo) are commonly growing under the tree canopy. Near the NSW border (eastern edge Lake Charles mapsheet), *E. largiflorens* is growing as a low open woodland over a wide area of grassy floodplain with *Casuarina pauper* (black oak) and *Callitris glaucophylla* (native pine) • Woodlands or low woodlands which are either sparse (10-30% tree cover) or very sparse (<10%), and often composed almost completely of introduced species and annuals. There is usually no middle shrub layer • Condition is variable but generally poor, because the community acts as a focus for stock for shade, and the proximity to many dams and tanks near the creeklines in which it grows • Found along watercourses, and fringing lakes and swapns, mainly in the north-eastern portion of the study area (=North Olary Plains), north and east of the SE corner of Lake Frome. Its range doesn't overlap that of the red gum woodland community, which is found near to the ranges in the south and west of the region • Frequent species, in order from more frequent to less: *Eucalyptus largiflorens, Tetragonia eremaea / tetragonoides, Brassica tournefortii, Salsola kali, Schismus barbatus, Zygophyllum ammophilum, Craspedia pleiocephela, Atriplex holocarpa, Bulbine semibarbata, Enchylaena tomentosa* var *tomentosa, Rhodanthe moschata*		

Unit	Source	Description	Species details	Comments
NW NSW black box	Millthorpe (1991)	"These communities occur mainly as fringing communities around many of the ephemeral lakes and pans distributed throughout the region or on clay soils of higher floodplain and high channel areas of major watercourses. the communities usually exist as open or very open woodlands, with the stunted trees rarely exceeding 10m in height. In localised more favoured areas, such along the inlet channels to lakes, denser stands occur. Associated tree species include river red gum, coolibah, cooba (*Acacia salicina)* and eurah (*Eremophila bignoniflora)*. Old man saltbush (*Atriplex nummularia)*, lignum *(Muehlenbeckia florulenta)*, spotted fuchsia *(Eremophila maculata)*, canegrass (*Eragrostis australasica)*, black bluebush *(Maireana pyramidata)* and nitre goosefoot (*Chenopodium nitrariaceum*) are the most common mid-storey species. Groundstorey vegetation is highly variable and is largely controlled by current seasonal conditions. Perennial grasses such as mitchell grass (*Astrebla* spp), warrego summer-grass (*Paspalidium jubiflorum)* and common bottle-washers (*Enneapogon avenaceus*) are common in good seasons, while forbs such as roly-poly (*Sclerolaena muricata)*, copperburrs and saltbushes also occur. Ephemerals such as New Zealand spinach (*Tetragonia tetragonioides)* and daisies (*Calotis* and *Helipterum* spp) may also be periodically common"		
Black Box	Scott (1992)	**Structure:** woodland *, woodland - open woodland **Characteristic species:** *Eucalyptits largiflorens* **Associated species:** *Chenopodium nitrariaceum, Atriplex nummularia, Muehlenbeckia florulenta, Enchylaeana tomentosa, Einadia nutans*, *Sclerolaena tricuspis,* often with *Chamaesyce drummondii*, *Atriplex lindleyi.* **Soils:** Grey clays rarely cracking and with a flat or gently undulating surface. **Occurrence:** Throughout the region on the uppermost level of the floodplain; beyond the floodplain it may occur in depressions along creeks, drains and old stream beds (e.g. Box Creek), and fringing ephemeral lakes. Examples of this community include Yanga Nature Reserve, the floodplain just west of Euston on the south side of the Sturt Highway, and ringing many of the lakes such as Lake Marimley, Lake Talbetts, Harveys Lake and Chillichil Lake. **Comments:** Black Box woodland occurs on the floodplain of the major rivers usually bevond the River Red Gum forest. These areas are at the upper levels of the floodplain where flooding is less frequent. It also occurs along creek lines and is often seen forming a line of trees marking an intermittent or permanent creek. Areas of impeded drainage amongst other vegetation units ranging from mallee to shrublands may also support Black Box, but often as an isolated tree or group of trees. These areas, often too small to map, are most common in the region of the prior stream remains southeast of Balranald. The understorey here was often similar to the surrounding vegetation community. Yanga Nature Reserve consists almost entirely of this community. It has a more diverse understorey with the most abundant species in the Chenopodiaceae, Asteraceae and Poaceae. Within this community at Yanga are open areas of higher ground with grasses and *Maireana pyramidata* shrubland. Along the drainage channels are Lignum (*Muehlenbeckia florulenta)* and *Chenopodium nitrariaceum. Chenopodium nitrariaceum* is closely associated with Black Box as an understorey species, but can also extend beyond the tree line forming a shrubland. This may be seen east of Perekerten where it dominates a lake-bed, and in smaller patches east of Balranald. Some areas of this unit showed only a scattered distribution of trees, for example in the Swan Hill section of the map. These areas have probably been cleared or thinned in the past. A less common variant of this community consists of a *E. largiflorens* overstorey with the understorey dominated by *Melaleuca lanceolata..* This subunit was restricted to a few localities within the mapped area... Here the other understorey is more typical of the adjacent woodland of Belah-Rosewood (*Casuarina pauper – Alectryon oleifolius)*….		

Unit	Source	Description	Species details	Comments
Black Box woodland	Fox (1991)	**Structural formation:** Low open-woodland **Height:10-20** m (function of time since fire) **Cover:** 10-30% (Basal area 5 m^2 ha^{-1}) **Dominant species:** *Eucalyptus largiflorens* **Understorey species:** *Atriplex nummularia, Chenopodium nitrariaceum.* **Ground layer.** *Osteocarpum acropterum* var*. deminutum, Boerhavia diffusa, Chamaesyce drummondii, Scleroblitum atriplicinum* **Species richness:** (0.1 ha) 36.6 ±3.0 (n=7) **Landform:** Floodplains beyond major rivers and dry lake margins **Habitat (photopattern):** Along creek lines and less dense than Riverine Forest **Soil:** Heavy grey clay **Degradation/regeneration:** Subject to periodic inundation, major regeneration occurs as floods subside. Most stands contain trees of similar size (age) and may represent past establishment patterns. The Black Box Woodlands are prime grazing country and the understorey is affected by this land use. In particular much of the previously extensive *Atriplex nummularia* stands that formed a shrub layer under and between the Black Box trees have now been lost		
E. largiflorens low open forest	Pickard and Norris (1994)	**Geographic distribution**: widespread as a fringing community along creeks, around lakes and in depressions of various sizes from Tibooburra to White Cliffs and along the Darling R floodplain downstream of Wilcannia. Immediately upstream of of Wilcannia both *E. largiflorens* and *E. coolabah* ssp *coolabah* may occur but on different sites. Further upstream, *E. coolabah* open forest predominates **Landforms**: intermittently flowing billabongs and anabranches adjacent to Darling R.; floodplains generally; seasonally flooded internal drainage basins **Soils** variable; grey cracking clays with and without extensive areas of crabholes; some texture-contrast soils **Structure** very variable. At its max development an open forest but more generally low open-forest and even open woodland. Trees are typically bent, and often occur as a single line around the contour of a previous high flood line. Various shrubs including *Chenopodium nitrariaceum* and *Acacia stenophylla* and herbs occur, forming discontinuous lower layers. Forms complex mixtures with *Eragrostis australasica - Muehlenbeckia florulenta* herbland on floodplains of the Paroo R, and with *E. coolabah* on the floodplains of the Darling R. **Canopy species**: *E. largiflorens*, *E. populnea* ssp *bimbil, E. coolabah, Casuarina pauper, Grevillea striata* Other species: Dense to open stands of *Muehlenbeckia florulenta, Acacia stenophylla, Chenopodium nitrariaceum, Sclerolaena* species, and a range of grasses (eg *Eragrostis setifolia, Sporobolus mitchellii* and *Eragrostis australasica.* Slightly higher areas on sandier soils with annual *Sclerolaena* and *Atriplex* species, and *Enneapogon avenaceus* under *Myoporum montanum* and *Dodonea viscosa* ssp *angustissma.* Some *Acacia victoriae.*		

NEC 1.22: Riparian eucalypt communities on levees and banks of major drainage lines or permanent lakes or waterholes in WA

Description

Key flora and fauna, and abiotic elements

This NEC contains all of the riparian eucalypt woodland vegetation that lines the levees and banks of major drainage lines. It primarily occupies the Pilbara, Gascoyne, Murchison, Carnarvon and Little Sandy Desert IBRA regions (Figure 1; Table 1; Appendix 1). The floodplain eucalypt woodlands are incorporated into NEC1.23.

The dominant eucalypts in these communities are *Eucalyptus camaldulensis* and, less frequently, *E. victrix* (formerly *E. microtheca*). Attachment 22-1 contains details from the descriptions of Beard (1975, 1976 and 1979) and from the WA draft synopsis reports for the subregions (McKenzie 2003). The following from Beard provides some examples of typical vegetation within each of the IBRA regions:

- CAR region: *E. camaldulensis* and *Melaleuca glomerata* line the channels of the rivers. Stunted trees of *E. camaldulensis* of 6-8m in height appear on creeks
- GAS region: The main river channels are lined with *E. camaldulensis* up to 20m high; also *Melaleuca leucadendron* present. Some major creeks descending from the Carnarvon Range have excavated deep perennial pools such as Karri-Karri Pool and Windich Spring; these are lined with *E. camaldulensis*. In the Kumarina Hills: *E. victrix* occurs along major drainage lines. In the Gascoyne ranges, the river banks and islands carry a dense marginal vegetation in which *E. camaldulensis* is found up to 18m tall. *Acacia aneura, A. citrinoviridis, and A. grasbyi* occur as subordinate trees. The shrub layer is variable. The ground layer is now frequently dominated by the introduced *Cenchrus ciliaris* (buffel grass).
- MUR region: *E. camaldulensis* and *Casuarina obesa* appear in the mulga, and they also line the drainage channels. The calcrete platforms of the Wiluna area are interspersed with drainage channels which may carry *E. camaldulensis* woodland. There are also small lakes in the Byro subregion that have groves of small *E. camaldulensis* (7.5m in height) in the centre where they are subject to deep flooding.
- PIL region: On the Abydos Plain, the banks of major creeks and rivers are wooded by comparatively large trees of *E. camaldulensis* and smaller ones of *Melaleuca leucadendron,* which form a gallery woodland. A sparse understorey of trees and shrubs include *Acacia* sp. aff. *coriacea* (waterwood), *Crotalaria cunninghamii, Gossypium robinsonii, Hibiscus panduriformis, Notoxylinon australe* and *Triumfetta appendiculata.* The introduced *Aerva javanica* sometimes may be very common. In the gorges of the Hamersley Plateau, there is a riverine woodland or scattered elements of the woodland flora: *E. camaldulensis, Corymbia dichromophloia, E. victrix, Acacia pruinocarpa, Melaleuca leucadendron, A. tumida, Eremophila longifolia, Hibiscus goldsworthii, Cleome viscosa, Swainsona stenodonta, Tephrosia bidwillii, Jasminum lineare* and *Porana sericea.* In the Stuart Hills, *E. camaldulensis* and *Acacia citrinoviridis* line all major rivers in the unit. In the Fortescue valley, a woodland of *E. camaldulensis* ± *E. victrix* lines the banks of active watercourses.

The data in Attachment 22-1 includes most of the data on riparian communities, excluding those on calcrete and claypan substrates. It is possible that some of these are referring to floodplain communities, but there is insufficient data to determine the landform. Experts need to be consulted to clarify this. Similarly, the data shown in Figure 1 and Table 1 are total areas for these communities; the floodplain component cannot be separated.

Fauna records are more difficult to access. Some fauna records exist that have not been accessed because of time constraints - for example, the series of biological surveys of the goldfields (e.g., Dell *et al* 1992) have associated faunal records. Riparian woodlands are usually rich in fauna because they

provide food, water and shelter in what can otherwise be an inhospitable landscape. Arid zone rivers may provide a seasonal refuge to wildlife. Attachment 22-1 details some faunal records: for example;

- Wooleen Lake, in the Murchison region, is important waterbird breeding habitat; it is a significant breeding area for Gull-billed Terns (*Gelochelidon nilotica*). This lake is surrounded by *E. camaldulensis* woodlands; the synopsis report does not detail which parts of the wetland habitat are utilised by the tern.
- *Petrogale rothschildi,* Rothschild's Rock-wallaby, is a priority species and occurs in *E. victrix* woodland in PIL1
- *Rhinonicteris aurantius,* Orange Leaf-nosed Bat, Schedule 1 (Rare/likely to become extinct) and *Macroderma gigas*, Ghost Bat, species at risk within the PIL1, occur in *E. camaldulensis* and *E. victrix* woodlands.

The synopsis reports list other fauna but do not provide links between the fauna and preferred habitat. Morton *et al*'s (1995) analysis of refugia for biological diversity in arid and semi-arid Australia also refers to a number of the wetlands associated with the rivers and creeks of these IBRA regions, and gives important details of the refuge value, listed and other important species, key threats, and further references. For example, their refuge reference numbers WA15, 21, 22, and 29 are relevant. These records could add substantial information to this NEC.

Figure 1: Occurrence of riverine communities in WA, as mapped in NVIS data. *Bioregions are outlined in black, and the boundary of the arid/ semi-arid region in red.Subregions are labelled and their boundaries, where separate to that of the region, are grey. The rivers are shown in aqua. Altitude is shades of orange, with darker shades higher altitudes. The riparian communities are coloured according to Beard codes (Table 1): 11 (blue), 305 (purple), 619 (dark green), 641 (light green), 2151 (pink)*

Table 1: Riparian communities in the WA arid / semi-arid NVIS data

Name	Beard veg association	IBRA region (subregion)	Current extent (ha x 10^3) †	% of pre-European remaining #	% in IUCN class I to IV reserves #	% in other reserves or CALM-managed leases #
Medium woodland; coolabah (*E.victrix*)	11	CAR (1), GAS (2,3), LSD (2*), MUR (2), PIL (1,4)	36	100	0	0
Medium woodland over scrub; coolabah (*E. victrix)* over bowgada (*A. ramulosa-A.linophylla*)	305	MUR (2)	7	100	0	0
Medium woodland; river gum (*E. camaldulensis*)	619*	PIL (1,4)	106	99.9	0.2	0
Medium woodland; coolabah (E*. victrix*) & river gum (*E. camaldulensis*)	641	CAR (1), PIL (1,4)	36	100	2.9	0
Low woodland; coolabah (*E. victrix*) & paperbark (*Melaleuca* sp.)	2151	GSD(2), LSD (1,2)	9	100	71.7	0

* This appears to be a composite of the original Beard 619 and 627 (medium woodland; river gum), remapped for NVIS

† From Beeston et al (2002); rounded to the closest thousand hectares because none of these data are precise. These data were used rather than Shepherd et al (2002) because they were an updated version of the data and were slightly different to that in Shephard et al (2002).

\# From Shepherd et al (2002). Note that this source is different to that of current extent; the data may not be exactly comparable, but equivalent data were not available in Beeston et al (2002)

Natural distribution

Known natural distribution (including bioregions, conservation areas)

These communities are mapped in the CAR, GAS, LSD, MUR, PIL and GSD IBRA regions. There are occurrences that are unmapped in NVIS – for example, Milewski and Dell (1992) record *E. camaldulensis* low woodland at Banjawarn Station, which is on one of the mapped rivers in MUR1 (Figure 1; Attachment 22-1). Other detailed reports need to be accessed to ascertain the known distribution of these communities. As it stands, this should be interpreted as the main distribution of the communities, but there will be additional occurrences elsewhere.

Some of the sub-communities are reserved (Table 1; Attachment 22-1). The two mapped reserves in PIL1 are the Mungroona Range Nature Reserve and the Millstream-Chichester National Park. Since occurrences of vegetation associations 619 and 641 are reserved in PIL1, presumably they are within these reserves. The synopsis reports mention other parks and reserves that are not mapped in this region in the NVIS data (i.e. Environment Australia 2002). Vegetation association 2151 is largely reserved in the Rudall River National Park. The synopsis reports provide details of the extent and quality of management in these reserves, and of ongoing issues.

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

None of these woodlands are listed.

Decline in geographic distribution

Declines appear to be negligible (Table 1).

Threats to the national ecological community

The data collected for the Terrestrial Biodiversity Assessment (Sattler and Creighton 2002) indicate threats that have been recorded for any ecosystem on a sub-regional basis (Table 2). These can be used to get a broad picture of the processes within the sub-regions, but will not all be applicable to these woodlands and are biased by survey effort. Nevertheless, they add information to an otherwise data-poor environment. They show that feral animals, grazing pressure, exotic weeds and changed hydrology are prevalent threats for the subregions inhabited by this NEC, but that a range of processes are operating.

Table 2: Summary of threats to any ecosystems within the subregions *(from data developed for Sattler and Creighton 2002). " y" indicates that the threat has been recorded as present.*

	CAR1	CAR2	GAS1	GAS2	GAS3	GSD2	LSD1	LSD2	MUR1	MUR2	PIL1	PIL2	PIL3	PIL4
Broad scale vegetation clearing														
Changed fire regimes		y			y				y	y			y	
Changed hydrology - other		y		y	y					y		y	y	y
Changed hydrology - salinity	y			y					y	y				y
Exotic weeds		y				y	y	y		y			y	y
Feral animals	y	y		y	y	y	y	y	y	y	y		y	y
Firewood collection														
Grazing pressure		y		y	y				y	y	y		y	y
Increasing fragmentation									y					y
Other	y	y							y	y	y			y
Pathogens														
Pollution	y			y	y				y	y				y

These are consistent with the threats noted in Attachment 22-1, though for these ecosystems, grazing is probably a more substantial threat than implied in Table 2.

Loss or decline of functionally important species

No data has been identified.

Reduction in ecological community integrity

The records of condition in Attachment 22-1 give some indication of community integrity. Of the communities listed, six are condition rank 1 (degraded; recovery unlikely in medium term), nine are condition rank 2 (fair; recovery requires significant management intervention), and one is condition rank 3 (good; recovery would occur in short term with minimum intervention). This indicates that overall the communities have suffered a reduction in integrity.

Rate of detrimental change

The records of trend in condition in Attachment 22-1 give some indication of community integrity. Of the communities listed, 12 are trend rank 3 (condition declining) and 4 are trend rank 4 (condition static).

Summary and recommendation regarding category of threat under EPBC Act

In common with many riparian communities, this NEC is clearly affected by ongoing threatening processes. There are substantial impacts on the community and, in the majority of cases, the condition of the community is declining. However, the informal CALM listings do not list any of these communities as threatened. Without further data the appropriate recommendation appears to be that they are not currently eligible for listing.

Outstanding issues

The data on these communities is fragmented; without further resources we are unable to provide more data to analyse these communities further. Given that the condition and trend in condition of the sub-communities is generally not good, further research may be productive. It would be helpful to clarify which of the sub-communities in Attachment 22-1 truly belong in this NEC (i.e., whether any are on floodplains and therefore belong in NEC 1.23 instead). More faunal data also would make the information more complete.

Attachment 22-1: Data from the WA synopsis reports (McKenzie, 2003) on riparian woodlands, with Beard descriptions interspersed. *The Beard references are to the explanatory notes to the 1:1000000 mapping. We have assigned the comments to the subregion that overlaps best with the region. The name* E. microtheca *has been updated to* E. victrix*, following Hill and Johnson (1994).*

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
CAR1 Beard	Cape Range: *E. victrix* in sheltered valleys on flat ground										
CAR1 (Kendrick & Mau, 2003)	Med. woodland; coolibah (*E. victrix*)	Beard 11		0.0	na	H					
CAR1 (Kendrick & Mau, 2003)	Med. woodland; coolibah & river gum	Beard 641		0.0	na	H					
CAR1 (Kendrick & Mau, 2003)	Lyndon – Minilya Rivers		Recorded under the heading "Riparian Zone Veg", so may apply to the above vegetation associations (11& 641)					iv, v (cattle, sheep and goats), vi (buffel grass), vii	1	3	2
CAR1 (Kendrick & Mau, 2003)	Permanent and semi-permanent pools		Recorded under the heading "Riparian Zone Veg" No indication of vegetation type					iv (grazing pressure), v (cattle, sheep, horse), vi (buffel grass)	1	3	2
CAR2 Beard PIL Beard MUR	Gascoyne Marshes: "stunted trees of *E. camaldulensis* of 6-8m in height appear on creeks" Wooramel River flood-plain: *E. camaldulensis* and *Melaleuca glomerata* line the channels of the rivers (cf *Acacia citrinoviridis* on the flood-plain).										
GAS1 Beard PIL	"Hard alkaline red soils are dominant, but there are significant areas of coherent porous clays and deep loams. A surface layer of gravel and shingle derived from the harder surrounding rocks – chert, jaspilite and dolomite – is a feature. .. The main river channels are lined with *E. camaldulensis*, which may attain 20m in height and a correspondingly impressive diameter, with smaller *Melaleuca leucadendron. ..."*										
GAS1 (Kendrick, 2003a)	Med. woodland; coolabah (*E.victrix*)	Beard 11	Under "reservation priorities". NB not mapped NVIS?	0.0		H					
GAS2 Beard MUR	Carnegie salient : " Major creeks coming down from the Carnarvon Range have excavated deep perennial pools such as Karri-Karri Pool and Windich Spring, which are lined with *E. camaldulensis*."										

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
GAS2 (Cowan, 2003b)	Med. woodland; coolabah (*E.victrix*)	Beard 11				L					
GAS2 (Cowan, 2003b)	Gascoyne Catchment Area		Listed under "Riparian vegetation" – applies to the above?					iv (cattle),v (camels), vi, x, vii Animals may alter drainage patterns which in turn alter vegetation structures and contribute to eutrophication downstream after rainfall events	2	3-4	2
GAS3 Beard PIL Beard MUR	Kumarina Hills: *E. victrix* occurs along major drainage lines, *Corymbia dichromophloia* and *E*ucalyptus sp. aff. *aspera* along minor ones. These are handsome white trees to 12m in height Gascoyne ranges: " On the river flood plains the banks and islands carry a dense marginal vegetation in which *E. camaldulensis* is found up to 18m tall. *Acacia aneura, A. citrinoviridis, and A. grasbyi* occur as subordinate trees. The shrub layer is variable. The ground layer is now frequently dominated by the introduced *Cenchrus ciliaris* (buffel grass).										
GAS3 (Desmond & Kendrick, 2003)	Med. woodland; coolabah (*E. victrix*)	Beard 11				M					
GAS3 (Desmond & Kendrick, 2003)	Gasgoyne and Lyons Rivers		Listed under "Riparian vegetation" – applies to the above?					iv, v (foxes, rabbits & goats), vi (Buffel grass, Athel Pine), x (increased flow), vii	1	3	2
GAS3 (Desmond & Kendrick, 2003)	*Eucalyptus ferriticola* over trees on drainage lines in Gascoyne	NVIS MVS 8	Listed as "other ecosystem under risk"; not mapped and seen no other ref to it					No known threatening processes	2	4	1
GSD2 (Kendrick, 2003b) & **LSD1** (Kendrick, 2003c)	Rudall River	na	The only example of an arid zone river, with near permanent wetlands along its course, flowing from uplands across the desert and into a major salt lake within the Great Sandy Desert. This river is the only refuge listed by Morton *et al.* (1995) within GSD2. They note that it may provide a seasonal refuge					v (camel), vi (buffel grass)	2	3	2

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
LSD2 (Cowan & Kendrick, 2003)			to wildlife.					iv, v (cattle, donkeys, camels and rabbits), vi (buffel grass), vii	2	3-4	2
GSD2 (Kendrick, 2003b)	Semi-permanent pools along course of Rudall River.	NVIS MVS 18	Noted as an "ecosystem at risk, status V"					v, vi	2-3	3	2
GSD2 (Kendrick, 2003b) & **LSD1** (Kendrick, 2003c)	Low woodland; coolabah & paperbark (*Melaleuca* sp.)	Beard 2151		5,192.6 ha (GSD2) + 1,816.3ha (LSD1) in Rudall R National Park	1	H					
LSD2 (Cowan & Kendrick, 2003)	Med. woodland; coolibah (*E. victrix*)	Beard 11		-		H					
LSD2 (Cowan & Kendrick, 2003)	Low woodland; coolibah & paperbark (*Melaleuca* sp.)	Beard 2151		-		H					
LSD2 (Cowan & Kendrick, 2003)	Riparian zone and pools of upper Rudall River	NVIS MVS 19 (+ 15,38)	Noted as an "ecosystem at risk, status V". This may summarise the 2 woodlands above	Rudall R National Park, is there, but no areas listed	2-3	H		vi (weeds, date palms), v (feral grazers)	2	3	2
MUR1 Beard MUR	Murchison region : "Towards the rivers, where there is active drainage [cf "disorganised" drainage in other areas], scattered trees of *E. camaldulensis* and *Casuarina obesa* appear in the mulga, and they also line the drainage channels. .." Wiluna sub-region : "the calcrete platforms are interspersed with drainage channels which may carry *E. camaldulensis* woodland, notably along the discharge into Lake Way at Wiluna, east of Wiluna, and on the Hope River at Belele.										
MUR1 (Cowan, 2003c)	Med. woodland; coolibah (*E. victrix*)	Beard 11				H					

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
MUR1 (Cowan, 2003c)	All fringing vegetation of riparian zones		Under “riparian zone veg”; presumably applies to the above					iv (particularly sheep), v (goats, rabbits), vi, x, vii	2	3-4	2
MUR1 (Milewski & Dell 1992)	*E. camaldulensis* low woodland at Banjawarn Station. *E. camaldulensis* in stratum 1 (trees 10-15m, cover 10%); Stratum 2: shrubs 3-5m, cover <1%; *Acacia acuminata, Hakea arida*; Stratum 3: shrubs 1.5-2.5m, cover <1%; *Acacia victoriae, A. tetragonophylla:* Stratum 4: shrubs 0.5-1, cover >1%, *Enchylaena tomentosa, Cassia nemophila, Sida* spp.; Stratum 5: shrubs 0.2-0.5m, cover >1%, *Cyperus gymnocaulos, Rhagodia* sp.*, Senecio magnificus, Streptoglossa* sp.*, Solanum lasiophyllum, Scaevola spinescens, Atripplex vesicaria, Ptilotus obovatus, P. symonii, Sclerolaena* sp.; Stratum 6: 0-0.2m, cover up to 20% in season; ephemerals: *Centipeda thespidioides, Daucus glochidiatus, Alternanthera nana, Marsilea hirsuta.* Along drainage line; soils dark redbrown clay; sandy alluvium on ridge bank.									
MUR2 Beard MUR	Upper Murchison sub-region : on the upper courses of the Murchison and its tributaries there are extensive salt flats … “downstream, where salt is flushed out by more active drainage, halophytes tend to be flushed out by phreatophytes. On Berringarra Station the Murchison flows through braided channels in a flood-plain 8km wide. The vegetation mainly *Acacia* scrub with scattered *E. camaldulensis*, these eucalypts mainly along the channels. and a few open bare areas. Byro sub-region : “There are a few small lakes, where drainage coming down from the east has been ponded. Lake Breberle contains an association of *Frankenia, Arthrocnemum* and *Atriplex*, with groves of small *E. camaldulensis* 7.5m in height in the centre where subject to deep flooding.										
MUR2 (Desmond, 2003a)	Med. woodland over scrub; coolibah over bowgada	305	listed as “Ecosystem Types That Have at Least 85% of Their Total Extent Confined” to MUR2	-		H					
MUR2 (Desmond, 2003a)	Med. woodland; coolibah (*E. victrix*)	11				L					
MUR2 (Desmond, 2003a)	Wooramel River		Recorded under the heading “Riparian Zone Veg”, and therefore probably overlaps the records for vegetation associations 305 & 11, above					iv, v (goats, rabbits & foxes) vi (buffel grass, saffron thistle, thorn apple, mexican poppy), x	1	3	2
MUR2 (Desmond, 2003a)	Murchison River		Recorded under the heading “Riparian Zone Veg”, and therefore probably overlaps the records for vegetation associations 305 & 11, above					iv, v (goats, rabbits & foxes) vi (buffel grass, saffron thistle, thorn apple, mexican poppy), x	1	3	2
MUR2 (Desmond, 2003a)	Wooleen Lake	na	A floodplain lake and associated marshes with samphire on the floor and lignum and *Eucalyptus camaldulensis* low open woodland around the margins.				Important waterbird breeding habitat. Significant breeding area for Gull-billed Terns (*Gelochelidon nilotica*).				

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
MUR2 (Desmond, 2003a)	*Eucalyptus camaldulensis* woodlands on Berringarrah and Milly Milly Stations along the Murchison River	NVIS NVS 8	Noted as an "ecosystem at risk, status V". Not mapped therefore no Beard code				these are Major Mitchell Cockatoo nesting sites	iv, v (goats, rabbits), vii	3	4	2
PIL1 Beard PIL	Note there also is detailed information on the *E. victrix* communities of the Fortescue R from Florentine (1999) Abydos plain: "the numerous river channels and watercourses which seam the plain are important as they provide distinctive habitats with alluvial detritus and phreatic moisture" …minor creek beads acacia etc… " "The banks of major creeks and rivers are wooded by comparatively large trees of *E. camaldulensis* and smaller ones of *Melaleuca leucadendron,* which form a gallery woodland. A sparse understorey of trees and shrubs includes *Acacia* sp. aff. *coriacea* (waterwood), *Crotalaria cunninghamii, Gossypium robinsonii, Hibiscus panduriformis, Notoxylinon australe* and *Triumfetta appendiculata.* The introduced *Aerva javanica* sometimes may be very common. …"beds of all the rivers, which are intermittent, are wide and braided, often changing course."…."on the deGrey..chief soils are neutral and acid red earths" On Millstream station on the western Fortescue, where the river prepares to leave the valley for its gorges through the Chichester Plateau and has incised valley-fill deposits, an aquifer is tapped which rises through several powerful springs and converts the intermittent Fortescue into a permanent stream. There are in consequence several large and deep permanent pools in the main course, in particular the "Deep Reach", which is over 2km long, and several permanent feeder creeks such as the 'Millstream' itself. These are lined by well-grown *E. camaldulensis* and *Melaleuca leucadendron,* and some introduced date palms have become established. .. The flats beside the rivers and creeks carry an irregular woodland of *E. camaldulensis*, *Melaleuca glomerata* and *Acacia cyanophylla,* which contains some unusual plants, notably the palm *Livistona alfredii*, a local endemic. .. Other species recorded were the tree *Sesbania formosa,* shrubs *Hibiscus panduriformis, Samolus repens, Stemodia grossa, Stylobasium spathulatum.*										
PIL1 (Kendrick & McKenzie, 2003)	Med. woodland; coolabah (*E.victrix*)	Beard 11		0.0	na	H	*Petrogale rothschildi,* Rothschild's Rock-wallaby; a priority species, occurs in this habitat (and others)	foxes threaten the wallaby			
PIL1 (Kendrick & McKenzie, 2003)	Med. woodland; river gum (*E. camaldulensis*)	Beard 619		264.2	3	H	*Rhinonicteris aurantius,* Orange Leaf-nosed Bat, Schedule 1; Rare/likely to become extinct, & *Macroderma gigas,* Ghost Bat, species at risk within the subregion occur in this habitat (and others)				

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
PIL1 (Kendrick & McKenzie, 2003)	Med. woodland; coolabah & river gum	Beard 641		1,147.9	3	H	*Rhinonicteris aurantius,* Orange Leaf-nosed Bat, Schedule 1; Rare/likely to become extinct, & *Macroderma gigas,* Ghost Bat, species at risk within the subregion occur in this habitat (and others)				
PIL1 (Kendrick & McKenzie, 2003)	All fringing vegetation of riparian zones		Recorded under the heading "Riparian Zone Veg", and probably applies to the vegetation associations above					iv, v (cattle, donkey, camel, horse), vi (buffel grass, Parkinsonia, Mesquite, Mexican Poppy)	1	3	2
PIL1 (Kendrick & McKenzie, 2003)	Wetlands of De Grey River (from confluence with Nullagine to sea)	include 619 & 641						iv, v (feral pigs. Pigs present in the lower De Grey (high densities), and spreading upstream.			
PIL2 Beard PIL	Fortescue Valley: "At Roy Hill Station the flood plain narrows and then discharges into an enormous salt marsh 100km long and 10km wide. ."*Melaleuca lasiandra* grows peripheral to the marsh, and long lines of *E. camaldulensis* extend out into it along creeks. the soil is red loam and does not appear visibly salt. Coolabah trees (*E. victrix*) are scattered in the mulga around the marsh" "Once the active streams of the western Fortescue are established, there are again grass plains along them. In this case the vegetation is patchy" and includes several communities including "Woodland or tree savanna of *E. camaldulensis* and *E. victrix* along watercourses.										
PIL2 (Kendrick, 2003d)	Med. woodland; coolabah (*E.victrix*)	Beard 11	Under "reservation priorities". NB not mapped NVIS?	0.0	na	H					
PIL2 (Kendrick, 2003d)	Med. woodland; coolabah & river gum	Beard 641	Under "reservation priorities". NB not mapped NVIS?	0.2		H					
PIL2 (Kendrick, 2003d)	Fortescue River		Under "riparian zone veg"; presumably applies to the above					iv (cattle, horse), v (donkey), vi (buffel grass, Parkinsonia, Mesquite, date palm, cotton palm, Indian water fern and water lilies)	2	4	2
PIL2 (Kendrick, 2003d)			Note that wetlands of national and subregional significance also listed (and for some other subregions) – woodland info not linked to them								

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
PIL3 Beard PIL	Hamersley Plateau: Soils for gorges: "Deep coherent clays and loams in the valleys". Vegetation: "In the bottoms of the gorges one finds a riverain woodland or scattered elements of the woodland flora: *E. camaldulensis*, *E. dichromophloia, E. victrix*, *Acacia pruinocarpa, Melaleuca leucadendron; Acacia tumida, Eremophila longifolia, Hibiscus goldsworthii, Cleome viscosa, Swainsona stenodonta, Tephrosia bidwillii, Jasminum lineare, Porana sericea."* Stuart Hills.. "soils are often shallow and stony". "*E. camaldulensis* and *Acacia citrinoviridis* line all major rivers in the unit.."										
PIL3 (Kendrick, 2003e)	Med. woodland; coolabah & river gum	Beard 641		0.0		H					
PIL4 (Kendrick & Stanley, 2003)	Fortescue River Maitland River Turner River De Grey River George River Nichol River Sherlock River		All recorded under the heading "Riparian Zone Veg, with the same threats, condition etc. Likely to apply to the communities below					iv, v (cattle, sheep and horse), vi (buffel grass, Parkinsonia, Mesquite), iv, vi, vii, v (foxes, cats, rabbits and goats), iii	2	3	2
PIL4 (Kendrick & Stanley, 2003)	Wetlands of De Grey River (from confluence with Nullagine River to sea)							i, ii (none of this wetland is reserved, all occurs on pastoral lease), iv (high stocking rates (cattle) because country is so productive), vi (significant weed problems within river valley), v (feral pigs a major concern, moving upstream from De Grey station), vii.			
PIL4 (Kendrick & Stanley, 2003)	Med. woodland; coolabah (*E. victrix*)	11	Note the offshore islands, Dampier Archipelago (from Delambre to Eaglehawk).. Large islands have *E. victrix* along ephemeral drainage lines. Not mapped but may be this community			M					

Subregion & ref	Name	Vegetation classification	Comments	Reservation status	Reserve mgt standard	Reservation priority	Fauna	Threats	Condition	Trend	Reliability
PIL4 (Kendrick & Stanley, 2003)	Med. woodland; river gum (*E. camaldulensis*)	619				H					
PIL4 (Kendrick & Stanley, 2003)	Med. woodland; coolabah & river gum	641				H					

Rank – Reserve management standards

1. Poor e.g. high visitor impact and/or other Threatening Processes that are not managed and are leading to permanent resource degradation in a number of parks.
2. Fair e.g. Biodiversity values and or management issues are poorly identified; resource degradation is occurring though retrievable.
3. Good e.g. major biodiversity issues effectively managed
4. Very good e.g. high proportion of parks have park management plans, ecological monitoring programs in place and key biodiversity issues are being addressed.

Rank - Condition

1 Degraded (Recovery unlikely in medium term)
2 Fair (Recovery requires significant management intervention)
3 Good (Recovery would occur in short term with minimum intervention)
4 Near pristine

Rank – Trend in status/condition

1 Extinction e.g. targeted research has not observed species in recent times or no record in last 20 years
2 Status/condition rapidly declining e.g. < 10 year time frame
3 Status/condition declining
4 Status/condition static
5 Status/condition improving
6 Unknown

Reliability Rank

1 Anecdotal
2 Qualitative
3 Quantitative and qualitative
4 Quantitative

Threatening Processes

(i) Broad scale vegetation clearing
(ii) Increasing fragmentation, loss of remnants and lack of recruitment
(iii) Firewood collection
iv) Grazing pressure
(v) Feral animals - list in order of significance
(vi) Exotic weeds - list in order of significance
(vii) Changed fire regimes
(viii) Pathogens
(ix) Changed hydrology- Salinity
(x) Changed hydrology- other, e.g. altered flow regimes affecting riparian vegetation
(xi) Pollution
(xii) Other – describeIUCN reserves

IUCN I-IV are Commonwealth listed reserves that are given these IUCN categories:

1.. Strict nature reserve;
2.. Wilderness area;
3.. National park;
4.. Natural monument;

NVIS Major Vegetation Sub-groups

8. *Eucalyptus* woodlands with a shrubby understorey
9. *Eucalyptus* woodlands with a grassy understorey
15. *Melaleuca* forests and woodlands
18. Arid *Eucalyptus* low open woodlands with hummock grass
19. Arid *Eucalyptus* low open woodlands with tussock grass
38. Herbland, Sedgeland and Rushland
43. Unclassified native vegetation

NEC 1.23: Eucalypt floodplain communities in WA

Description

Key flora and fauna, and abiotic elements

Most of the eucalypt floodplain communities of WA are dominated by *Eucalyptus victrix (*formerly named *E. microtheca*). There are also occasional examples of *E. camaldulensis* on floodplains. This NEC is different to the other riparian community for WA (NEC 1.22) because NEC1.22 focuses on communities on levees and banks of major drainage channels, whilst NEC 1.23 focuses on floodplain communities.

There are relatively few clear records of *E. victrix* on floodplains in WA. They include:

- Occurrences on the floodplains of the Fortescue River, Pilbara region (Florentine 1999; Beard 1975). Here, *E. victrix* occurs on red clay soils and tends to occupy the edges or tops of gilgai (Florentine 1999); these woodlands are most common around Newman on Ethel Creek, Roy Hill and Marillana Stations (Figure 1). These are " mainly pure stands" of *E. victrix*; associated species include *Grevillea striata* and *Atalaya hemiglauca* near Roy Hill and Marillana Stations, and *Acacia aneura* and *Corymbia aspera* near Ethel Creek station (Florentine 1999). The *E. victrix* in these woodlands can attain heights of 10-12m in favourable locations (Florentine 1999). Some of them are simply fringing vegetation around strand lines of the large marsh (100km long x 5-10km wide) that occurs near Marillana Station. These occurrences tend to be scattered amongst mulga (Beard 1975) and may not be considered as coolibah woodlands. Further details are in Table 1.
- Other drainage systems that originate in the Hamersley Ranges also flow across Marillana Station into the marsh – e.g., Weeli Wolli Creek. This also carries floodplain coolibah woodland with some *G. striata* and *A. hemiglauca* (Florentine 1999).
- Beard (1975), on the Pilbara region (Abydos Plain, in PIL1 subregion): On the lower courses of the major rivers the woodlands spread out on the floodplain beside the main channels and becomes extensive enough to be mapped. Sometimes *E. victrix* and *Atalaya hemiglauca* replace *E. camaldulensis* and *Melaleuca,* especially on the deGrey below Yarrie Station. Note the topography and soils: "the deGrey..possesses a substantial delta and extensive lower alluvial plain. The beds of all the rivers, which are intermittent, are wide and braided, often changing course.….on the deGrey..chief soils are neutral and acid red earths". Note that Beard classifies these as tree savannahs rather than woodlands. *Eucalyptus victrix* woodlands are also reported on floodouts of the Oakover River.
- Beard (1975), on the Pilbara region (in GAS1 subregion): 'Narrow bands of riverain flats may also be tree-covered, with *E. victrix*, *Acacia citronoviridis*, *A. coricea*, and a ground cover of *Cenchrus ciliaris* and *Calotis multicaulis."*
- Communities on river floodplains with calcrete in the Murchison IBRA region – these are rare and are informally recognised as "vulnerable" in WA (Table 1). There is not much information on the floristics or structure of these communities; they are generally not mapped because they are so restricted, and are not even described fully in the one detailed report of the relevant area (Curry et al 1994). Presumably they are considered unique because they occur on calcrete.
- Communities fringing claypans: widespread but small occurrences of *E. victrix* over *Muehlenbeckia florulenta* on claypans throughout the Gascoyne, Murchison, Pilbara and Goldfields Regions. These are also informally recognised as "vulnerable" in WA (Table 1). They are sometimes referred to as "coolibah lignum flats". The Yadjiyugga claypan vegetation is a variant on the usual, with open coolibah woodland (*Eucalyptus victrix*) over bunch grass (*Eriachne benthamii*) and samphire (*Tecticornia verrucosa*). This flora assemblage is unique to the GAS1 bio-subregion (Ashburton subregion) (Kendrick 2003; Table 1)

One record of *E. camaldulensis* on floodplains is provided by Beard (1976) in the Murchison region, where he reports that "Locally *E. camaldulensis* may form woodland on flood plains, in claypans and on calcrete areas. Some of these areas are large enough to be mapped"

In the coolibah woodlands of the Pilbara, seasonal effects have a dramatic influence on ground cover. For example, after flooding, floodwaters exclude most plant species in the lower stratum except for species that can withstand inundation such as sedges *Cyperus* spp., *Marsilea drummondii* and *Peplidium* spp (Florentine, 1999). The *E. victrix* communities merge into grassland with few scattered trees of *E. victrix* or merge into *A. xiphophylla* low woodland (Florentine, 1999).

It is likely that other occurrences of floodplain communities occur in WA, but the data we have accessed does not provide enough detail for separation into floodplain and channel communities. Other records of *E. victrix* communities are currently treated within NEC 1.22: riparian eucalypt communities on levees and banks of major drainage lines in WA. Note that a detailed survey of the Murchison River Catchment (Curry 1994) identified the calcrete and claypan communities; the only other *E. victrix* woodland described was one along main drainage channels, with *E. camaldulensis* (and therefore part of NEC 1.22). Other occurrences of *E. victrix* on floodplains was within *Acacia* – dominated shrublands. This may be common in other parts of WA. Further work is therefore needed to refine these NECs.

Fauna records are more difficult to access. Riparian woodlands are usually rich in fauna because they provide food, water and shelter in what can otherwise be an inhospitable landscape. Arid zone rivers may provide a seasonal refuge to wildlife (Morton *et* al 1995). The synopsis reports (McKenzie 2003) list fauna but do not provide links between the fauna and preferred habitat, and we have not identified faunal records for these communities.

Processes by which the biotic and abiotic elements interact

An important abiotic factor in these communities is flooding regime. Flooding events play a major role in the reproductive cycle of *E. victrix*, perhaps stimulating seed production but definitely triggering seedling establishment (Florentine 1999). *Eucalyptus victrix* has no canopy seed storage; reproduction events may be triggered by summer rains, whilst wet soil events trigger the germination of *E. victrix* seeds (Florentine 1999). The Pilbara area is defined as arid to semi-arid (mean annual rainfall 180-300 mm). About 35% of rainfall is cyclonic. Heaviest rain falls in the summer months from decaying cyclones, which often cause flooding (Florentine 1999).

Flooding regime also affects the understorey. Relatively frequent flooding causes seed to be widely transported and a rich suite of Poaceae in the floodplain gives rise to varying swards depending on precisely when the floods occur and on the seed dormancy mechanisms of individual species.

Natural distribution

Known natural distribution (including bioregions, conservation areas)

These woodlands have been reported in the Pilbara, Murchison and Gascoyne regions of WA (Table 1). CALM also report that the coolibah lignum flats (*E. victrix* around claypans) occurs in the Goldfields areas. It is not clear from the WA synopsis reports of subregions whether examples of any of these communities are reserved. The reports for subregions PIL3, GAS1 and MUR2 are most relevant for the specialised communities around claypans or on calcrete (Table 1); it appears from these that the communities may not be reserved. The suggested recovery actions are recorded in Attachment 23-1.

Many of these woodland occurrences (especially the claypan and calcrete ones) are too small to be mapped, so a map and estimates of area are not provided here. A map relevant to some of the

Fortescue River communities is available in Florentine (1999), whilst the report of Curry et al (1994) identified vegetation in relation to land systems. A map of all the NVIS riparian communities for the arid / semi-arid region is provided with NEC 1.22.

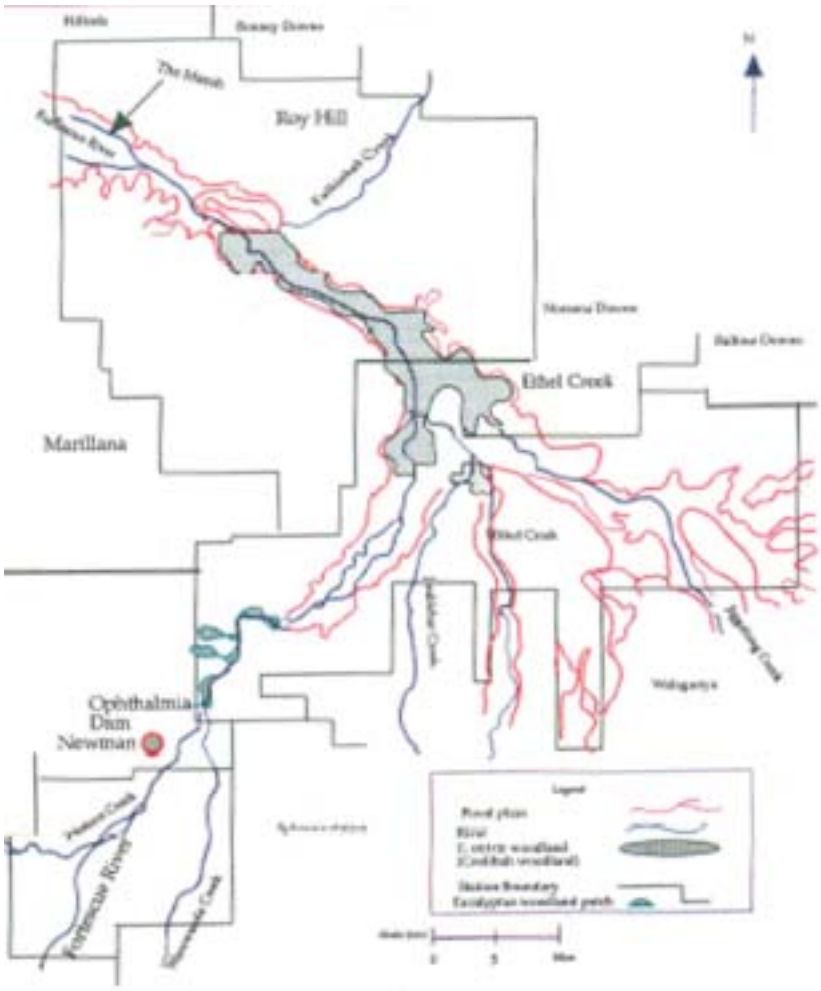

Figure 1: Distribution of the* E. victrix *woodlands near Newman, WA (Florentine 1999).

Information contributing to assessment of conservation status under EPBC Act

Components listed under State or Territory legislation

These are not formally listed in WA. However, CALM informally considers the claypan and calcrete communities to be vulnerable. One of the claypan communities contains an undescribed species: "Yadjiyugga Claypan: A large ephemeral claypan, with open coolibah woodland (*Eucalyptus victrix*) over bunch grass (*Eriachne benthamii*) and samphire (*Tecticornia verrucosa*). Also contains an undescribed *Peplidium*" (Kendrick 2003a).

Decline in geographic distribution

No data are available.

Threats to the national ecological community

The information on threats and their impacts on these communities is variable and inconsistent. In the Fortescue Valley, a major land use is pastoral grazing; some leases are held by mining companies

working in the area (e.g., BHP Billiton is the owner of Ethel Creek Station). Some information is provided by BHP Billiton, and some research is on their properties, by invitation. This may not affect the accuracy of the data but is noted here to make possible conflict of interest clear.

In the Fortescue Valley:

- In the past, the area has been heavily stocked and the leases were degraded. BHP Billiton report on their rehabilitation work (BHP 2003), which included reducing stock numbers, fencing areas to exclude stock and feral animals (especially donkeys and camels), contouring the soil to discourage rapid run-off from compacted areas. BHP (2003) report this as being successful, and believe it is sustainable in the long term. BHP Billiton embarked on a rehabilitation exercise from 1991-1992 to re-vegetate the scalded areas adjacent to the Coolibah Land system. This work has been completed and, to date, has been remarkably successful so much so that animals have been allowed to return to some of the treated areas. Florentine (1999) notes that rehabilitation has included use of the introduced naturalised perennial grasses *Cenchrus ciliatus* and *C. setiger* that are considered to be exotic weeds and unsuitable for successful rehabilitation.
- The Opthalmina Dam was built in 1981 to supply water to Newman and mining operations. The dam captures water from three of the 15 major tributaries of the Fortescue River. It has been implicated in vegetation stress along the river, especially in years of light rainfall, when the dam does not overflow (BHP 2003). However, some flooding is maintained because the dam overflows when the upper Fortescue River floods (Florentine 1999).
- In some areas *E. victrix* woodlands have suffered considerable mortality. This is believed to be the result of overgrazing and a run of comparatively dry years with no extensive flooding (Fox and Wilcox, 1992).
- Whilst pastoral overgrazing and mismanagement are often identified as major contributors to degradation in the coolibah woodlands, others have argued that the dam, changed fire regimes and atmospheric pollution from mining operation at Newman have promoted degradation.

The synopsis reports for the subregions (Table 1) list the following threatening processes as being relevant to some or all of the communities of the claypans and calcrete areas:

- Grazing pressure
- Feral animals (donkey, horse, cattle, goats)
- Exotic weeds
- Changed fire regimes
- Changed hydrology- other (mine dewatering)
- Other (ground water draw-down)

Curry *et al* (1994) comments that the calcrete areas are regarded as having high pastoral value, and that severe degradation has occurred due to past grazing activities. The low shrub layer and grasses are frequently degraded, susceptible to increases by unpalatable shrubs and mildly susceptible to accelerated erosion (Curry *et al*, 1994). The condition of the vegetation is regarded as good according to Desmond (2003) and that recovery would occur in the short term with minimum intervention.

Loss or decline of functionally important species

No data are available.

Reduction in ecological community integrity

As discussed under “threats”, grazing has altered the communities.

Rate of detrimental change

The synopsis reports for the claypan and calcrete communities indicate that the trend in condition is rank 3 to 5 (Table 1), ie ranging from declining through static to improving.

Summary and recommendation regarding category of threat under EPBC Act

As a group, these woodlands do not appear to be threatened. However, it could be argued that the calcrete and / or claypan occurrences of these woodlands are sufficiently restricted and unique that they need to be separated into their own NECs and nominated for listing. Our advice is that further attention needs to be given to this group.

Outstanding issues

This NEC is incomplete in the sense that: further expert advice should be sought about other occurrences of the woodlands, and about separating the calcrete and claypans occurrences into their own NECs. It has been largely written from the referenced data; there has been insufficient time to seek feedback from experts. This means that some of the data may not be correctly interpreted; the synopsis reports are draft reports and as such are not always easy to analyse. Expert feedback would improve the quality of the interpretation.

Table 1: Community details from various sources. *In many cases the data are extracts from the source material.*

General group	Subregion & source	Name	Vegetation classification	Comments	Threats	Condition	Trend	Reliability
Claypan	**PIL3** (Kendrick, 2003e)	Mount Bruce coolibah claypan	not mapped	Eastern foot of Mt Bruce, Karajini National Park . Listed under "wetland of subregional significance" because unique community of *E. victrix*	vi, vii, x (mine dewatering)	3	4	3
Claypan ?	**PIL3** (Kendrick, 2003e)	Coolibah Swamp, Mount Bruce, Karijini National Park	NVIS MVS 9	Listed as "other ecosystem at risk"; same as above?	iv (cattle), v (donkey, horse and cattle), vi (ruby dock)	3	3-4	3
Claypan	**PIL3** (Kendrick, 2003e)	Coolibah-Lignum Flats	NVIS MVS 43	Listed as "other ecosystem at risk" Not mapped. From CALM: *Eucalyptus victrix* over *Muehlenbeckia*. Widespread small occurrences on claypans throughout Gascoyne, Murchison, Pilbara, Goldfields Regions. Extent unknown. Priority 3(i). Curry *et al* (1984), p81, describe an open woodland (*E. victrix* and *M. florulenta* with grass understorey)	iv, xii (ground water drawdown)	2	3	2
Claypan	**GAS1** (Kendrick, 2003a)	Yadjiyugga Claypan, GAS004WA	Seasonal / intermittent freshwater lakes (>8ha), floodplain lakes	Listed under "Wetlands of National Significance (DIWA listings)" A large ephemeral claypan, with open coolibah woodland (*Eucalyptus victrix*) over bunch grass (*Eriachne benthamii*) and samphire (*Tecticornia verrucosa*). Also contains an undescribed *Peplidium*. This flora assemblage is unique to the GAS1 bio-subregion (Ashburton subregion).	v (cattle, donkey, but now fenced) Previously severely degraded by stock and donkeys, it has been protected by exclusion fencing since 1996. Recovery has been very successful.	3	4	3
Claypan	**GAS1** (Kendrick, 2003a)	Yadjiyugga Claypan	NVIS 19,39	These data under "other ecosystems at risk", relating to the vegetation in particular.	iv (cattle), v (donkey) currently protected by fencing	2	5	3
Claypan and Calcrete	**MUR1** Beard MUR	Murchison region : "Locally *E. camaldulensis* may form woodland on flood plains, in claypans and on calcrete areas. Some of these areas are large enough to be mapped"						

General group	Subregion & source	Name	Vegetation classification	Comments	Threats	Condition	Trend	Reliability
Calcrete	**MUR2** (Desmond, 2003a)	Calcrete Eucalypt woodlands of Murchison River catchment (Curry et al 1994)	NVIS MVS 8	Noted as an "ecosystem at risk, status V". Likely to be *E. victrix*. See info in row above	iv, v (goats, rabbits), vii	3	4	2
Calcrete	Curry *et al* (1994)	Calcrete eucalypt woodlands	Woodlands of *E. coolabah* with numerous under shrubs of *Acacia victoriae*, *Cassia* spp., *Ptilotus* spp. and scattered perennial grasses. Cover 10-30%. High pastoral value. Covers <0.1% of the survey area in Curry (1994) ie the Murchison River Catchment. Vegetation condition: Low shrub layer and grasses frequently degraded, susceptible to increases by unpalatable shrubs, mildly susceptible to accelerated erosion. Occurs on floodplains and calcreted plains; alkaline clayey soils. Calcrete plains: are gently sloping, often strewn with calcrete pebbles and gravels. Soils are yellowish-red fine sandy clay loams with abundant calcrete inclusions throughout the profile overlying calcrete at variable depth; pH 9.0.					
Flood-plain	**GAS1** Beard (1975)	Narrow bands of riverine flats may also be tree-covered, with *E. victrix*, *Acacia citronoviridis* , *A. coricea,* and a ground cover of *Cenchrus ciliaris* and *Calotis multicaulis."*						
Flood-plain	**PIL1** Beard (1975)	On the lower courses of the major rivers the woodlands spread out on the floodplain beside the main channels and becomes extensive enough to be mapped. Sometimes *E. victrix* and *Atalaya hemiglauca* replace *E. camaldulensis* and *Melaleuca,* especially on the deGrey below Yarrie Station" Note this latter association is a tree savanna not a woodland, in Beard's mapping. Topography and soils: "the deGrey..possesses a substantial delta and extensive lower alluvial plain. The beds of all the rivers, which are intermittent, are wide and braided, often changing course."…."on the deGrey..chief soils are neutral and acid red earths"						
Flood-plain	**PIL2** Beard (1975)	Fortescue Valley: The flood-out zones begin along the branches of the eastern Fortescue as high as Ethel Creek and widen out into an extensive plain above Roy Hill. …mentions *E. victrix* / *Atalaya hemiglauca* tree savannahs on the flood-out zones. "At Roy Hill Station the flood plain narrows and then discharges into an enormous salt marsh 100km long and 10km wide. ."*Melaleuca lasiandra* grows peripheral to the marsh, and long lines of *E. camaldulensis* extend out into it along creeks. the soil is red loam and does not appear visibly salt. Coolabah trees (*E. victrix*) are scattered in the mulga around the marsh" "Once the active streams of the western Fortescue are established, there are again grass plains along them. In this case the vegetation is patchy" and includes several communities including "Woodland or tree savanna of *E. camaldulensis* and *E. victrix* along watercourses.						
Flood-plain	Florentine (1999)	*E. victrix* woodland at Ethel Ck Station	*E. victrix* is the dominant tree species; in some places some *Corymbia aspera*. Small trees include *Atalaya hemiglauca, Hakea suberea, Acacia distans and Grevillea striata.* The shrub *Acacia tetragonophylla* is also common. Seasonal ground cover is mainly composed of annual grass species. Some degraded areas have had the introduced perennial grasses *Cenchrus ciliaris* and *Cenchrus setiger* introduced for "rehabilitation" (ie improving grazing potential). The native perennials *Astrebla pectinata, A. elymoides, Eriachne flaccida* and *E. benthamii* occur in some large stands. Soils are mainly alluvium: clay, silt and gravel; with mixed lacustrine and aeolian deposits (silt, clay and sand with some red sands and earthy sands on flanks).					

General group	Subregion & source	Name	Vegetation classification	Comments	Threats	Condition	Trend	Reliability
Flood-plain	Florentine (1999)	*E. victrix* woodland at Roy Hill Station	*E. victrix* with a few patches of *Acacia aneura* and *A. victoriae.* Dominant grass species include *Eriachne flaccida, E. benthamii, Panicum decompositum; Themeda australis* is also present. Soils as above					
Flood-plain	Florentine (1999)	*E. victrix* woodland at Marillana Station	*E. victrix* is the dominant tree species; small trees include *Atalaya hemiglauca* and *Grevillea striata.* Grasses include perennial grasses: *Chrysopogon fallax, Dichanthium sericeum, Panicum decompositum;* annual grasses include *Eragrostis japonica, Iseilema membranaceum,* and *Setaria dielsii.* Merges into *Acacia xiphophylla* low woodland to the south. Soil is mainly alluvium with redbrown, clay soil					

Rank - Condition

1	Degraded (Recovery unlikely in medium term)
2	Fair (Recovery requires significant management intervention)
3	Good (Recovery would occur in short term with minimum intervention)
4	Near pristine

Rank – Trend in status/condition

1	Extinction e.g. targeted research has not observed species in recent times or no record in last 20 years
2	Status/condition rapidly declining e.g. < 10 year time frame
3	Status/condition declining
4	Status/condition static
5	Status/condition improving
6	Unknown

Reliability Rank

1	Anecdotal
2	Qualitative
3	Quantitative and qualitative
4	Quantitative

Threatening Processes

iv)	Grazing pressure
(v)	Feral animals - list in order of significance
(vi)	Exotic weeds - list in order of significance
(vii)	Changed fire regimes
(viii)	Pathogens
(ix)	Changed hydrology- Salinity
(x)	Changed hydrology- other, e.g. altered flow regimes affecting riparian vegetation
(xi)	Pollution
(xii)	Other – describe

Attachment 23-1: Recovery actions suggested in synopsis reports

- PIL3, from Kendrick (2003e):

Coolibah Swamp, Mount Bruce, Karijini National Park
Habitat retention through reserves or on other State lands (including pastoral lease).
Fencing to exclude stock.
Weed removal, especially of Date palms, cotton palms, Parkinsonia.
Feral animal control, especially of goats and donkeys.
Fire management, with specific fire program to encourage a mosaic fire/age distribution.
Basic documentation of distribution and abundance, and threatening processes.

- GAS1, from Kendrick (2003a):

Yadjiyugga Claypan
Habitat retention through reserves or on other State lands (including pastoral lease).
Fencing has been done but needs to be maintained.
Weed control.
Feral animal control.
Fire management, with specific fire program to encourage a mosaic fire/age distribution.
Research into species distributions, requirements and threatening processes.

- MUR2, from Desmond (2003a):

Calcrete Eucalypt woodlands of Murchison River catchment –
Habitat retention through reserves or on other State lands or on private lands.
Feral animal control most particularly goats.
Weed control.
Fencing of sensitive areas where there are heavy goat numbers, as exclosures.
Capacity building required with industry.