## *Introduction to National Ecological Communities endemic to Western Australia*

Most of the eucalypt woodlands within the arid and semi-arid region of WA are found within the eastern Goldfields region, mainly the Coolgardie IBRA region. Towards the north of the eastern Goldfields, the so-called mulga-eucalypt line marks the transition between *Eucalyptus* woodlands to the south and *Acacia* shrublands to the north (figure 1; Burbidge et al. 1995). The climate is arid to semi-arid with 200-300 mm of rainfall, sometimes in summer but usually in winter (Cowan, 2003a).

Photo: Grant Pronk – Forest Products Commission

*Figure 1: Eucalypt woodlands of the Eastern Goldfields merging into mulga shrublands.*

Within the Coolgardie IBRA region, there is an exceptionally high diversity of *Eucalyptus* species with as many as 170 species occurring in the bioregion (Cowan, 2003a). Many of these species are endemic to Western Australia and endemic to the Goldfields region. Most form mallee communities and thus are excluded here.

Five main associations or national ecological communities for eucalypt woodlands were identified from the NVIS mapping at a scale of 1:250,000. This is based on the vegetation mapping by J. S. Beard. These NECs were classified according to similar floristic associations, soil types, landforms and threatening processes. The communities within these NECs are endemic to Western Australia.

- NEC 1.8: Woodlands of *E. salmonophloia* and *E. salubris* of the arid and semi-arid regions of Western Australia
- NEC 1.9: Woodlands of *E. lesouefii, E. dundasii* and *E. torquata* of the arid and semi-arid regions of Western Australia
- NEC 1.10: Woodlands of *E. longicornis* of the arid and semi-arid regions of Western Australia
- NEC 1.11: Woodlands of *E. loxophleba* of the arid and semi-arid regions of Western Australia
- NEC 1.12: Woodlands of *E. flocktoniae* and *E. transcontinentalis* in the arid and semi-arid regions of Western Australia

In addition, the following NECs were identified from the biological surveys of the eastern Goldfields region. These do not appear as eucalypt woodlands in the current NVIS data due to the broad scale of mapping:

- NEC 1.13a: Low woodlands of *E. formanii* of the arid and semi-arid regions of Western Australia
- NEC 1.13b: Low woodlands of *E. melanoxylon* of the arid and semi-arid regions of Western Australia

There are a number of rare eucalypt species that occur within this region that may not be covered here. These are generally restricted in distribution and may not form woodland communities. The aim of this report was to describe woodland communities of the arid zone, not to produce an exhaustive list of eucalypt species for the arid zone. The priority species listed below may form woodlands within this region, but little data is available to assess them. These warrant further investigation. For example, *Eucalyptus fraseri* is reported to form woodlands in the Norseman – Balladonia region (Hall and McKenzie, 1993).

***Table 1:*** *Rare or priority eucalypt species in the Coolgardie IBRA region (excluding mallees). Data extracted from the Florabase database (WA Herbarium).*

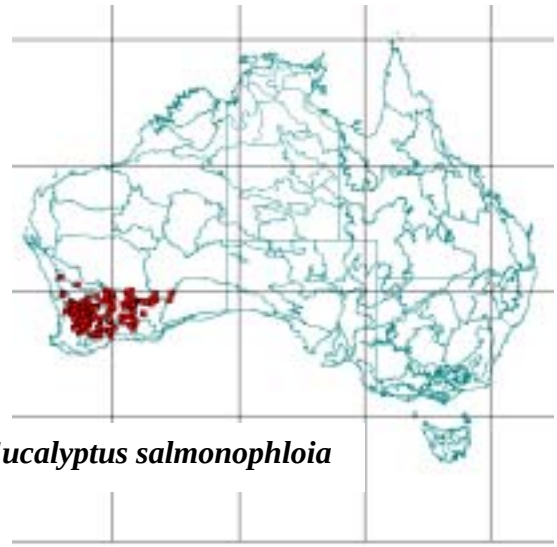
| **Species** | **Conservation status** |
|---|---|
| *Eucalyptus brockwayi* | Priority 4 |
| *Eucalyptus fraseri* | Priority 2 |
| *Eucalyptus georgei* ssp. *fulgid* | Priority 4 |
| *Eucalyptus georgei* ssp. *georgei* | Priority 4 |
| *Eucalyptus pterocarpa* ssp. *obtusa* | Priority 1 |
| *Eucalyptus pterocarpa* ssp. *pterocarpa* | Priority 4 |

A summary of the history of timber harvesting in this region and current threatening processes is provided within each NEC description.

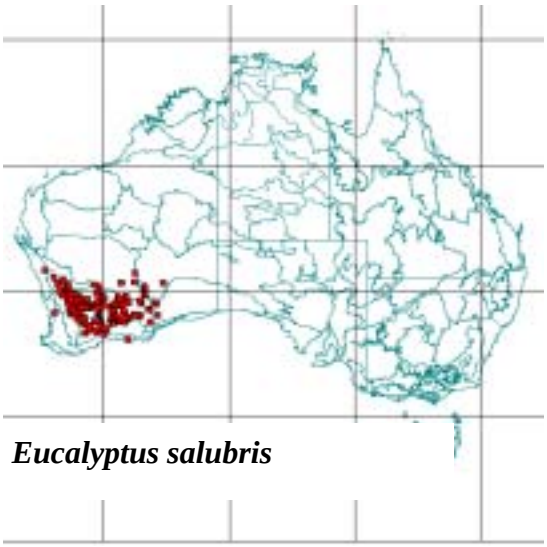
The two following appendices contain maps of species distributions (Appendix A) and lists of rare and priority flora (Appendix B). These will be referred to throughout the WA NECs 1.8 – 1.13.

*Appendix A*
*Maps illustrating distribution of selected* Eucalyptus *species in Western Australia*

Distribution maps are from the Australia's Virtual Herbarium (website: http://avh.calm.wa.gov.au/cgi-bin/avh.cgi). IBRA regions are outlined in blue.

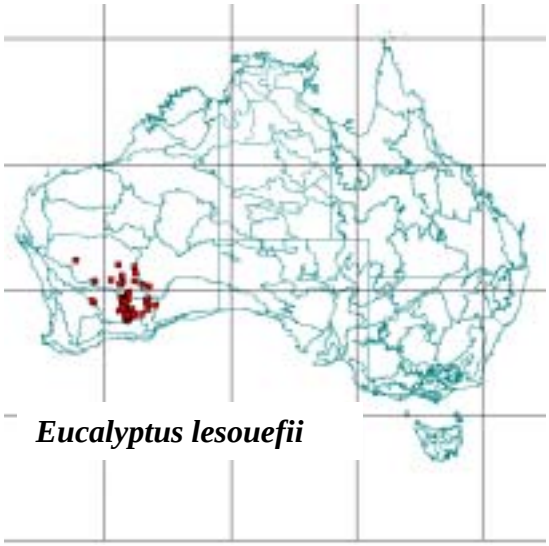


***Eucalyptus salmonophloia***



***Eucalyptus salubris***

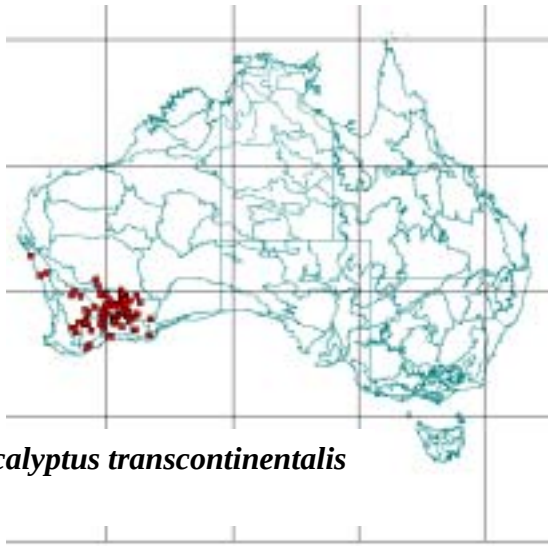
***Eucalyptus dundasii***



***Eucalyptus lesouefii***

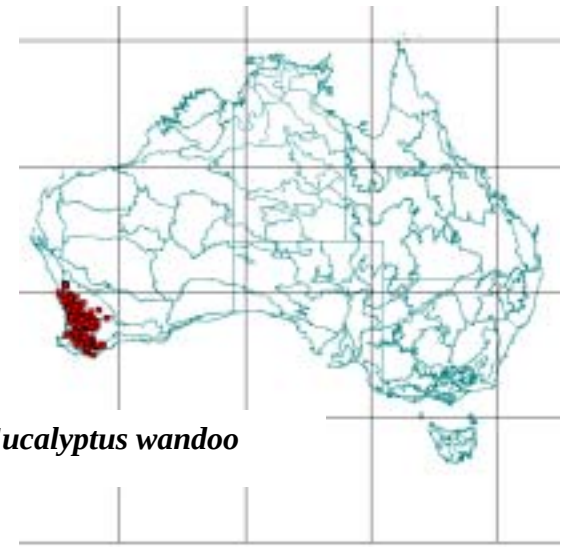
*Eucalyptus torquata*

*Eucalyptus flocktoniae*

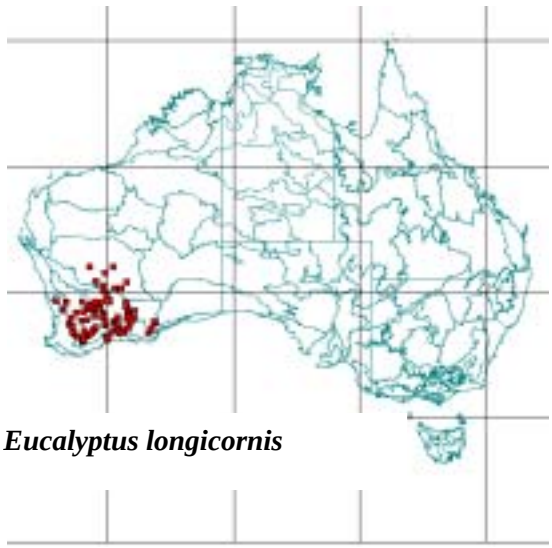


*Eucalyptus transcontinentalis*

*Eucalyptus loxophleba*



*Eucalyptus wandoo*



*Eucalyptus longicornis*

***Appendix B:*** *Rare and priority flora listed for the Coolgardie IBRA region(data from the Western Australian Herbarium Florabase). Categories of conservation status are described at end of appendix.*

| **Rare flora** | **Priority 1 Flora** | **Priority 2 Flora** |
|---|---|---|
| *Acacia denticulosa* | *Acacia adinophylla* | *Acacia asepala* |
| *Acacia lanuginophylla* | *Acacia desertorum* | *Acacia concolorans* |
| *Acacia lobulata* | *Acacia diaphana* | *Acacia kerryana* |
| *Banksia sphaerocarpa* ssp. *dolichostyla* | *Acacia dorsenna* | *Acacia subrigida* |
| *Boronia adamsiana* | *Acacia epedunculata* | *Astartea* sp.Jyndabinbin Rocks |
| *Conospermum toddii* | *Acacia hystrix* ssp. *continua* | *Boronia westringioides* |
| *Daviesia microcarpa* | *Acacia sclerophylla* var. *teretiuscula* | *Bossiaea cucullata* |
| *Eremophila virens* | *Acacia websteri* | *Brachysola halganiacea* |
| *Eremophila viscida* | *Allocasuarina globosa* | *Chthonocephalus multiceps* |
| *Eucalyptus brevipes* | *Astartea* sp.Esperance | *Dampiera orchardii* |
| *Eucalyptus cerasiformis* | *Astartea* sp.Mt Dimer | *Dicrastylis obovata* |
| *Eucalyptus crucis* ssp. *crucis* | *Astartea* sp.Red Hill | *Dryandra epimicta* |
| *Eucalyptus platydisca* | *Calothamnus superbus* | *Elachanthus pusillus* |
| *Eucalyptus steedmanii* | *Calytrix creswellii* | *Eucalyptus educta* |
| *Eucalyptus synandra* | *Chamelaucium paynterae* | *Eucalyptus fraseri* |
| *Frankenia parvula* | *Chorizema circinale* | *Eucalyptus jutsonii* |
| *Gastrolobium graniticum* | *Conostephium marchantiorum* | *Frankenia brachyphylla* |
| *Leucopogon* sp.Helena & Aurora Range | *Dampiera plumosa* | *Goodenia scapigera* ssp. *graniticola* |
| *Marianthus* sp.Bremer | *Dampiera scaevolina* | *Goodenia varia* |
| *Pityrodia scabra* | *Dicrastylis capitellata* | *Gratiola pedunculata* |
| *Stylidium merrallii* | *Diocirea microphylla* | *Grevillea plurijuga* ssp. *superba* |
| *Tetratheca aphylla* | *Dodonaea hexandra* | *Grevillea secunda* |
| *Tetratheca harperi* | *Echinop ogon ovatus* | *Haegiela tatei* |
| *Tetratheca paynterae* | *Eremophila lucida* | *Hakea pendens* |
| | *Eremophila perglandulosa* | *Hakea rigida* |
| | *Eremophila praecox* | *Hydrocotyle coraginaensis* |
| | *Eremophila* sp.Mt Jackson | *Isolepis australiensis* |
| | *Eucalyptus jimberlanica* | *Keraudrenia adenogyna* |
| | *Eucalyptus myriadena* ssp. *parviflora* | *Lepidium genistoides* |
| | *Eucalyptus pterocarpa* ssp. *obtusata* | *Lepidium merrallii* |
| | *Eucalyptus websteriana* ssp. *norsemanica* | *Leucopogon* sp.Marvel Loch |
| | *Euryomyrtus ciliata* | *Logania exilis* |
| | *Gastrolobium tenue* | *Malleostemon* sp.Adelong |
| | *Gnephosis intonsa* | *Microcorys lenticularis* |
| | *Gnephosis* sp.Norseman | *Micromyrtus serrulata* |
| | *Goodenia heatheriana* | *Micromyrtus stenocalyx* |
| | *Goodenia* sp.Scaddan | *Olearia laciniifolia* |
| | *Grevillea lissopleura* | *Phebalium clavatum* |
| | *Grevillea marriottii* | *Philotheca apiculata* |
| | *Grevillea phillipsiana* | *Phlegmatospermum eremaeum* |
| | *Halosarcia flabelliformis* | *Pimelea halophila* |
| | *Hibbertia axillibarba* | *Rumex crystallinus* |
| | *Hibbertia lepidocalyx* | *Stenanthemum poicilum* |
| | *Homalocalyx grandiflorus* | *Stylidium choreanthum* |
| | *Jacksonia jackson* | *Thysanotus brachyantherus* |
| | *Keraudrenia cacaobrunnea* | *Trachymene pyrophila* |
| | *Labichea eremaea* | *Verticordia dasystylis* ssp. *dasystylis* |
| | *Lepidium fasciculatum* | *Verticordia multiflora* ssp. *Solox* |
| | *Leptospermum macgillivrayi* | *Verticordia pulchella* |
| | *Leucopogon* sp.Roberts Swamp | |
| | *Microcorys* sp.Forrestania | |
| | *Microcybe pauciflora* | |
| | *Micromyrtus papillosa* | |
| | *Millotia newbeyi* | |
| | *Mirbelia taxifolia* | |
| | *Muelleranthus crenulatus* | |
| | *Persoonia leucopogon* | |
| | *Phebalium appressum* | |
| | *Philotheca nutans* | |
| | *Prostanthera splendens* | |
| | *Pseudactinia sp.Bungalbin Hill* | |
| | *Ptilotus procumbens* | |

| **Priority 3 Flora** | **Priority 4 Flora** |
|---|---|
| *Acacia acanthoclada* ssp. *glaucescens* | *Calamphoreus inflatus* |
| *Acacia ancistrophylla* var. *perarcuata* | *Darwinia polycephala* |
| *Acacia crenulata* | *Eremophila biserrata* |
| *Acacia cylindrica* | *Eremophila caerulea* |
| *Acacia dissona* var. *indoloria* | *Eremophila denticulata* |
| *Acacia eremophila* var. *variabilis* | *Eremophila parvifolia* |
| *Acacia filifolia* | *Eremophila racemosa* |
| *Acacia formidabilis* | *Eremophila serpens* |
| *Acacia improcera* | *Eucalyptus caesia* ssp. *caesia* |
| *Acacia inophloia* | *Eucalyptus caesia* ssp. *magna* |
| *Acacia pritzeliana* | *Eucalyptus deflexa* |
| *Acacia truculenta* | *Eucalyptus formanii* |
| *Acacia undosa* | *Eucalyptus georgei* ssp. *georgei* |
| *Adenanthos gracilipes* | *Eucalyptus georgei* ssp. *fulgida* |
| *Allocasuarina eriochlamys* ssp. *grossa* | *Eucalyptus kruseana* |
| *Alyxia tetanifolia* | *Gyrostemon ditrigynus* |
| *Astartea* sp.Bungalbin Hill | *Myriophyllum balladoniense* |
| *Austrostipa blackii* | *Myriophyllum petraeum* |
| *Banksia lullfitzii* | *Sowerbaea multicaulis* |
| *Calandrinia porifera* | *Wurmbea murchisoniana* |
| *Calytrix plumulosa* | |
| *Comesperma calcicola* | |
| *Cryptandra imbricata* | |
| *Cryptandra polyclada* ssp. *polyclada* | |
| *Daviesia elongata* ssp. *implexa* | |
| *Dryandra ferruginea* ssp. *flavescens* | |
| *Dryandra viscida* | |
| *Elatine macrocalyx* | |
| *Eremophila purpurascens* | |
| *Eremophila veronica* | |
| *Eucalyptus brockwayi* | |
| *Eucalyptus depauperata* | |
| *Eucalyptus exigua* | |
| *Eucalyptus histophylla* | |
| *Eucalyptus ovularis* | |
| *Euryomyrtus leptospermoides* | |
| *Eutaxia* sp.Hatter Hill | |
| *Frankenia drummondii* | |
| *Frankenia georgei* | |
| *Frankenia glomerata* | |
| *Galium migrans* | |
| *Gompholobium asperulum* | |
| *Goodenia laevis* ssp. *laevis* | |
| *Goodenia trichophylla* | |
| *Grevillea eriobotrya* | |
| *Grevillea georgeana* | |
| *Grevillea insignis* ssp. *elliotii* | |
| *Grevillea pilosa ssp. redacta* | |
| *Gunniopsis rubra* | |
| *Lasiopetalum fitzgibbonii* | |
| *Melaleuca coccinea* | |
| *Melaleuca macronychia* ssp. *trygonoides* | |
| *Menkea draboides* | |
| *Microseris scapigera* | |
| *Phebalium brachycalyx* | |
| *Pityrodia chrysocalyx* | |
| *Prostanthera nanophylla* | |
| *Stylidium pulviniforme* | |
| *Synaphea divaricata* | |
| *Verticordia gracilis* | |
| *Verticordia mitodes* | |
| *Verticordia stenopetala* | |

**R: Declared Rare Flora - Extant Taxa ( = Threatened Flora = Endangered + Vulnerable)**

Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.

**P1: Priority One - Poorly Known Taxa**

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

**P2: Priority Two - Poorly Known Taxa**

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

**P3: Priority Three - Poorly Known Taxa**

Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.

**P4: Priority Four - Rare Taxa**

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

# NEC 1.8: *Eucalyptus salmonophloia* (Salmon Gum) and / or *E. salubris* (Gimlet) woodlands of the semi-arid and arid region of Western Australia

*Figure 1:* Eucalyptus salmonophloia *and* E. salubris *woodland of the eastern Goldfields of Western Australia. This area is regrowth following clearfelling in the 1900's and has been grazed.*

Photo: Grant Pronk – Forest Products Commission

*Figure 2:* Eucalyptus salubris *woodland of the eastern Goldfields of Western Australia.*

# NEC 1.8: *Eucalyptus salmonophloia* (Salmon Gum) and / or *E. salubris* (Gimlet) woodlands of the semi-arid and arid region of Western Australia

## *Description*

Introduction, key flora, fauna and abiotic components

Woodlands dominated by *E. salmonophloia* and *E. salubris* are grouped together in this NEC because these two species occupy approximately the same area in southwestern WA and commonly occur together on similar soil types and landforms (Beadle, 1981). This NEC only includes the sub-communities that predominantly occur in the arid and semi-arid region (mainly the eastern Goldfields region of WA). There are a number of additional sub-communities with salmon gum and gimlet that occur predominantly in the temperate zone; these are not detailed here or included in tables or mapping. Use of the semi-arid boundary (defined in the introduction) to separate the arid sub-communities from the predominantly temperate ones, also separates the sub-communities with respect to the processes threatening them. Specifically, the temperate *E. salmonophloia* and *E. salubris* communities (mainly in the Avon Wheatbelt IBRA region) are highly fragmented due to extensive clearing over the past 100 years (Yates *et al*. 1994) and are within the intensive land-use zone of WA (Beeston *et al*. 2002). In contrast, the arid and semi-arid occurrences are within the extensive land-use zone in which there are large areas of potentially undisturbed vegetation (Beeston *et al*. 2002). In addition, understorey species are typically different between the semi-arid and temperate regions. In the arid zone, bluebush, saltbushes and other species typical of the arid zone dominate the shrub layer (Beadle, 1981; Dell et al. 1985), whilst tall shrubs of *Acacia* and *Melaleuca* species are common in temperate areas.

This NEC includes 16 sub-communities listed in the NVIS data (1:250,000 mapping) within the arid and semi-arid region of WA. Note that the sub-communities are simply a listing of the communities identified in the available data that fit within this NEC. In some cases sub-communities may be very similar but given different names because they originate from different surveys. Western Australia is continuing to update their mapping (Shepherd et al 2001), and it is conceivable that some of these sub-communities will change with time. *Eucalyptus salmonophloia* occurs as the dominant eucalypt in most of the sub-communities within this NEC, occurring as the dominant tree in 14 sub-communities (Table 1). *Eucalyptus salubris* occurs as the dominant eucalypt in two of the sub-communities and as a co-dominant in 7 sub-communities (Table 1).

It should be noted that communities containing *E. salmonophloia* as a co-dominant but *E. lesouefii*, *E. dundasii* or *E. loxophleba* as the dominant tree are included in other NECs (NEC #1.9 and 1.11).

The most extensive sub-communities in this NEC according to NVIS mapping at a scale of 1:250,000 (following the NVIS 1: 250,000 / Beard nomenclature) are:

- pure stands of *E. salmonophloia*,
- mosaic communities of medium woodlands of *E. salmonophloia*, *E. oleosa* and hummock grasslands,
- medium woodlands of *E. salmonophloia* and *E. salubris*, and
- medium woodlands of *E. salmonophloia* and *E. lesouefii*.

*Eucalyptus salubris* dominates on more saline areas of heavy clays (Beadle, 1981). Several other tree species may be present, such as *E. longicornis* and *E. transcontinentalis*. *Eucalyptus longicornis* is locally dominant where lime lies near the surface (Beadle, 1981), whilst *E. transcontinentalis* and *E. flocktoniae* are recorded on red or loamy soils (Beadle, 1981). Woodlands of *E. salmonophloia* and *E. salubris* often form mosaics with mallee communities or other woodland communities (see Table 1). In addition, these eucalypts form ecotonal associations with the following species: *E. wandoo*, *E. loxophleba*, *E. lesouefii* and *E. dundasii*.

Pure stands of *E. salmonophloia* are scattered throughout the central part of the Coolgardie IBRA region. These woodlands intergrade with *E. salubris* and *E. longicornis* towards the west extending into the Avon Wheatbelt IBRA region. Around the Kalgoorlie area, *E. lesouefii* is co-dominant. Towards the east of the Coolgardie IBRA region, the *E. salmonophloia* woodlands form mosaic communities with hummock grasslands or shrublands of mallee scrub. Co-dominant eucalypts in the east include *E. oleosa* and *E. flocktoniae*.

Beard generally describes the woodlands as medium woodlands. In the biological surveys of the eastern Goldfields region these communities are described as woodlands typically 15-20m when dominated by *E. salmonophloia* and low woodlands typically 8-12m when dominated by *E. salubris* (McKenzie and Hall, Hall and McKenzie, 1993, Burbidge et al. 1995, Keighery et al. 1995, Dell et al. 1985 and Newbey et al. 1984). Stands are often very irregular with respect to density of trees and therefore crown cover (Beard, 1981). According to the Beard's floristic codes the projected foliage cover of the tree layer ranges from 10-30%.

Examples of the prominent tall shrubs, low shrubs and ground flora recorded in the *E. salmonophloia* and *E. salubris* woodlands of the Goldfields region are summarised in Table 3. The most common low shrubs are *Maireana sedifolia*, *Atriplex hymenotheca*, *A. nummularia*, and *Crastylis conocephala*. Taller shrubs may be scattered and these include *Eremophila scoparia*, *Pittosporum phylliraeoides* and *Eucarya acuminata*. The herbaceous layer consists mainly of annuals or short-lived perennials in genera such as *Atriplex*, *Bassia*, *Helipterum*, *Ptilotus* and *Zygophyllum* (Beadle, 1981). The understorey of *E. salubris* woodlands is generally sparse (Arnold and Weeldenburg, 1998)

This NEC occurs on the following soil types: grey brown or red calcareous soils, calcareous red earths, solonized brown soils, solodized soils and in the driest areas solonshaks (Beadle, 1981). Soils may be saline. In the Coolgardie district, *E. salmonophloia* generally occurs on light loams, whilst *E. salubris* occurs on stiff clays (Beard, 1981). Within the general landscape, this NEC mainly occurs on alluvial or flat plains in valley bottoms, and sometimes on slopes (Hobbs and Yates, 2000).

Fauna surveys were conducted during the biological surveys of the eastern Goldfields and should be consulted for fauna lists (eg. McKenzie and Hall 1992; Hall and McKenzie 1993; Newbey et al. 1984; Dell et al. 1985). There are records that point to the importance of the habitat for cockatoos. Desmond (2003b) records occurrences of the endangered *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) and specially protected *Cacatua leadbeateri mollis* (Major Mitchell Cockatoo) in the Salmon gum woodlands of the Yalgoo region. Carnaby's Black Cockatoo nests in hollows of *E. salmonophloia* and *E. wandoo* (Birds Australia/RAOU 1995-2002). This species is listed as endangered under the EPBC Act. Many of the small mammals that once covered this region are now extinct due to predation by feral cats and foxes.

## *National distribution*

### Known natural distribution (including bioregions & conservation areas)

This NEC mainly occurs in the Coolgardie, Avon Wheatbelt, and Mallee IBRA regions, with minor areas in the Yalgoo and Great Victorian Desert IBRA regions (NVIS data) in WA (Map 1). Both eucalypt species generally occur in areas with an average annual rainfall of between 200mm and 500mm (Hobbs and Yates, 2000) across arid and / or semi-arid and temperate regions of WA and are endemic to Western Australia (Appendix A). Although this NEC includes the NVIS sub-communities that are predominantly arid in distribution, the distribution of some of these sub-communities extends into temperate regions of WA (Avon Wheatbelt and Mallee IBRA regions).

The available mapping that indicates the extent of the community is derived from J.S.Beard's mapping (Shepherd, 2001). In this, current vegetation is mapped at 1:250 000. There are many areas where the scale of ecological variation is smaller than the mapping scales. In part, this is covered by the mapping of mosaics (see Table 2 and Map 1). Thus the mapping is not detailed enough to properly estimate

"area of occupancy" of the woodland community. The mapped polygons may be a reasonable indication of area of occupancy for some sub-communities, particularly those that are continuous over large areas. In other areas where woodlands and shrublands and / or grasslands exist in mosaics or where the boundaries between the sub-communities are genuinely broad and diffuse, the polygon area is at the best an upper limit to the area occupied. In the mosaic description Beard listed the more prevalent association first (if one clearly occurred over a larger area). However, unfortunately there is no information on the proportion of each component of a mosaic within these units. On the other hand, the mapping has sufficient detail to be doing more than indicating extent of occurrence (defined in the EPBC Act, 1999 as "the total area contained within the shortest continuous boundary that can be drawn to encompass all the areas where the ecological community occurs"). These issues need to be kept in mind in interpreting the data presented here.

The mapped area for the non-mosaic units totals ~2.6 million ha, and the mosaic map units cover a further 1.4 million ha (Table 2). Regardless of whether this indicates area of occupancy or extent of occurrence, this is regarded as a large geographic distribution according to the EPBC criteria.

The mapped current extent of each sub-community varies substantially (Table 1). Several communities have a limited distribution according to the EPBC criteria (total area of occupancy < 100,000 ha) – in particular, of the non-mosaics: numbers 148, 1067, 1078 and 2903 all have limited distributions. However, at this stage we see no evidence for proposing any of these as a separate NEC in their own right. The extant areas and the percentage of the pre-European extent remaining are presented in Table 1.

Overall, approximately 11% of the extant area of this NEC are reserved in CALM estate (429,000ha). This may be regarded as inadequate reservation of an NEC on a bioregional scale according to the Australian Terrestrial Biodiversity Assessment (2002), as <15% of the ecological community is reserved. In addition to CALM reserves, a number of the sub-communities included in this NEC are present in proposed reserves (Chapman et al. 1984). For example, areas in the proposed reserve at Johnson's Lakes and the proposed extension of Peak Charles National Park include sub-community #1. Although, not yet listed as CALM reserves, practices such as timber harvesting are not allowed in these proposed areas.

The proportion of each sub-community reserved varies substantially (Table 1). For example, the following sub-communities are well reserved with > 10% reserved in CALM estate:

- Medium woodland; salmon gum (*E. salmonophloia*), morrel (*E. longicornis*), gimlet (*E. salubris*) & rough fruited mallee (*E. corrugata*)
- Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & morrel (*E. longicornis*) /Shrublands; mallee scrub, redwood
- Medium woodland; salmon gum (*E. salmonophloia*) & morrel (*E. longicornis*)
- Medium woodland; salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*)
- Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & Dundas blackbutt (*E. dundasii*) / Shrublands; mallee scrub *E. eremophila*
- Medium woodland; salmon gum (*E. salmonophloia*), redwood (*E. transcontinentalis*), merrit (*E. flocktoniae*), gimlet (*E. salubris*) & *Eucalyptus sheathiana*

In contrast, several units are not reserved at all in the CALM estate:

- Medium woodland; salmon gum (*E. salmonophloia*), goldfields blackbutt (*E. lesouefii*), gimlet (*E. salubris*) & *Allocasuarina cristata*,
- Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) / Hummock grasslands, mallee steppe; red mallee (*E. oleosa group*) over spinifex (*T. scariosa*)
- Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) / Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa* group).
- Mosaic: Medium woodland; gimlet (*E. salubris*) / Shrublands; mallee scrub *E. eremophila*

Table 2 lists the reserves and national parks in which each of the sub-communities is represented.

## *Information contributing to the conservation status under the EPBC Act*

Components listed under State or Territory legislation

Western Australia currently has no legislation dealing specifically with Threatened Ecological Communities (TECs). However, TECs that occur in WA may now be listed as nationally threatened under the EPBC Act (1999). None of the *Eucalyptus salmonophloia* and *E. salubris* woodlands in WA are listed under the EPBC Act as threatened to date.

The Western Australian Threatened Species and Communities Unit (WATSCU) keeps an informal list of TECs and other ecosystems regarded as at risk. None of the sub-communities listed in this NEC are listed as TECs by CALM. However, sub-community #5 is listed as an ecosystem at risk (Grant et al. 2003). The threatening processes are unknown, although grazing is likely (Grant et al. 2003). This sub-community is not currently reserved in reserves under CALM management.

The flora and fauna of the goldfields region remain relatively unexplored (Burbidge et al. 1995; McKenzie and Hall, 1992). Appendix B lists known rare flora, priority 1-4 flora listed for the Coolgardie IBRA region (Western Australian Herbarium 2003).

Threatened fauna within the *E. salmonophloia* and *E. salubris* woodlands of the arid region include the endangered[1] *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) and specially protected *Cacatua leadbeateri mollis* (Major Mitchell Cockatoo). These birds may be found in the Salmon gum woodlands of the Yalgoo region. Carnaby's Black Cockatoo nests in hollows of *E. salmonophloia* and *E. wandoo* (Birds Australia/RAOU 1995-2002).

Decline in geographic distribution

Substantial areas (78%) of the *E. salmonophloia* and *E. salubris* woodlands in WA in general have been cleared for agriculture because of the high fertility of the broad valley floors on which they occur (Hobbs and Yates, 2000). Overall, approximately 15% of the pre-European extent of this NEC remain. This estimate is based on the percentage pre-European vegetation remaining for all sub-communities in this NEC across their entire range / distribution. Most of this clearing occurred within the agricultural wheatbelt region and around the Kalgoorlie region between 1900 and 1960.

It is clear from Table 1 that this low percentage for pre-European vegetation remaining is due to the substantial clearing of sub-communities # 1, 3, 4, 7, and 9. Most of the clearing of these vegetation types took place in the wheatbelt region. A clearer picture of the decline in geographic distribution within the arid zone is gained by determining what percentage of the arid component of these sub-communities has been cleared (Table 1). Table 1 shows the percentage pre-European vegetation remaining in the arid zone for each sub-community. According to these data, in most cases, very little clearing of these sub-communities has taken place in the arid zone. An estimated 96% of the pre-European vegetation of this NEC remains in the arid zone. However, it must be acknowledged that many of the areas clearfelled during the 1900's in the goldfields region that have regenerated (regrowth woodlands) are mapped in the NVIS data as uncleared vegetation types. This is misleading as these woodlands are modified by previous clearing, grazing and mining practices. They may be more appropriately mapped / classified as different vegetation types to those areas that are relatively unmodified (eg. uncleared).

The sub-communities most affected by clearing are the following (< 10% of the original extant remaining):

- Medium woodland; salmon gum (*E. salmonophloia*) and gimlet (*E. salubris*).

[1] Conservation status according to the EPBC act

- Medium woodland; salmon gum (*E. salmonophloia*).

The following sub-communities have also been substantially cleared with 10-30% remaining (Hobbs and Yates, 2000):

- medium woodlands of salmon gum (*E. salmonophloia*) and morrel (*E. longicornis*).
- medium woodlands of salmon gum (*E. salmonophloia*) and goldfields blackbutt (*E. lesouefii*).
- medium woodlands of salmon gum (*E. salmonophloia*) and red mallee (*E. oleosa*).

All other sub-communities have >30% of the pre-European extent remaining.

It should be noted that the broad scale of mapping used to estimate current and pre-European extent means that the data must be interpreted with caution. More detailed mapping, would likely reduce the apparent extent of vegetation types. At present, we are unsure what uncertainty surrounds these estimates (ranges / bounds would be a more useful approach).

## Threats to the national ecological community

General threats to this NEC include past clearing, increased fragmentation, livestock grazing, weed invasion, changed fire regimes and feral animals (National Land and Water Resources Audit, 2001). Large areas of salmon gum woodlands around the gold mining centres of Coolgardie and Kalgoorlie are regrowth following clearfelling to supply mining timber and fuelwood (Yates *et al*. 1994). Timber harvesting was extensive from 1900 to 1960, with an estimated 30 million tonne of timber cut for mining infrastructure and fuelwood purposes (3.4 million ha of eucalypt woodlands was intensively cut / clearfelled). Many of these areas now support regrowth woodlands that have regenerated naturally (Figures 1 & 2). Generally, regeneration of eucalypt species has been vigorous with regrowth stands showing significantly higher numbers of trees / ha and basal area / ha than in similar uncut communities such as those in timber reserves (Table 4). Soil disturbance during harvesting and subsequent bushfires most likely promoted seed germination of eucalypt species. Most regeneration is from seed with some coppicing (Siemon and Kealley, 1999; Figure 5). Regeneration is particularly dense along where the timber tramlines were in operation 1900 to 1975.

In some areas, regeneration was so vigorous that thinning the vegetation may be necessary to encourage the development of larger and more widely spaced trees, thus creating woodland somewhat similar to those that would naturally have occurred prior to disturbance. Nevertheless, small bird species appear to favour the vigorous regrowth areas, whilst larger birds requiring hollow bearing trees prefer areas with old trees.

However, in some cases, regrowth was not successful and woodlands are very sparse (Yates *et al*. 1994). In particular the pure stands of salmon gum over bluebush communities around Kalgoorlie show poor regeneration after clearfelling (Figure 7).

The Forests Products Commission (FPC) of Western Australia are currently investigating the potential use of goldfields eucalypts[2] such as *E. salmonophloia* and *E. salubris* for speciality timbers for use in the production of musical instruments, timber crafts, furniture, and specialised flooring, and more generally for use in joinery and turnery (Siemon and Kealley, 1999). Harvesting is restricted to regrowth areas and is at present a small-scale operation. Between 1995 and 1998, 600 tonnes of goldfields eucalypts were harvested by FPC and a further 100 tonnes were harvested this year. Typical sawlog volumes for Goldfields eucalypts are 0.2 $m^3$ / ha, this amounts to a harvesting regime of ~1 tree per ha. FPC are also currently investigating thinning of dense regrowth sites for vineyard posts (Figure 6).

Other significant issues in the goldfields area are grazing and feral goats. Pastoral leases account for 37.8% of subregion COO3 and 17% of subregion COO2 in the Coolgardie IBRA region. The impacts of grazing by sheep and feral goats are evident at pastoral stations such as Woolibar station near Kalgoorlie. The understories of woodlands are denser in ungrazed areas compared with areas grazed by sheep. Species diversity is also likely to be higher in the ungrazed areas (Figures 1-4). However,

there is a lack of data on the effects of grazing in the goldfields region, unlike the agricultural wheatbelt. There are no feral predator programs in place (Cowan, 2003a; Cowan et al. 2003), although rabbit calicivirus disease has reduced rabbit populations (Cowan, 2003a). There are still relatively few goats (Cowan, 2003a; Cowan et al. 2003). However, goat numbers may increase ~4 fold yearly.

In general, the salmon gum and gimlet woodlands of the goldfields area are regarded as relatively undisturbed compared with neighbouring woodlands in the Avon wheatbelt region (Yates et al. 1994). For those communities that also occur as isolated patches in the wheatbelt region of WA, these patches may be severely degraded due to prolonged livestock grazing and weed invasion (Abensperg-Traun *et al*. 1998). Within the wheatbelt region, undisturbed woodlands of *E. salubris* occur only in small fragmented populations in nature reserves, with the bulk of existing remnants (mostly < 2ha) lying on private properties (Abensperg-Traun *et al*. 1998).

Degradation of the salmon gum and gimlet woodlands in this region is well documented (Arnold and Weeldenburg, 1998; Yates et al. 2000; Yates et al. 1994; Abensperg-Traun et al. 1998). For example, grazing in the *Eucalyptus salmonophloia* woodlands has an impact not only on vegetation structure and composition but also on soil surface condition, soil chemical, physical and hydrological properties (Yates et al. 2000). Consequences include loss of litter cover, loss of soil cryptograms, reduced organic carbon, reduced soil water infiltration rates, increased nutrients and increased soil erosion (Yates et al. 2000). In many cases there is little or no understorey remaining and little or no regeneration of the dominant tree *E. salmonophloia* (Yates et al. 2000). Similarly, the abundance of weed species increases with grazing intensity in *Eucalyptus salubris* woodlands resulting in a decline in the abundance and / or cover of native species (Hobbs and Yates, 2000). A number of the *E. salmonophloia* and *E. salubris* woodlands in the wheatbelt region are considered to be potentially at risk from salinisation due to the susceptibility of soil type on which they occur and their fragmented nature (Hopkins, 2000). The component of sub-community #7 that occurs in the wheatbelt region is included on th list community types potentially at risk of salinisation (Hopkins, 2000).

Exclusion of livestock and adequate methods of control and prevention of further weed invasions are essential requirements for the conservation of these woodlands in the wheatbelt region (Abensperg-Traun *et al*. 1998). Reintroduction of native understorey species may also be needed in severely degraded areas due to loss of seed reserves (Yates and Hobbs, 1997). Increased fragmentation and grazing in the salmon gum and gimlet woodlands in the Coolgardie IBRA region may result in similar degradation in the future. Therefore, grazing and clearing should be minimised.

Many of the eucalypts in the goldfields region are sensitive to fire. Trees die after hot fires, however, seed germination is enhanced by fire. Fire management in these areas requires investigation.

## Loss or decline of functionally important species

Lack of regeneration of *E. salmonophloia* is observed in many remnant woodlands within the wheatbelt region. Contributing factors may include reduced probability of burning of these areas (Hobbs and Yates, 2000) and decreased soil water availability as a result of grazing, which may limit the establishment of *E. salmonophloia* seedlings (Yates and Hobbs, 1997). However, mechanical disturbance enhances germination of goldfields eucalypts such as *E. salmonophloia*.

## Reduction in ecological community integrity

The threats discussed in the above sections have lead to a reduction in ecological community integrity within the salmon gum and gimlet woodlands. Many of these woodlands are modified by past clearing and grazing as noted earlier. Within the Goldfields region, understories are sparser and there is a lower diversity of shrubs and herbaceous species in heavily grazed woodlands compared with ungrazed areas in reserves (personal obesrvations).

In the wheatbelt region, many of the degraded small remnants of Gimlet woodland are too small to support resident birds (particularly small passerines) due to loss of shrub understorey and loss of tree canopy cover (Arnold and Weeldenburg, 1998). These woodlands provide feeding habitat and nesting sites for the endangered Carnaby's Black-Cockatoo (Desmond, 2003b). Breeding habitat has been destroyed by the loss of old, hollow-bearing trees. Recovery plans should include habitat retention, control of foxes and cats, and reduction in grazing pressure (Desmond, 2003b). Increased abundance of weeds and a decline in species richness of native flora is associated with a significant decline in the species richness of lizards, scorpions and termites (Abensperg-Traun *et al*. 1996).

### Rate of detrimental change

No data available.

## *Summary & recommendations re: category of threat under the EPBC Act*

From the data provided in this report it may be concluded that this NEC is not eligible for listing as threatened at present under the EPBC Act. Although, there is evidence of a substantial decline (> 70%) in the extent of this ecological community since pre-European settlement (1750), most of the clearing occurred in the temperate areas of WA. There are large areas of relatively unfragmented examples of many of the sub-communities within this NEC in the arid zone (Map 1), and at the present time clearing is not regarded as a threatening process for the remaining arid zone occurrences. It must also be acknowledged that the salmon gum and gimlet woodlands cover a relatively large area in WA and thus do not have a small geographic distribution (Criterion 2). However, the apparent contiguity of the vegetation may be affected by mapping accuracy, and further research is required to verify its status. In particular, there are areas that have regenerated following previous clearing in the goldfields region. Many of these clearfelled areas that have regenerated well, however, are modified by past clearing and grazing.

Overall, there is no evidence to demonstrate a substantial loss or decline of functionally important species (Criterion 3) or a significant reduction in community integrity (Criterion 4) within the Coolgardie IBRA region. In general, these woodlands are regarded as relatively undisturbed compared with similar vegetation types in the wheatbelt region (Beeston et al. 2002; Yates et al. 1994). However, this area still remains unexplored.

These conclusions need to be qualified by the comment that alternative groupings may be more appropriate. For instance, it may be more appropriate to separate the sub-communities that have been substantially cleared, and group them with the salmon gum and gimlet woodlands of the temperate regions that have also experienced significant decline in distribution. Alternatively, the arid component of these sub-communities may be best grouped within this NEC and the temperate components grouped with other temperate woodlands dominated by *E. salmonophloia* and *E. salubris*. In this latter case, the assessment of the temperate occurrences must acknowledge the existence of extensive areas of these vegetation types within the arid zone. Part of the difficulty in defining the best approach for this group is that the floristic and abiotic data for the different sub-communities is sketchy and not clearly linked to the NVIS sub-communities; more data are needed to confirm the most appropriate grouping.

### Outstanding issues

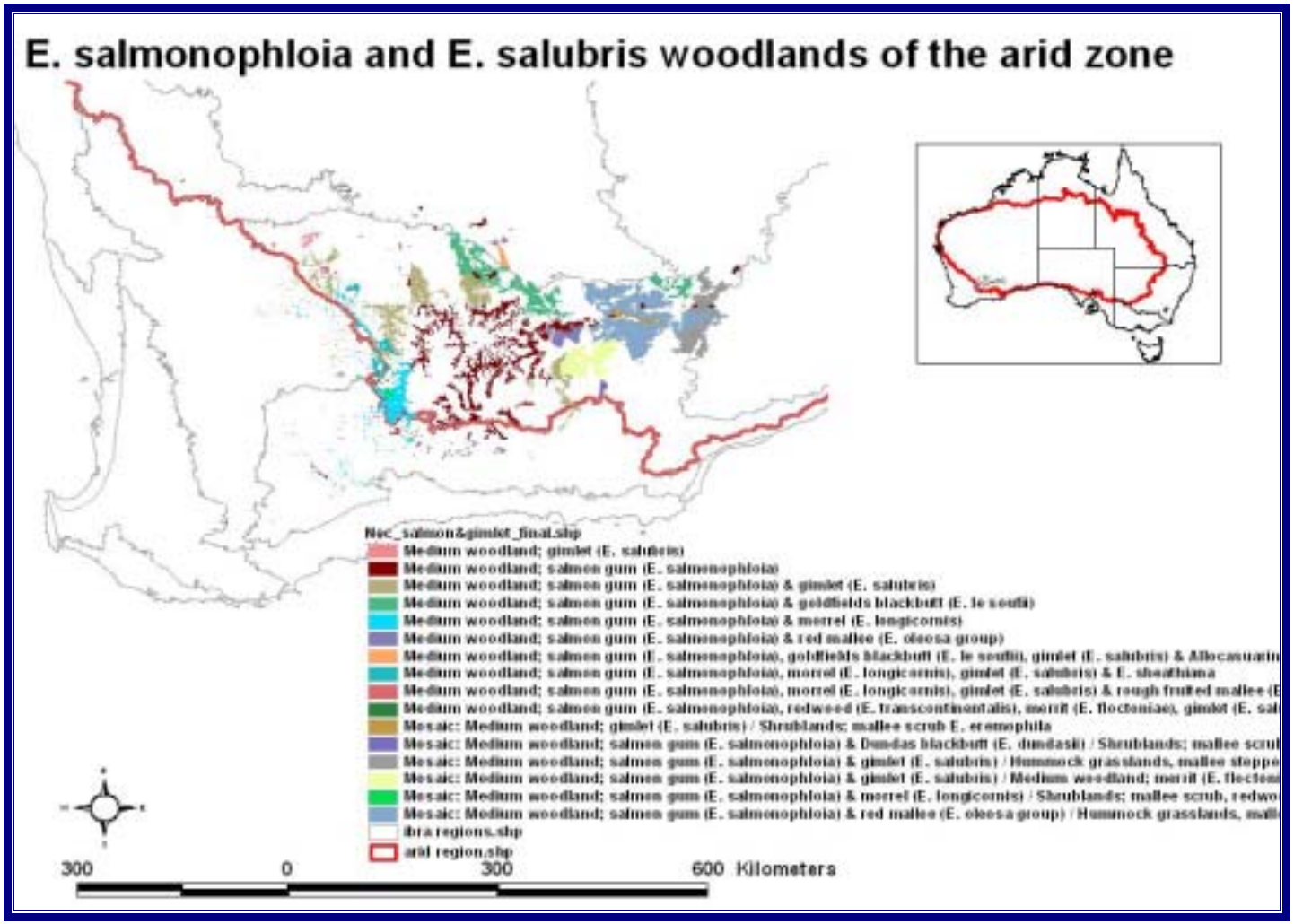
The following map unit (sub-community) was identified in the NVIS mapping and it may be best grouped within this NEC: Medium woodland; wandoo (*E. wandoo*), salmon gum (*E. salmonophloia*), morrel (*E. longicornis*), gimlet (*E. salubris*) & rough fruited mallee (*E. corrugata*). As *E. wandoo* is not generally found within the Coolgardie IBRA region, this is likely to be a misclassification in the NVIS data. This needs clarification. This community has experienced little decline in distribution (88% of pre-European extent remaining) and is well reserved (28% reserved in CALM estate).

Further analysis of floristic similarities between the sub-communities in this NEC will be possible once the NVIS data is updated to include species composition data (currently underway at CALM).

***Table 1:*** *Sub-communities within the NEC:* E. salmonophloia *and* E. salubris *woodlands of the arid and / or semi-arid region of Western Australia. Current extent, percentage remaining and areas reserved in CALM estate supplied by Shepherd (Agriculture WA, 2003). Sorted in descending order of current extent. Data is included here to show the extent of clearing for the sub-communities over their entire range and within the arid zone.*

| Sub # | No. [2] | Eucalypt woodlands in WA (NVIS Level 5 description) | Current extent (ha) | Overall % remaining[3] | % remaining in arid zone[4] | % reserved | | IBRA region |
|---|---|---|---|---|---|---|---|---|
| 1 | 936 | Medium woodland; salmon gum (*E. salmonophloia*) | 906800 | 7 | 100 | 4 | | AW, COO, GVD, MUR, NULL & YAL |
| 2 | 481 | Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & red mallee (*E. oleosa* group) / Hummock grasslands | 816200 | 43 | 100 | 6 | | COO, MUR & NULL |
| 3 | 8 | Medium woodland; salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) | 675500 | 11 | 92 | 38 | | AW, COO & MUR |
| 4 | 468 | Medium woodland; salmon gum (*E. salmonophloia*) & goldfields blackbutt (*E. lesouefii*) | 476100 | 22 | 100 | 2 | | COO, GVD & MUR |
| 5 | 467 | Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) / Hummock grasslands | 285300 | 43 | 100 | 0 | | COO, GVD & NULL |
| 6 | 525 | Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) / Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa* group) | 236600 | 85 | 100 | 0 | | COO |
| 7 | 511 | Medium woodland; salmon gum (*E. salmonophloia*) & morrel (*E. longicornis*) | 219300 | 16 | 99 | 23 | | AW, COO & MALL |
| 8 | 1068 | Medium woodland; salmon gum (*E. salmonophloia*), morrel (*E. longicornis*), gimlet (*E. salubris*) & *Eucalyptus sheathiana* | 137200 | 95 | 50 | 8 | | AW & COO |
| 9 | 521 | Medium woodland; salmon gum (*E. salmonophloia*) & red mallee (*E. oleosa* group) | 127500 | 22 | 100 | 6 | | COO & MUR |
| 10 | 488 | Mosaic: Medium woodland; gimlet (*E. salubris*) / Shrublands; mallee scrub *E. eremophila* | 38300 | 86 | 100 | 0 | | COO |
| 11 | 2903 | Medium woodland; Salmon gum (*E. salmonophloia*), goldfield blackbutt (*E. lesouefii*), gimlet (*E. salubris*) & *Allocasuarina cristata* | 32900 | 100 | 100 | 0 | | COO & MUR |
| 12 | 148 | Medium woodland; gimlet (*E. salubris*) | 26800 | 100 | 100 | 3 | | COO |
| 13 | 513 | Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & Dundas blackbutt (*E. dundasii*) / Shrublands; mallee scrub *E. eremophila* | 16000 | 85 | 100 | 42 | | COO & MALL |
| 14 | 1067 | Medium woodland; salmon gum (*E. salmonophloia*), morrel (*E. longicornis*), gimlet (*E. salubris*) & rough fruited mallee (*E. corrugata*) | 15600 | 100 | 100 | 12 | | COO |
| 15 | 941 | Mosaic: Medium woodland; salmon gum (*E. salmonophloia*) & morrel (*E. longicornis*)/ /Shrublands; mallee scrub, redwood (*E. transcontinentalis*) | 15400 | 89 | 100 | 15 | | |
| 16 | 1078 | Medium woodland; salmon gum (*E. salmonophloia*), redwood (*E. transcontinentalis*), merrit (*E. flocktoniae*), gimlet (*E. salubris*) & *Eucalyptus sheathiana* | 758 | 85 | 100 | 100 | | COO |
| | | **Totals and overall percentages** | **4026500** | **15** | **96** | **11** | | |

[2] Vegetation association number in the NVIS database
[3] This data is an estimate of the percentage area of pre-European vegetation remaining for the NVIS sub-community across its entire distribution (including arid and temperate regions).
[4] This data is an estimate of the percentage area of pre-European vegetation remaining for the NVIS sub-community within the arid zone only. Sub-communities that have regenerated following clearing during the 1900's are mapped in the NVIS data as uncleared vegetation units.




*Map 1: Distribution of sub-communities in the NEC:* E. salmonophloia *and* E. salubris *showing distribution of sub-communities in their entirety (temperate and arid regions of WA). Map is derived from the NVIS data (1:250 000). Entire distributions of sub-communities are illustrated.*

***Table 2:*** *List of reserves for each sub-community within the NEC:* Eucalyptus salmonophloia *and / or* E. salubris *woodlands of the semi-arid region of Western Australia.*

| **Description** | **Reserve Name** |
|---|---|
| Medium woodland; gimlet | Karroun Hill Nature Reserve |
| Medium woodland; salmon gum | Boorabbin National Park, Dragon Rocks Nature Reserve, Dunn Rock Nature Reserve, Gunyidi Nature Reserve, Holland Rocks Nature Reserve, Jilbadji Nature Reserve, Lake Bryde Nature Reserve, Lake Magenta Nature Reserve, Lakeland Nature Reserve, Mount Manning Nature Reserve, Pallarup Nature Reserve, Peak Charles National Park, Scahill Timber Reserve, South Keunder Nature Reserve, Victoria Rock Nature Reserve, Walyahmoning Nature Reserve |
| Medium woodland; salmon gum & gimlet | Barbalin Nature Reserve, Biljahnie Rock Nature Reserve, Calcaling Nature Reserve, Casuarina Nature Reserve, Chiddarcooping Nature Reserve, Condarnin Rock Nature Reserve, Cookinbin Nature Reserve, Duladgin Nature Reserve, Dundas Nature Reserve<br>Gorge Rock Nature Reserve, Hopkins Nature Reserve, Jilbadji Nature Reserve<br>Jilbadji Rock Nature Reserve, Jouerdine Nature Reserve, Karloning Nature Reserve, Kondinin Salt Marsh Nature Reserve, Lake Campion Nature Reserve, Lake Magenta Nature Reserve, Morton Nature Reserve, Mount Hampton Nature Reserve, Mount Manning Nature Reserve, North Bonnie Rock Nature Reserve, Walyahmoning Nature Reserve, Wundowlin Nature Reserve, Yanneymooning Nature Reserve, Yellowdine Nature Reserve |
| Medium woodland; salmon gum & goldfields blackbutt | Clear And Muddy Lakes Nature Reserve, Lakeside Timber Reserve, Queen Victoria Spring Nature Reserve |
| Medium woodland; salmon gum & morrel | Chirelillup Nature Reserve, Dunn Rock Nature Reserve, Jilbadji Nature Reserve<br>Kathleen Nature Reserve, Kuender Nature Reserve, Lake Ace Nature Reserve<br>Lake Biddy Nature Reserve, Lake Campion Nature Reserve, Lake Cronin Nature Reserve, Lake Hurlstone Nature Reserve, Lake Liddelow Nature Reserve, Lake Magenta Nature Reserve, Lake Varley Nature Reserve, Lockhart Nature Reserve, Mordette Nature Reserve, Pallarup Nature Reserve |
| Medium woodland; salmon gum & red mallee | Peak Charles National Park |
| Medium woodland; salmon gum, morrel, gimlet & *Eucalyptus sheathiana* | Jilbadji Nature Reserve, Jilbadji Rock Nature Reserve, Wockallarry Nature Reserve |
| Medium woodland; salmon gum, morrel, gimlet & rough fruited mallee | Karroun Hill Nature Reserve |
| Medium woodland; salmon gum, redwood, merrit, gimlet & *Eucalyptus sheathiana* | Jilbadji Nature Reserve |
| Mosaic: Medium woodland; salmon gum & Dundas blackbutt / Shrublands; mallee scrub *Eucalyptus eremophila* | Dundas Nature Reserve |
| Mosaic: Medium woodland; salmon gum & morrel / Shrublands; mallee scrub, redwood | Damnosa Nature Reserve, Kathleen Nature Reserve, Pallarup Nature Reserve |
| Mosaic: Medium woodland; salmon gum & red mallee / Hummock grasslands, mallee steppe; red mallee over spinifex | Cardunia Rocks Nature Reserve |

***Table 3: Floristic data from the Eastern Goldfields studies***

**Jackson – Kalgoorlie survey area**

**Comments:** *E. salmonophloia* & *E. salubris* woodlands dominate the broad valleys of the Jackson - Kalgoorlie region.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salmonophloia* woodlands | | | |
| **Landforms:** | Undulating plains & broad valleys | | | |
| **Soil types:** | Red loams overlying red clays | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salmonophloia* | *E. transcontinentalis, E. gracilis, E. celastroides* | *Atriplex nummularia* ssp. *spathulata, Eremophila scoparia, Maireana sedifolia, Santalum acuminatum, Acacia colletioides, Acacia hemiteles* | *Atriplex vesicaria* ssp. *variablis, , Cassia nemophila* var. *nemophila, Olearia muelleri, Rhagodia drummondii, Sclerolaena diacantha* | *Erodium cicutarium, E. crinitum, Gnephosis skirrophora, Pogonolepis stricta, Austrostipa trichophylla, Cephalipterum drummondii, Menka asutralis, Ptilotus exaltatus* var. *exaltatus, Zygophyllum ovatum, Austrostipa eremophila* |
| **Woodland type:** | *E. salubris* woodlands | | | |
| **Landforms:** | Undulating plains & broad valleys | | | |
| **Soil types:** | Red loams overlying red clays | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salubris* | na | *Atriplex nummularia* ssp. *spathulata, Eremophila oppositifolia* var. *angustifolia, Exocarpus aphyllus, Santalum acuminatum, Melaleuca pauperiflora* | *Atriplex vesicaria* ssp. *variabilis, Maireana triptera, Sclerolaena diacantha, Acacia erinacea, Maireana triptera, Scaevola spinescens, Templetonia sulcata* | *Erodium crinitum, Helipterum pygmaeum, Helipterum roseum, Lophochloa pumila, Austrostipa trichophylla, Helipterum* spp., *Pogonolepis stricta, Menka australis, Stelleria filifolia, Austrostipa trichophylla, Austrostipa* aff. *trichophylla* |

## Norseman – Balladonia survey area

**Comments:** The *E. salmonophloia* and *E. salubris* woodlands merge into the low open *E. oleosa* woodlands from west to east across the study area.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salmonophloia* woodlands | | | |
| **Landforms:** | calcareous plains, broad valleys | | | |
| **Soil types:** | shallow loamy sands, deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salmonophloia* ± *E. salubris* | na | *Acacia colletioides, Cratystylis conocephala, Santalum acuminatum* | *Scaevola bursariifolia, Lomandra effusum, Olearia muelleri, Rhagodia preissii* | Not provided |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salubris* woodlands | | | |
| **Landforms:** | calcareous plains, colluvial flats, broad valleys | | | |
| **Soil types:** | calcareous earths, deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salubris* | na | *Atriplex vesicaria, Eremophila scoparia, Melaleuca pauperifolia, Acacia hemiteles* | Not provided | Not provided |

## Kurnalpi – Kalgoorlie survey area

**Comments:** Trees 5-10m cover most of study area. *E. salmonophloia* found in southern parts. Sometimes woodland over *Maireana sedifolia* low shrubland.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salmonophloia* woodland | | | |
| **Landforms:** | calcareous plains, undulating plains, broad valleys / colluvial flats | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salmonophloia* | | *Maireana sedifolia, Acacia hemiteles, Eremophila scoparia, Alyxia buxifolia, Scaevola spinescens, Cassia nemophila* | *Maireana sedifolia* | *Erodium spp., Crassula exerta, Cephalipterum drummondii* |
| **Woodland type:** | *E. salubris* low woodland | | | |
| **Landforms:** | calcareous plains, undulating plains / colluvial flats, broad valleys / alluvial flats | | | |
| **Soil types:** | deep calcareous earths, red cracking clays | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salubris* sometimes with *E. salmonophloia* | *Eucalyptus campaspe* | *Santalum acuminatum* | *Atriplex vesicaria A. nummularia* | *Helipterum strictum, Gnephosis brevifolia, Plantago debilis, Ptilotus exaltatus, Senecio glossanthus* |

## Widgiemooltha – Zanthus survey area

**Comments:** low woodlands 5-8m dominate the landscape of the study area. The colluvial flats, prime grazing areas for stock, were once covered by *E. salmonophloia* woodlands but now support *Maireana sedifolia* low shrubland. In northeast of survey area, *Maireana sedifolia* is replaced by *Atriplex* spp as the main understorey species. In the *E. salubris* low woodlands, *Cratystylis conocephala* cover tends to decrease with pH. Most western areas have been cut over and grazed. Near Widgiemooltha *Sclerostegia disarticulata* was the dominant shrub.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salmonophloia* woodland | | | |
| **Landforms:** | calcareous plains, colluvial flats, broad valleys, | | | |
| **Soil types:** | Deep calcareous soils, sandy loams over sandy clay loams | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salmonophloia* | N/A | *Atriplex nummularia, Acacia jennerae, Acacia hemiteles* | *Cratystylis conocephala, Atriplex vesicaria, Rhagodia drummondii, Ptilotus obovatus* var. *obovatus* and *Scaevola spinescens, Maireana sedifolia* (eastern sections) | *Helipterum pygmaeum* |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salubris* low woodland | | | |
| **Landforms:** | Calcareous plains | | | |
| **Soil types:** | Deep calcareous soils | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salubris* sometimes with *E. longicornis* and *E. lesouefii* | Sometimes with *E. longicornis* and *E. lesouefii, E. gracilis* | *Melaleuca* aff. *pauperiflora, Eremophila scoparia, Eremophila ionantha* | *Cratystylis conocephala, Atriplex vesicaria, Cassia nemophila* var. *nemophila.* Where saline *Sclerostegia disarticulata, Maireana sedifolia.* | *Zygophyllum ovatum* |

## Boorabbin – Southern Cross survey area

**Comments:** *E. salmonophloia* woodlands are sometimes present on the colluvial flats in the greenstone area south of Coolgardie. *E. salubris* low woodlands are common on the colluvial flats in the greenstone area south of Coolgardie. Where soil has increasing salt content tall shrubs were absent and low shrubs consisted mainly of *Sclerostegia disarticulata* and annuals such as *Pogonolepis stricta.*

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salmonophloia* woodland | | | |
| **Landforms:** | undulating plains (colluvial flats), broad valleys (valleys floors and slopes) | | | |
| **Soil types:** | shallow or deep calcareous earths, sandy loams and loams (broad valleys) | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salmonophloia* | *E. flocktoniae, E. gracilis, E. loxophleba, E. salubris* sometimes (broad valleys) | *Acacia hemiteles, Acacia nyssophylla, Eremophila ionantha, Eremophila scoparia, Melaleuca pauperiflora* | *Atriplex vesicaria* ssp. *veriabilis, Scaevola spinescens, Acacia hemiteles, Acacia merrallii, Cassia nemophila* var. *nemophila* | *Austrostipa elegantissima, Plantago debilis, Helichrysum tepperi, Podolepis capillaris, Pogonolepis stricta* |
| **Woodland type:** | *E. salubris* low woodland | | | |
| **Landforms:** | undulating plains (colluvial flats), broad valleys (valleys floors and slopes) | | | |
| **Soil types:** | shallow or deep calcareous earths, sandy loams to clay loams (broad valleys), red clay loams over clays | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salubris* | *E. longicornis, E. salmonophloia, E. gracilis* sometimes (broad valleys) | *Eremophila scoparia, Eremophila ionantha, Melaleuca pauperiflora, Exocarpus aphyllus* | *Maireana georgei, Scaevola spinescens, Acacia nyssophylla, Olearia muellerii, Sclerolaena diacantha* sometimes no tall shrubs and low shrubs dominated by *Eremophila veronica, Acacia merrallii, Templetonia sulcata, Sclerostegia disarticulata* (saline areas) | *Asteridea athrixiides, Pogonolepis stricta* (saline areas) |

## Barlee – Menzies survey area

**Comments:** Barlee - Menzies area straddles the mulga eucalypt line (the transition between low woodland of *Acacia* to the north with woodlands of *Eucalyptus* of the moister southern parts of the goldfields). It is relatively unmodified by recent human activity mainly attributed to scarcity of mineral deposits and cover of highly infertile sandplains unable to support domestic stock. *E. salmonophloia* woodlands consisted of relatively tall, scattered trees of *E. salmonophloia* with an open understorey and very few ephemerals. This woodland type covered only small areas in gentle basins on broad valleys.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. salmonophloia* woodland | | | |
| **Landforms:** | broad valleys | | | |
| **Soil types:** | Deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salmonophloia* | Not provided | Not provided | Not provided | Not provided |
| **Woodland type:** | *E. salubris* low woodland | | | |
| **Landforms:** | drainage channels on breakaways, undulating plains (colluvial flats), broad valleys | | | |
| **Soil types:** | deep calcareous earths, dark reddish brown clay loams over red clay loams | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. salubris* | *Casuarina cristata, E. gracilis, E. campaspe* | *Eremophila* and *Dodonaea* spp. | *Atriplex vesicaria* (valleys) | *Gnephosis skirrophora, Austrostipa* spp., *Zygophyllum iodocarpum, Plantago drummondii* |

***Table 4:*** *Comparison of stems / ha in uncut and regrowth woodlands of the Goldfields area. Data collated by Grant Pronk, Forest Products Commission (Siemen and Kealley, 1999).*

| **Species** | **Regrowth woodland** | | **Uncut woodlands** | |
|---|---|---|---|---|
| | **Average stems / ha** | **Average basal area ($m^2$/ha)** | **Average stems / ha** | **Average basal area ($m^2$/ha)** |
| *E. salubris* | 417 | 9.02 | 181 | 4.73 |
| *E. salmonophloia* | 241 | 18.03 | 25 | 0.08 |

Photo: Grant Pronk – Forest Products Commission

*Figure 3: Old growth woodlands of* E. salmonophloia *in the eastern Goldfields of Western Australia. This area has not been clearfelled.*

*Figure 4: Woodland of* E. salmonophloia *and* E. salubris *in the Kambalda Reserve. This area was not clearfelled and has not been grazed. Note the dense understorey vegetation possibly as a result of absence of grazing.*

*Figure 5: At many regrowth sites eucalypts have coppiced from stumps of clearfelled trees (*E. salubris*).*

*Figure 6: Vigorous regrowth of woodlands following clearfelling in the mid 1900's. Forest Products Commission have thinned this site. Harvested timber is used for vineyard posts.*

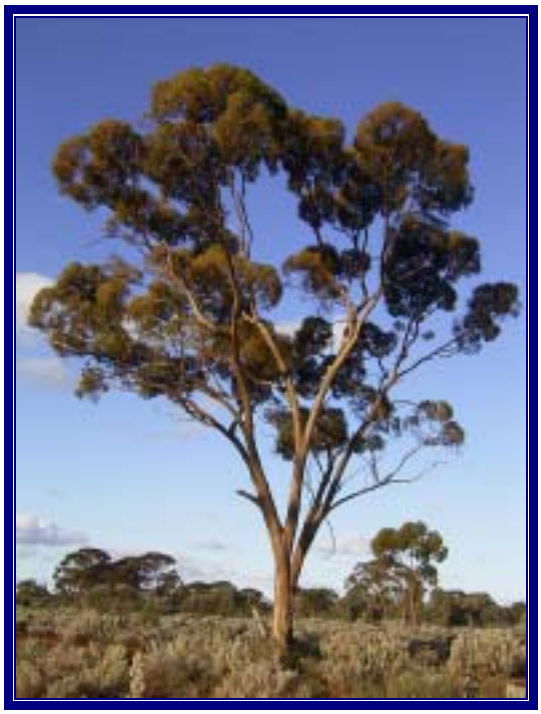


Photo: Grant Pronk – Forest Products Commission

*Figure 7: Regrowth of the* E. salmonophloia *woodlands was poor in some areas, in particular* E. salmonophloia *woodlands over* Maireana sedifolia *(bluebush) near Kalgoorlie as pictured above. This area has also been grazed. Note the lower species diversity in the understorey than in uncut areas such as those pictured in figures 3 and 4.*

# NEC 1.9: *Eucalyptus lesouefii* (Goldfields Blackbutt) and / or *Eucalyptus dundasii* (Dundas Blackbutt) and / or *E. torquata* (Coral Gum) woodlands in the Kalgoorlie and Norseman districts of Western Australia

Photo: Grant Pronk – Forest Products Commission

Photo: Grant Pronk – Forest Products Commission

*Figures 1 and 2:* Eucalyptus lesouefii *woodland within the eastern Goldfields of Western Australia.*

*Figure 3:* Eucalyptus torquata *woodlands north of Kambalda in the eastern Goldfields of Western Australia.*

# NEC 1.9: *Eucalyptus lesouefii* (Goldfields Blackbutt) and / or *Eucalyptus dundasii* (Dundas Blackbutt) and / or *E. torquata* (Coral Gum) woodlands in the Kalgoorlie and Norseman districts of Western Australia

## *Description*

Introduction and key flora, fauna and abiotic elements

*Eucalyptus lesouefii* and *E. dundasii* are grouped together in this NEC, as they are reported to form an alliance in the Norseman and Kalgoorlie region of WA (Beadle, 1981). These woodlands occur on similar soil types: calcareous red earths, solonized brown soils, solodized–solonetz, and solonchaks or lithosols (Beadle, 1981). Furthermore, soils are mainly derived from greenstone or alluvium washed from greenstone ridges (Beadle, 1981). Clay content is moderately high and some soils are moderately saline, particularly where *E. dundasii* occurs. *Eucalyptus torquata* is included in this NEC, as it also mainly occurs on greenstone ridges between Coolgardie and Norseman and may occur with *E. lesouefii*.

*Eucalyptus lesouefii* is found to the north of this NEC and *E. dundasii* occurs to the south of this NEC. The two species co-occur in the mid-region (Beadle, 1981). There are 7 sub-communities included in this NEC (Table 1; Map 1). These are derived from the NVIS 1:250 000 mapping which is based on the mapping by J. S. Beard. Note that the sub-communities are simply a listing of the communities identified in the available data that fit within this NEC. In some cases sub-communities may be very similar but given different names because they originate from different surveys. Western Australia is continuing to update their mapping (Shepherd et al 2001), and it is conceivable that some of these sub-communities will change with time.

The sub-communities in this NEC are described as medium woodlands or mosaic communities with shrublands according to Beard (Table 1). Subsequent biological surveys of the eastern Goldfields region describe these woodlands as low woodlands typically 5-10m high (McKenzie and Hall, 1992; Hall and McKenzie, 1993; Newbey et al. 1984; Keighery et al. 1995). *Eucalyptus lesouefii* occurs in pure stands or in association with several other eucalypts such as *E. torquata* (Beadle, 1981) and may form ecotones with *E. salmonophloia* and *E. salubris*. *Eucalyptus dundasii* is the dominant tree around salt lakes. It is often associated with *E. salubris* and may occur with *E. salmonophloia* and *E. longicornis* in less saline areas. It should be noted that communities in which *E. salmonophloia* is the dominant tree and *E. lesouefii* or *E. dundasii* occurs as a co-dominant tree are included in NEC #1.8. The *E. lesouefii* woodlands occupy low ridges and flats, or depressions following minor watercourses, which empty into saline lakes (Beadle 1981).

Projective foliage cover is between 10-30% according to Beard's floristic codes. Generally, there are few understorey species in *E. lesouefii* woodlands. Understorey species, where present, are usually scattered but may include clumps of *Melaleuca* and *Atriplex* species. In the more saline areas *Arthrocnemum arbuscula* and *Frankenia pauciflora* may occur. *Ptilotus exaltatus* is the most abundant herbaceous species (Beadle, 1981). Table 3 lists the prominent species found in *E. lesouefii*, *E. dundasii* and *E. torquata* woodlands during the biological surveys of the eastern Goldfields (McKenzie and Hall, 1992; Hall and McKenzie, 1993; Newbey et al. 1984; Keighery et al. 1995).

Where the woodlands form mosaic communities with shrublands the shrubs are generally >1m tall and projective foliage cover of the shrublands is variable, ranging from 10-30% where *A. quadrimarginea* is dominant (no. 489) to 30-70% where *Dodonaea* scrub is dominant (no. 2901).

*Eucalyptus dundasii* woodlands are often dense and sometimes approach forest structure (Beadle, 1981). Understorey species may include tall mallee species such as *E. flocktoniae*. Shrubs species vary with salinity, with *Acacia* species dominating the least saline areas and being replaced by *Eremophila* and *Atriplex* species with increasing salinity (Beadle, 1981).

Typical tall shrubs in this NEC include *Acacia merrallii, Alyxia buxifolia, Atriplex nummularia* spp. *spathulata, Atriplex vesicaria, Eremophila* spp. *(E. interstans E. oppositifolia, E. paisleyi, E. scoparia*) *Exocarpus aphyllus Melaleuca* aff. p*auperiflora, Olearia muellerii Pittosporum phylliraeoides* and *Santalum acuminatum.*

Typical low shrubs include *Atriplex vesicaria, Beyeria brevifolia, Cratystylis conocephala, Disphyma clavellatum, Eremophila caerula, Eremophila ionantha Maireana appressa, Maireana sedifolia, Olearia muellerii, Ptilotus obovatus* var. *obovatus, Santalum acuminatum, Sclerostegia disarticulata, Sida calyxhymenia* and *Westringia rigida.*

Common ground flora include *Bossiaea walkeri, Crassula exserta, Dianella revoluta, Helichrysum tepperi, Lepidosperma brunonianum, Pentaschistis airoides, Pogonolepis stricta, Senecio glossanthus, Stellaria filiformis* and *Zygophyllum ovatum.*

This subregion in which most of this NEC lies (Eastern Goldfields subregion) is regarded as an area of high floristic diversity (Cowan, 2003a). Fauna surveys were also undertaken during the biological surveys of the eastern Goldfields region and these should be consulted for fauna lists.

## *National distribution*

Known natural distribution

In general, *E. lesouefii* and *E. dundasii* occur between the 250 and 300 mm isohyets (Beadle, 1981). These woodlands mainly occur in the Coolgardie IBRA region (mainly subregion COO3: Eastern Goldfields subregion) with small areas in the Mallee and Murchison IBRA regions.

This NEC is estimated to cover 821,700ha in total (Table 1; Map 1); ~ 700,000 ha covered by the non-mosaic units and a further 100,000 ha covered by the mosaic units. If we assume that this is an estimate of area of occupancy, this distribution is regarded as large according to the EPBC criteria (area of occupancy > 100,000ha). However, the area of each sub-community varies substantially, ranging from 6,200ha for the Medium woodland; coral gum (*E. torquata*) to 353,500ha for the Medium woodland; Dundas blackbutt (*E. dundasii*) & red mallee (*E. oleosa* group). Current extent (ha) and the percentage of pre-European area remaining for each of the sub-communities in this NEC are summarised in Table 1. The pure stands of *E. torquata* are restricted in distribution (area of occupancy < 10,000ha; Figure 3). Perhaps these woodlands should be assessed separately.

The WA mapping is not detailed enough to properly estimate "area of occupancy" of the woodland community, particularly due to the presence of mosaic communities, in which there is no estimate of the proportion of area covered by woodland. These issues need to be kept in mind in interpreting the data presented here.

Overall, a total of 24% of the extant area of this NEC is reserved in CALM estate (Table 1). This may be regarded as adequate reservation on a bioregional scale (>15% reserved). However, the proportion of each sub-community that is reserved varies.

The following sub-communities are not represented in CALM estate at all:

- Medium woodland; goldfields blackbutt (*E. lesouefii*) & red mallee (*E. oleosa* group)
- Mosaic: Medium woodland; goldfields blackbutt (*E. lesouefii*) & Dundas blackbutt (*E. dundasii*) / Shrublands; *Dodonaea* scrub
- Mosaic: Medium woodland; *Allocasuarina cristata* & goldfields blackbutt (*E. lesouefii*) / Shrublands; *A. quadrimarginea* thicket

The following sub-communities are well reserved within CALM estate (>10% reserved:

- Medium woodland; goldfields blackbutt (*E. lesouefii*)

- Medium woodland; Dundas blackbutt (*E. dundasii*) & red mallee (*E. oleosa* group)

Table 2 lists the reserves and national parks in which each of the sub-communities are represented.

## *Information contributing to the conservation status under the EPBC Act*

### Components listed under State or Territory legislation

Western Australia currently has no legislation dealing specifically with Threatened Ecological Communities (TECs). However, TECs that occur in WA may now be listed as nationally threatened under the EPBC Act (1999). None of the woodlands included in this NEC are listed as threatened under the EPBC act to date. The Western Australian Threatened Species and Communities Unit (WATSCU) keeps an informal list of TECs and other ecosystems regarded as at risk. None of the sub-communities listed in this NEC are listed as TECs or ecosystems at risk by CALM within the semi-arid and arid region (Cowan et al. 2003; Cowan, 2003a; Grant et al. 2003).

Rare flora and priority 1 and 2 flora for the Coolgardie IBRA region are listed in Appendix B.

### Decline in geographic distribution

Clearing of the *E. lesouefii* and *E. dundasii* woodlands has not been as extensive as the *E. salmonophloia* and *E. salubris* woodlands, with all sub-communities having ≥ 29% of the original area remaining. Overall, 39% of the pre-European extent of this NEC remains.

It should be noted that the broad scale of mapping used to estimate current and pre-European extent means that the data must be interpreted with caution. More detailed mapping, would likely reduce the apparent extent of vegetation types. At present, we are unsure what uncertainty surrounds these estimates (ranges / bounds would be a more useful approach).

### Threats to national ecological community

General threats to woodlands in the Coolgardie IBRA region include grazing pressure, changed fire regimes, exotic weeds, and feral animals (National Land and Water Resources Audit, 2001). Grazing pressure (cattle, sheep and goats) is the most common threatening process in this IBRA region (National Land and Water Resources Audit, 2001). The dominant land uses in the COO3 subregion (Eastern Goldfields subregion) in which most of this NEC occurs are vacant Crown land and Crown reserves, grazing-native pastures-leasehold (37.8%) freehold (7.15%), conservation, and mining leases (Cowan, 2003a).

The threatening processes affecting the *E. lesouefii* and *E. dundasii* woodlands are similar to those reported for the *E. salmonophloia* and *E. salubris* woodlands (NEC #1.8). Around the Kalgoorlie region, the *E. lesouefii* woodlands were clearfelled in the 20$^{th}$ century to supply mining timber and fuelwood. In many cases the woodlands have regenerated, however, these communities are modified due to past clearing activities and grazing. As these woodlands commonly occur on greenstone areas, mining activities occur within them (Figure 4). The Kalgoorlie and Norseman districts have a long and ongoing history of mining for gold, nickel, copper. Within the Coolgardie IBRA region mining exploration activities are supervised (except for old exploration drill holes which often remain open) (Cowan et al. 2003). Mining companies are required to search for rare and / or threatened flora and fauna prior to clearing any vegetation.

The impacts of grazing by sheep and feral goats are evident at pastoral stations such as Woolibar station near Kalgoorlie. The understories of woodlands are denser in ungrazed areas compared with areas grazed by sheep. Grazing within this NEC, particularly the *E. lesouefii* woodlands may pose a threat to species diversity. However, there is a lack of data on the effects of grazing in the goldfields

region, unlike the agricultural wheatbelt. There are no feral predator programs in place (Cowan, 2003a), although rabbit calicivirus disease has reduced rabbit populations (Cowan, 2003a). There are still relatively few goats (Cowan, 2003a). However, goat numbers may increase ~4 fold yearly.

Many of the eucalypts in the goldfields region are sensitive to fire. Trees die after hot fires, although seed germination is enhanced by fire. Fire management in these areas requires further investigation.

The Forests Products Commission (FPC) of Western Australia are currently investigating the potential use of goldfields eucalypts[1] such as *E. lesouefii* for speciality timbers such as musical instruments, turnery, timber crafts, furniture, joinery and specialised flooring (Siemon and Kealley, 1999). Harvesting is restricted to regrowth areas and is at present a small-scale operation. Between 1995 and 1998, 600 tonnes of goldfields eucalypts were harvested by FPC and a further 100 tonnes were harvested this year. Typical sawlog volumes for Goldfields eucalypts are 0.2 $m^3$ / ha, this amounts to a harvesting regime of ~1 tree per ha. FPC acknowledges that these species are of limited availability because of the scattered nature of the resource.

In dense regrowth areas following past clearfelling in the early 1900's, FPC has harvested trees for vineyard posts. Such thinning may encourage the development of larger and more widely spaced trees, thus creating woodland somewhat similar to those that would naturally have occurred prior to disturbance. Nevertheless, small bird species appear to favour the vigorous regrowth areas, whilst larger birds requiring hollow bearing trees prefer areas with old trees.

### Loss or decline of functionally important species

No data available

### Reduction in ecological community integrity

No data available

### Rate of detrimental change

No data available

## *Summary & recommendations re: category of threat under the EPBC Act*

From the data collated in this report, it would appear that this NEC is not eligible for listing as threatened under the EPBC Act according to criterion 1 (decline in geographic distribution) or criterion 2 (small geographic distribution coupled with demonstrable threat). For example, an estimated 39% of the pre-European extent of this NEC remains and this NEC covers a relatively large area of occupancy (> 100,000 ha). We do not have sufficient data to assess criteria 3-6 of the EPBC act. Further information on the effects of grazing and mining on these woodlands is needed to assess these criteria. The pure stands of *E. torquata* are restricted in distribution (area of occupancy < 10,000ha). Perhaps these woodlands should be assessed separately.

[1] Goldfields eucalypts currently investigated by FPC are: *E. salmonophloia*, *E. salubris*, *E. lesouefii*, *E. transcontinentalis*, *E. longicornis* and *E. melanoxylon*.

## Outstanding issues

Data on specific threats to this NEC are lacking, in particular mining. Assessments of criteria 3-6 are required.

The pure stands of *E. torquata* are restricted in distribution (area of occupancy < 10,000ha). Perhaps these woodlands should be assessed separately.

Further analysis of floristic similarities between the sub-communities in this NEC will be possible once the NVIS data is updated to include species composition data (currently underway at CALM).

***Table 1:*** *Sub-communities within the NEC: Woodlands of* Eucalyptus lesouefii *and / or* E. dundasii *and / or* E. torquata *in the Kalgoorlie and Norseman districts of Western Australia.*

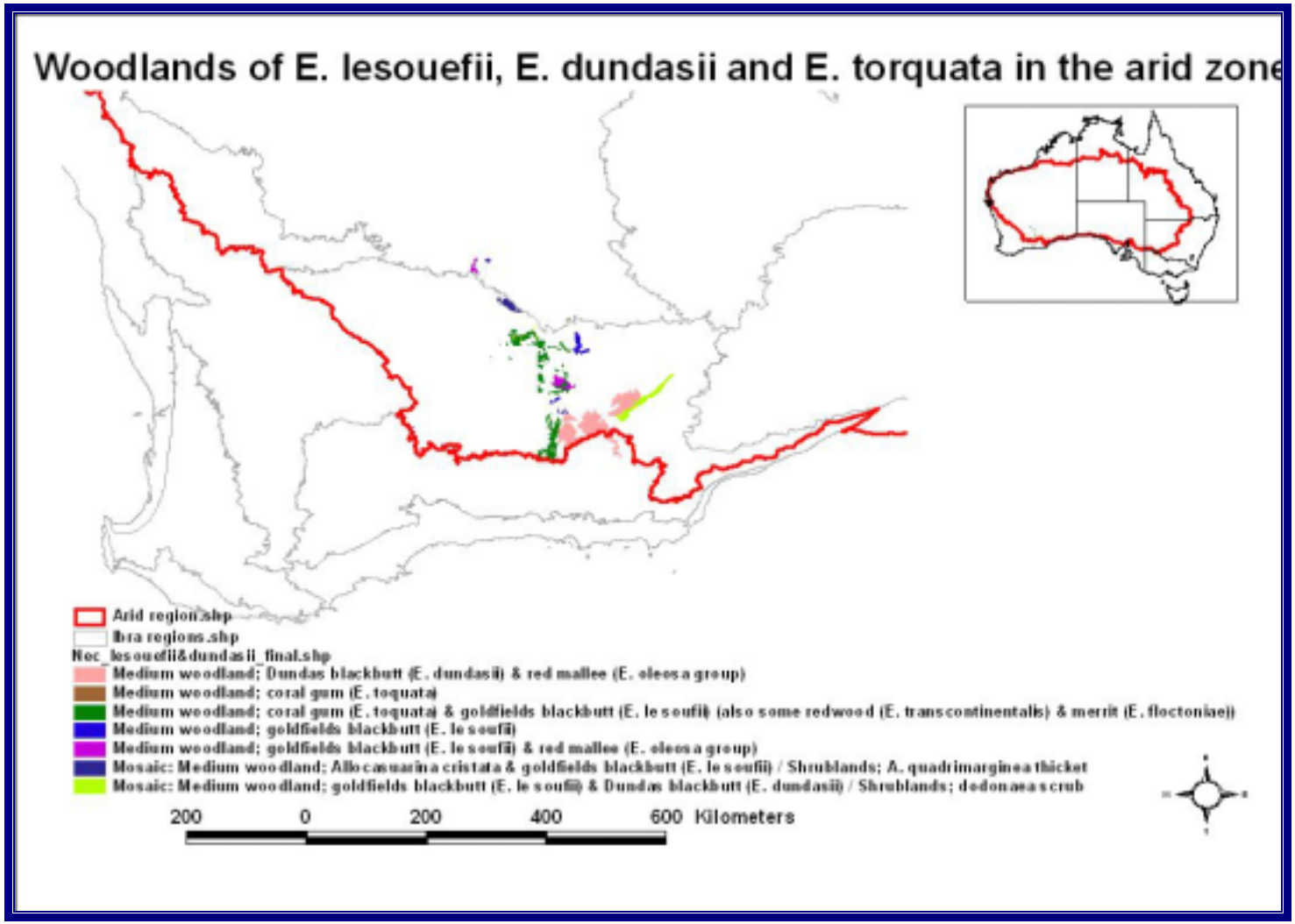
Sorted in descending order of current extent.

| Sub # | No.[2] | Sub-community (Level 5 description in NVIS) | | IBRA region | Current extent (ha)[3] | Percent remaining | % total in CALM Estate |
|---|---|---|---|---|---|---|---|
| 1 | 524 | Medium woodland; Dundas blackbutt (*E. dundasii*) & red mallee (*E. oleosa* group) | | COO & MAL | 353500 | 43 | 51 |
| 2 | 9 | Medium woodland; coral gum (*E. torquata*) & goldfields blackbutt (*E. lesouefii*) (also some redwood (*E. transcontinentalis*) & merrit (*E. flocktoniae*)) | | COO & MAL | 250200 | 29 | 6 |
| 3 | 489 | Mosaic: Medium woodland; goldfields blackbutt (*E. lesouefii*) & Dundas blackbutt (*E. dundasii*) / Shrublands; *Dodonaea* scrub | | COO | 79100 | 85 | 0 |
| 4 | 502 | Medium woodland; goldfields blackbutt (*E. lesouefii*) & red mallee (*E. oleosa* group) | | COO & MUR | 48500 | 45 | 0 |
| 5 | 501 | Medium woodland; goldfields blackbutt (*E. lesouefii*) | | COO & MUR | 48200 | 29 | 16 |
| 6 | 2901 | Mosaic: Medium woodland; *Allocasuarina cristata* & goldfields blackbutt (*E. lesouefii*) / Shrublands; *A. quadrimarginea* thicket | | COO | 36100 | 86 | 0 |
| 7 | 1294 | Medium woodland; coral gum (*E. torquata*) | | COO | 6200 | 86 | 2 |
| | | **Totals and overall percentages** | | | **821700** | **39** | **24** |

***Table 2:*** *List of reserves and national parks in which each of the sub-communities is represented for the NEC: Woodlands of* Eucalyptus lesouefii *and / or* Eucalyptus dundasii *in the Kalgoorlie and Norseman districts of Western Australia.*

| Description | Reserve Name |
|---|---|
| Medium woodland; goldfields blackbutt (*E. lesouefii*) | Not available |
| Medium woodland; coral gum (*E. torquata*) & goldfields blackbutt (*E. lesouefii*) (also some redwood (*E. transcontinentalis*) & merrit (*E. flocktoniae*)) | Binaronca Nature Reserve<br>Coolgardie Arboretum<br>Kurrawang Nature Reserve |
| Medium woodland (*E. torquata*) | Kurrawang Nature Reserve |
| Medium woodland; Dundas blackbutt (*E. dundasii*) & red mallee (*E. oleosa*) | Dundas Nature Reserve |

[2] Vegetation association number assigned for the NVIS database.
[3] Area data was supplied by Agriculture WA (D. Shepherd, 2003).




***Map 1:*** *Distribution of sub-communities in the NEC:* E. lesouefii, E. dundasii *and* E. torquata *woodlands of the semi-arid and arid region of WA. Map was derived from the NVIS data (1:250 000).*

***Table 3:*** *Summary of floristic data reported for the* E. lesouefii, E. dundasii *and* E. torquata *low woodlands in the biological surveys of the Eastern Goldfields region. Table is divided into survey areas.*

**Norseman – Balladonia survey area (Hall and McKenzie, 1993)**

**Comments:** Low woodlands dominate particularly on calcareous plains, undulating plains and broad valleys. The north-western section supports greenstone slopes and summits of *E. lesouefii* low woodlands. *E. lesouefii* low woodlands are also found on calcareous plains. *E. torquata* occurs on the summit of a greenstone hill on the margins of Lake Dundas.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. dundasii* low woodland | | | |
| **Landforms:** | calcareous plains – slopes | | | |
| **Soil types:** | calcareous earths, shallow sandy clay loams over sandy light clay | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. dundasii* | n/a | n/a | *Beyeria brevifolia, Eremophila caerula, Santalum acuminatum* | *Calotis hispidula, Daucus glochidiatus* (note cover ~1% for ground flora) |
| **Woodland type:** | *E. dundasii*, *E. flocktoniae*, *E. lesouefii*, *E. longicornis* and *E. oleosa* low woodland | | | |
| **Landforms:** | Broad valleys | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. dundasii, E. flocktoniae, E. lesouefii, E. longicornis* and *E. oleosa* | | *Acacia hemiteles, Eremophila scoparia, Exocarpus aphyllus, Melaleuca pauperiflora, Olearia muellerii* | | |
| **Woodland type:** | *E. lesouefii, E. oleosa, E. dundasii* low woodland | | | |
| **Landforms:** | undulating plains, greenstone | | | |
| **Soil types:** | shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii, E. oleosa, E. dundasii* | | *Melaleuca pauperoflora, Eremophila scoparia* | | |
| **Woodland type:** | *E. lesouefii* and mixed eucalypt species low woodland | | | |
| **Landforms:** | hills, greenstone: slopes and summits | | | |
| **Soil types:** | | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | Not provided | Not provided | Not provided | Not provided |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. lesouefii* low woodland | | | |
| **Landforms:** | lake slopes | | | |
| **Soil types:** | | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. Lesouefii* | Not provided | Not provided | Not provided | *Bossiaea walkeri, Dianella revoluta, Lepidosperma brunonianum* |
| **Woodland type:** | *E. torquata* woodland | | | |
| **Landforms:** | hills, greenstone: slopes and summits | | | |
| **Soil types:** | Shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. torquata* | *E. dundasii* | *Atriplex vesicaria, Eremophila scoparia, Pittosporum phylliraeoides* | Not provided | Not provided |

**Kurnalpi – Kalgoorlie survey area (McKenzie and Hall, 1992)**

**Comments:** *E. lesouefii* low woodlands occur over most of the undulating plains of the study area. *E. lesouefii - E. oleosa* low woodland over *Maireana sedifolia* low shrubland. *E. torquata* low woodlands are found in extreme south of study area and are similar to those at Widgiemooltha – Zanthus. To the north the woodlands of *E. lesouefii* merge into *Acacia aneura* shrublands / woodlands.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. lesouefii* low woodland | | | |
| **Landforms:** | Salt lakes | | | |
| **Soil types:** | Similar to Widgiemooltha – Zanthus study area | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| **Woodland type:** | *E. lesouefii* low woodland | | | |
| **Landforms:** | Undulating plains | | | |
| **Soil types:** | ** | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | | *Eremophila oldfieldii* ssp. *angustifolia,* | | |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. lesouefii - E. oleosa* low woodland | | | |
| **Landforms:** | Undulating plains | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii, E. oleosa* | *E. concinna, E. salmonophloia* | *Eremophila interstans, Santalum acuminatum* | *Maireana sedifolia, Atriplex vesicaria* | *Zygophyllum ovatum* |
| **Woodland type:** | *E. torquata* low woodland | | | |
| **Landforms:** | ridges | | | |
| **Soil types:** | ** | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. torquata* | *E. gracilis* | *Acacia* spp., *Eremophila interstans, Santalum spicatum, Atriplex nummularia, Dodonaea lobulata* | *Ptilotus obovatus* var. *obovatus, Sida calyxhymenia* | *Senecio glossanthus, Zygophyllum ovatum* |

**Widgiemooltha – Zanthus survey area (Newbey et al. 1995)**

**Comments:** *E. dundasii* low woodlands distribution is scattered, restricted to south-western sector of study area. Low shrubs are absent in some of the *E. lesouefii* low woodlands.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E.lesouefii* low woodland over *Sclerostegia disarticulata* | | | |
| **Landforms:** | outer salt lake slopes | | | |
| **Soil types:** | sub-saline soils | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | | Not provided | *Sclerostegia disarticulata, Atriplex vesicaria, Disphyma clavellatum* | *Pogonolepis stricta, Pentaschistis airoides* |
| **Woodland type:** | *E. lesouefii* low woodland | | | |
| **Landforms:** | undulating plains over greenstone / narrow colluvial flats | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | | *Eremophila oppositifolia, Eremophila scoparia, Acacia merrallii* | *Cratystylis conocephala, Maireana appressa, Westringia rigida* | |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. lesouefii* low woodland | | | |
| **Landforms:** | undulating plains, | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | *E. longicornis* | *Melaleuca* aff. *pauperiflora, Exocarpus aphyllus* | *Eremophila ionantha, Olearia muellerii* | |
| **Woodland type:** | *E. lesouefii* low woodland (note low shrubs are absent) | | | |
| **Landforms:** | ridges, greenstone | | | |
| **Soil types:** | shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | | *Eremophila scoparia, Eremophila paisleyi* | | |
| **Woodland type:** | *E. dundasii* low woodland (distribution is scattered, restricted to south-western sector of study area) | | | |
| **Landforms:** | slight rises of calcareous plains | | | |
| **Soil types:** | deep calcareous earths, surface soil dusky red loam, subsoil light brown clay loam | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. dundasii* | | *Melaleuca* aff. *pauperiflora* | *Halgania rigida, Atriplex vesicaria* | *Helichrysum tepperi, Stellaria filiformis, Senecio glossanthus* |
| **Woodland type:** | *E. torquata* low woodland | | | |
| **Landforms:** | ridges, greenstone | | | |
| **Soil types:** | shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. torquata* | | *Eremophila oppositifolia, Eremophila alternatifolia, Eremophila glabra, Acacia tetragonophylla* | *Ptilotus obovatus* var. *obovatus, Scaevola spinescens* | *Crassula exserta* |

**Boorabbin – Southern Cross survey area (Keighery et al. 1995)**

**Comments:** Mineral exploration and mining operations have almost entirely been restricted to the undulating plain, greenstone. Modification of the vegetation has varied greatly in intensity. Almost all the woody vegetation has been removed from abandoned mining centres such as Londonderry and Burbanks.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. dundasii* low woodland | | | |
| **Landforms:** | undulating plains (colluvial flats) over greenstone | | | |
| **Soil types:** | shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. dundasii* | Not provided | Not provided | Not provided | Not provided |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. lesouefii* low woodland | | | |
| **Landforms:** | low rises and ridges over greenstone | | | |
| **Soil types:** | shallow calcareous earths, surface soils red fine sandy loam, subsoil red sandy clay loam | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. lesouefii* | | *Eremophila scoparia, Exocarpus aphyllus, Atriplex nummularia* spp. *spathulata* | *Cratystylis conocephala, Olearia muelleri, Maireana appressa* | *Eriochiton sclerolaenoides, Zygophyllum apiculatum, Zygophyllum ovatum* |
| **Woodland type:** | *E. torquata* low woodland | | | |
| **Landforms:** | low rises and ridges over greenstone | | | |
| **Soil types:** | shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. torquata* | | *Alyxia buxifolia, Santalum spicatum* | *Ptilotus obovatus* var. *obovatus, Scaevola spinescens* | *Helipterum fitzgeraldii, Maireana pentatropis, Zygophyllum ovatum* |

*Figure 4: Mining operations within the eucalypt woodlands of the Eastern Goldfields region.*

# NEC 1.10: *Eucalyptus longicornis* (Morrel) woodlands of south-western Western Australia

## *Description*

Introduction, key flora, fauna and abiotic elements

*Eucalyptus longicornis* is scattered throughout the eastern Goldfields region of Western Australia and is endemic to WA (Appendix A). It is commonly found within other woodland types (eg NEC 1.8), however, it rarely is the dominant tree within these woodlands. From the NVIS mapping at a scale of 1: 250,000, 3 sub-communities were identified in which *Eucalyptus longicornis* occurs as the dominant tree species within the semi-arid and arid region of Western Australia (Table 1; Map 1). Note that the sub-communities are simply a listing of the communities identified in the available data that fit within this NEC. In some cases sub-communities may be very similar but given different names because they originate from different surveys. Western Australia is continuing to update their mapping (Shepherd et al 2001), and it is conceivable that some of these sub-communities will change with time. This species forms minor associations with *E. salmonophloia* and *E. salubris* or *E. lesouefii* and *E. dundasii* (Beadle 1981), and occurs as a co-dominant tree with *E. salmonophloia* and *E. wandoo*, but these sub-communities have been included in other NECs (eg. NEC 1.8).

*Eucalyptus longicornis* is generally found on level plains or alluvial plains (Hobbs and Yates, 2000). Soils are generally brown or red calcareous soils, or yellow duplex soils (Hobbs and Yates, 2000) and pH is generally > 8.0 (Keighery et al. 1995; Dell et al. 1985). The *E. longicornis* woodlands are 20 to 25 m high (Yates et al. 1999) with a projective foliage cover of 10-30% according to Beard's floristic codes. In general, these woodlands are small in size (5-10ha) and scattered throughout the goldfields region.

Prominent understorey species (tall and low shrubs and ground flora) recorded during the biological surveys of the eastern Goldfields region are provided in Table 2. Tall shrubs include *Acacia aneura, Acacia burkittii, Acacia muelleri, Acacia nyssophylla, Acacia ramulosa, Acacia tetragonophylla, Acacia hemiteles, Atriplex nummularia* ssp. *spathulata, Casuarina cristata, Eremophila ionantha, Eremophila longifolia, Eremophila oldfieldii, Eremophila oppositifolia, Eremophila scoparia, Eucalyptus concinna, Exocarpus aphyllus, Melaleuca* aff. *pauperiflora* and *Olearia muelleri* (McKenzie and Hall, 1992; Hall and McKenzie, 1993; Newbey et al. 1984; Keighery et al. 1995; Dell et al. 1985; Burbidge et al. 1995).

Low shrubs include *Acacia merrallii, Atriplex nummularia* spp. *spathulata, Atriplex vesicaria* spp. *variabilis, Cassia nemophila, Cratystylis conocephala, Enchylaena* spp., *Frankenia* spp., *Maireana sedifolia, Rhagodia drummondii, Scaevola spinescens, Sclerolaena* spp. *Templetonia sulcata* and *Ptilotus obovatus* (McKenzie and Hall, 1992; Hall and McKenzie, 1993; Newbey et al. 1984; Keighery et al. 1995; Dell et al. 1985; Burbidge et al. 1995).

Common ground flora include *Asteridea athrixioides, Cephalipterum drummondii, Crassula exserta, Eriochiton sclerolaenoides, Erodium crinitum, Heliperum fitzgibbonii, Helipterum rubellum, Helipterum strictum, Helipterum tenellum, Ptilotus exaltatus, Sclerolaena diacantha, Austrostipa trichophylla* and *Zygophyllum ovatum* (McKenzie and Hall, 1992; Hall and McKenzie, 1993; Newbey et al. 1984; Keighery et al. 1995; Dell et al. 1985; Burbidge et al. 1995).

Fauna surveys are published in the biological surveys of the eastern Goldfields region and should be consulted for fauna lists.

## *National distribution*

Known natural distribution (including bioregions, conservation reserves)

If we assume that Beard's mapping can be used to estimate "area of occupancy", this NEC has a limited distribution (<100,000ha), covering a total of 81,500ha (Table 1; Map 1). Woodlands dominated by *E. longicornis* are mainly found in the Coolgardie IBRA region (mainly the COO2 subregion; Southern Cross Subregion). However, Medium woodland; morrel (*E. longicornis*) & rough fruited mallee (*E. corrugata*) also occurs in small areas in the Mallee IBRA region.

Extant areas of the sub-communities range from 686ha for Medium woodland; morrel (*E. longicornis*) to 67,400ha for Medium woodland; morrel (*E. longicornis*) & Dundas blackbutt (*E. dundasii*). It would appear from the surveys undertaken in the eastern Goldfields between 1985 and 1995 that there are a number of additional areas in which *E. longicornis* is the dominant eucalypt (these do not appear on the NVIS data due to the broad scale of mapping used). These woodlands are usually small in size 2-10ha (Burbidge et al. 1995; Keighery et al. 1995).

Overall, this NEC is poorly reserved with 2% of the total area reserved within the CALM estate. Only one of the three sub-communities is reserved within CALM estate: Medium woodland; morrel (*E. longicornis*) & rough-fruited mallee (*E. corrugata*). All sub-communities within this NEC are listed by CALM as high priority areas for reservation (Cowan et al. 2003).

## *Information contributing to the conservation status under the EPBC Act*

Components under State or Territory legislation

Western Australia currently has no legislation dealing specifically with Threatened Ecological Communities (TECs). However, TECs that occur in WA may now be listed as nationally threatened under the EPBC Act (1999). None of the woodlands included in this NEC are listed as threatened under the EPBC Act to date. The Western Australian Threatened Species and Communities Unit (WATSCU) keeps an informal list of TECs and other ecosystems regarded as at risk. None of the sub-communities listed in this NEC are listed as TECs or ecosystems at risk by CALM within the semi-arid and arid region (Cowan et al. 2003).

Rare and priority 1-4 flora for the Coolgardie IBBRA region are provided in Appendix B.

Decline in geographic distribution

A total of 75% of the pre-European area of this NEC remains. Furthermore, > 30% of the pre-European extent of each sub-community in this NEC remains. Thus, none of these communities would be considered as threatened with respect to past clearing. In fact, some of these communities have not been cleared at all. For example, 100% of the pure stands of *E. longicornis* remain.

It should be noted that the broad scale of mapping used to estimate current and pre-European extent means that the data must be interpreted with caution. More detailed mapping, would likely reduce the apparent extent of these vegetation types. At present, we are unsure what uncertainty surrounds these estimates (ranges / bounds would be a more useful approach). There are small areas of *E. longicornis* woodlands that are not mapped in the NVIS data due to their scale of mapping.

Threats to the national ecological community

The dominant land uses in the subregion in which most of this NEC occurs are grazing – native pastures (17%), vacant crown land & crown reserves (66.74%), cultivation - dryland agriculture (2.27%) and conservation reserves (11.53%) (Cowan et al. 2003).

General threatening processes within the COO2 subregion include grazing, increasing fragmentation, changed fire regime, exotic weeds and feral animals (National Land and Water Resources Audit, 2001). No specific threats to the *E. longicornis* woodlands are listed by CALM (Cowan et al. 2003). However, as these woodlands commonly occur as scattered patches, they may be more vulnerable to the threatening processes listed above.

In the Coolgardie bioregion, no feral predator programs are in place yet. Wildfire management facilities are limited by resources, except for fire-breaks and fire-access tracks which are installed and maintained in all reserves. Mining exploration activities are supervised (except for old exploration drill holes which often remain open), and feral herbivore grazing activities are now minimal (e.g. rabbit calicivirus disease has reduced rabbit populations; there are still relatively few goats) (Cowan et al. 2003).

The Forests Products Commission (FPC) of Western Australia are currently investigating the potential use of goldfields eucalypts[1] such as *E. longicornis* for speciality timbers such as musical instruments, turnery, timber crafts, furniture, joinery and specialised flooring (Siemon and Kealley, 1999). Harvesting is restricted to regrowth areas and is at present a small-scale operation. Between 1995 and 1998, 600 tonnes of goldfields eucalypts were harvested by FPC and a further 100 tonnes were harvested this year. Typical sawlog volumes for Goldfields eucalypts are 0.2 $m^3$ / ha, this amounts to a harvesting regime of ~1 tree per ha. FPC acknowledges that these species are of limited availability because of the scattered nature of the resource.

### Loss or decline of functionally important species

No data available

### Reduction in ecological community integrity

No data available

### Rate of detrimental change

No data available

## *Summary & recommendations re: category of threat under the EPBC Act*

From the data collated in the report, it would appear that the *E. longicornis* woodlands are not eligible for listing as threatened under the EPBC Act according to criterion 1 (decline in geographic distribution). However, these woodlands may be eligible for listing according to criterion 2 (small distribution coupled with demonstrable threat), as some of these communities have a very restricted distribution. For example, pure stands of *E. longicornis* cover only 686 ha (this community is not reserved within the CALM estate). Many of the *E. longicornis* woodlands occur within the eastern Goldfields region as scattered patches 2-10ha in size. However, there is a lack of data on the condition of these woodlands and existing threatening processes. At present, these woodlands are not regarded as threatened by CALM. These communities should be a high priority for reservation, as very little is reserved at present (as acknowledged by CALM; Cowan et al. 2003).

### Outstanding issues

- Are the *E. longicornis* woodlands more appropriately grouped within other NECs in WA?
- Is this NEC threatened due to limited distribution and patch sizes?

---

[1] Goldfields eucalypts currently investigated by FPC are: *E. salmonophloia*, *E. salubris*, *E. lesouefii*, *E. transcontinentalis*, *E. longicornis* and *E. melanoxylon*.

- Further data on existing threatening processes is required to assess the conservation status of this NEC.

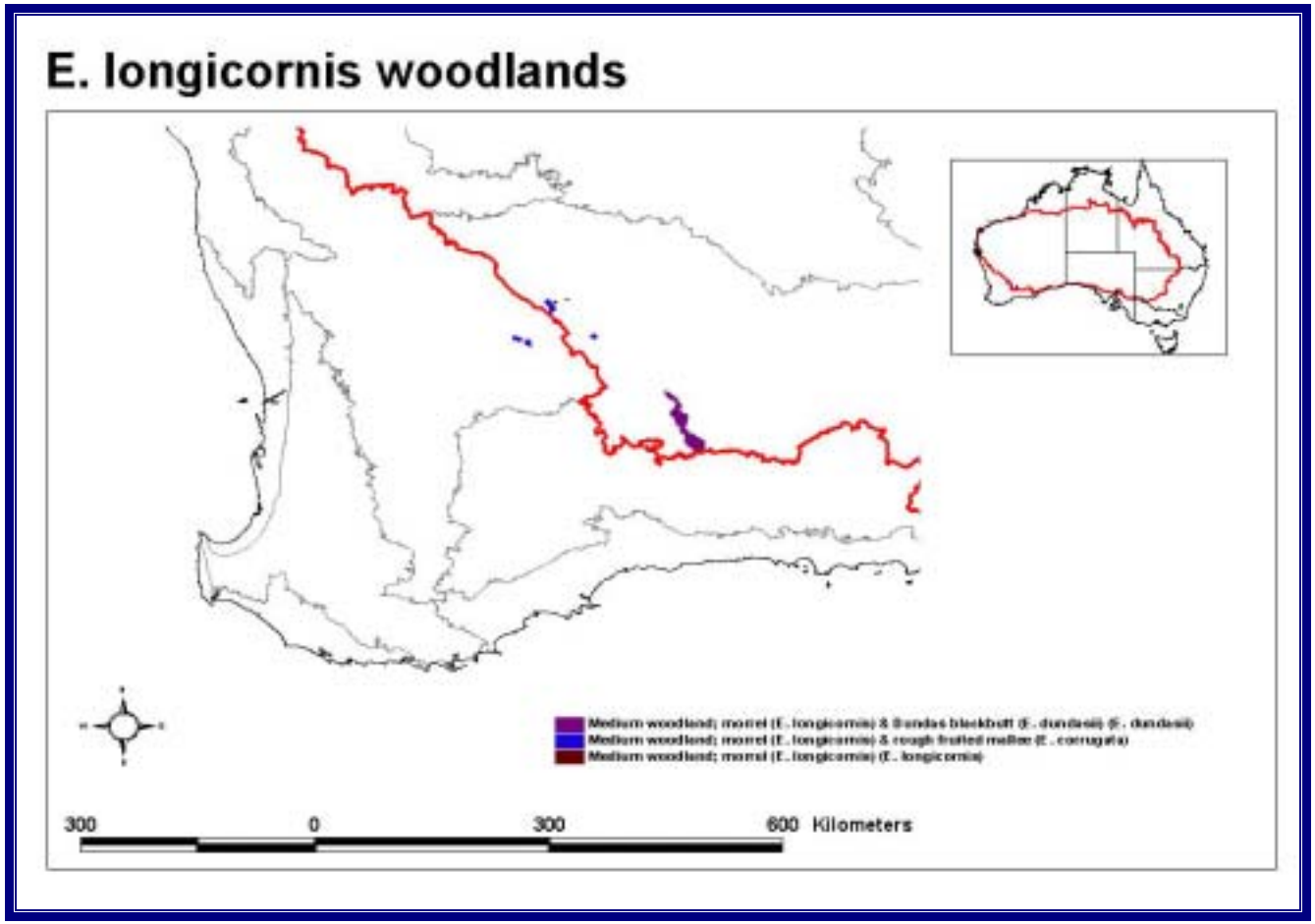
Further analysis of floristic similarities between the sub-communities in this NEC will be possible once the NVIS data is updated to include species composition data (currently underway at CALM.

***Table 1:*** *Sub-communities in the NEC: Medium woodlands dominated by* Eucalyptus longicornis *in south-western Western Australia*

| Sub # | Sub-community (level 5 description, NVIS) | | No.[2] | IBRA region | Current extent (ha) | Percent remaining | % total in CALM Estate[3] |
|---|---|---|---|---|---|---|---|
| 1 | Medium woodland; morrel (*E. longicornis*) & Dundas blackbutt (*E. dundasii*) | | 491 | COO | 67400 | 84 | 0 |
| 2 | Medium woodland; morrel (*E. longicornis*) & rough fruited mallee (*E. corrugata*) | | 536 | COO | 13500 | 49 | 12 |
| 3 | Medium woodland; morrel (*E. longicornis*) | | 537 | COO | 686 | 100 | 0 |
| | | | | Total | 81500 | 75 | 2 |

[2] Vegetation association number assigned for the NVIS database

[3] Percentage reserved is the percentage of current extent reserved in CALM estate (IUCN I-IV reserves and other CALM managed reserves)




*Map 1: Distribution of* Eucalyptus longicornis *woodlands in the arid and semi-arid regions of Western Australia. Map is derived from NVIS data (1:250,000).*

***Table 2:*** *Summary of floristic data reported for the* E. longicornis *woodlands in the biological surveys of the eastern Goldfields region. Table is divided into survey areas.*

**Norseman – Balladonia (Hall and McKenzie, 1993)**

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. longicornis* low woodland | | | |
| **Landforms:** | broad valleys | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis* | | *Acacia hemiteles, Eremophila scoparia, Exocarpus aphyllus, Melaleuca pauperiflora, Olearia muelleri* | | |

**Jackson –Kalgoorlie (Dell et al. 1985)**
**Comments:** *E. longicornis* woodlands occur where the soil exceeds pH 8.2. Few other species are present.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. longicornis* low woodland | | | |
| **Landforms:** | undulating plains greenstone (colluvial flats) | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis* | | *Atriplex nummularia* ssp. *spathulata,* | *Atriplex vesicaria* spp. *variabilis, Gilruthia osbornii* | *Austrostipa eremophila* |

**Kurnalpi – Kalgoorlie (McKenzie and Hall, 1992)**

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. longicornis - E. salmonophloia* low woodland | | | |
| **Landforms:** | calcareous plains | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis, E. salmonophloia* | | *Acacia hemiteles, Casuarina cristata, Exocarpus aphyllus* | *Maireana sedifolia* | *Cephalipterum drummondii, Crassula exserta, Eriochiton sclerolaenoides* |
| **Woodland type:** | *E. longicornis* low woodland | | | |
| **Landforms:** | calcareous plains | | | |
| **Soil types:** | shallow calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis* | | *Acacia hemiteles, Casuarina cristata, Exocarpus aphyllus* | *Maireana sedifolia,* | *Cephalipterum drummondii, Crassula exserta, Eriochiton sclerolaenoides* |

**Widgiemooltha – Zanthus (Newbey et al 1984)**

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. longicornis* low woodland | | | |
| **Landforms:** | calcareous plains | | | |
| **Soil types:** | shallow or deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis* | *E. dundasii, E. gracilis* | *Melaleuca* aff. *pauperiflora, santalum acuminatum, Eremophila* spp. | *Cratystylis conocephala, Scaevola spinescens,* | *Zygophyllum ovatum* |

**Boorabbin - Southern Cross (Keighery et al. 1995)**

**Comments:** *E. longicornis* woodlands occur on loams with pH > 8.0. Distribution is widespread, 1-8ha and scattered. Also frequently occurs as a low woodland within this region.

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. longicornis* low woodland | | | |
| **Landforms:** | broad valleys | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis* | n/a | *Melaleuca* aff. *pauperiflora, Eremophila ionantha* | *Atriplex nummularia* spp. *spathulata* | *Asteridea athrixioides* |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. longicornis, E. salubris, E. gracilis* low woodland | | | |
| **Landforms:** | broad valleys | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. longicornis, E. salubris,* | *E. gracilis* | *Acacia nyssophylla, Melaleuca pauperiflora, Exocarpus aphyllus* | *Acacia merrallii, Templetonia sulcata* | *Heliperum fitzgibbonii, Helipterum rubellum* |

**Barlee – Menzies (Burbidge et al. 1995)**

**Comments:** Understorey may be similar to *E. salubris* and *Casuarina cristata* woodlands of this area. *E. longicornis* woodlands are extensive in southern half of study area in small patches 2-10 ha. Sparse stratum of low shrubs mainly of succulent steppe type. Shrubs and herbaceous plants in the Chenopodiaceae with semi-succulent foliage contributed about 45% of the cover of plants lower than 1m.

| | |
|---|---|
| **Woodland type:** | *E. longicornis* low woodland |
| **Landforms:** | undulating plains, colluvial flats, greenstone |
| **Soil types:** | deep calcareous earths |

| Dominant trees | Other trees / mallees | Dominant tall shrubs | Dominant low shrubs | Common ground flora |
|---|---|---|---|---|
| *E. longicornis* | | *Acacia tetragonophylla, Eremophila oldfieldii, Eremophila oppositifolia, Eremophila scoparia* | *Atriplex vesicaria, Frankenia* spp., *Ptilotus obovatus, Rhagodia drummondii* | *Cephalipterum drummondii, Austrostipa trichophylla, Erodium crinitum, Helipterum strictum, Helipterum tenellum, Ptilotus exaltatus, Sclerolaena diacantha* |

| | |
|---|---|
| **Woodland type:** | *E. longicornis* low woodland |
| **Landforms:** | broad valleys / valley slopes |
| **Soil types:** | shallow calcareous earths |

| Dominant trees | Other trees / mallees | Dominant tall shrubs | Dominant low shrubs | Common ground flora |
|---|---|---|---|---|
| *E. longicornis* | | *Acacia aneura, Eucalyptus concinna, Acacia burkittii, Acacia ramulosa, Eremophila longifolia* | Mainly *Maireana* spp., *Atriplex* spp., *Enchylaena* spp. *Sclerolaena* spp. *Cassia nemophila, Atriplex bunburyana, Enchylaena tomentosa, Maireana triptera, Ptilotus obovatus, Sclerolaena diacantha* | *Cephalipterum drummondii, Austrostipa trichophylla, Erodium crinitum, Erodium cygnorum, Helipterum hyalospermum* ssp. *venustum, Goodenia havilandii* |

# NEC 1.11: *Eucalyptus loxophleba* (York gum) woodlands of the semi-arid and / or arid zone of Western Australia

## *Description*

Introduction, key flora, fauna and abiotic elements

*Eucalyptus loxophleba* is endemic to Western Australia and generally occurs between the 300mm and 480mm isohyets (Beadle, 1981) extending across temperate, semi-arid and arid regions (Appendix A). There are three sub-species of *E. loxophleba*: ssp. *loxophleba*, ssp. *supralaevis*, and ssp. *lissiphloia* (Hill and Johnson, 1992). It is the latter two subspecies that occur in the semi-arid and arid regions of WA, whilst the first occurs in temperate regions.

In the arid zone, *E. loxophleba* is predominantly found in mallee habit (mainly ssp. *lissiphloia*). However, low woodlands are found in the Barlee - Menzies area (Burbidge et al. 1995). These occur on red sands on valley slopes (Burbidge et al. 1995). The *E. loxophleba* woodlands occur between the *E. wandoo* woodlands in the west and the *E. salmonophloia – E. salubris* woodlands in the east (Beadle, 1981).

This NEC only includes the sub-communities dominated by *E. loxophleba* that predominantly occur in the arid and semi-arid region (mainly the Goldfields region of WA). Use of the semi-arid boundary (defined in the introduction) to separate these sub-communities from the predominantly temperate ones, also separates the sub-communities with respect to the processes threatening them. Specifically, the temperate *E. loxophleba* communities (mainly in the Avon wheatbelt IBRA region) are highly fragmented due to extensive clearing over the past 100 years (Yates *et al*. 1994; Hobbs and Yates, 1999) and are within the intensive land-use zone of WA (Beeston *et al*. 2002). In contrast, the arid and semi-arid occurrences are within the extensive land-use zone in which there are large areas of potentially undisturbed vegetation (Beeston *et al*. 2002). In addition, several of the temperate occurrences of *E. loxophleba* woodlands are recognised as threatened ecological communities (TECs) in WA (Department of Conservation and Land Management, W.A. 2003; Beecham, 2003a,b):

- *E. loxophleba* woodland over scrub on the footslopes of the Koolanooka system
- *E. loxophleba* and *E. oleosa* on red loam flats on the foothills of the Moonagin system
- *E. loxophleba* woodland over sandy clay loam / rocky clay on lower slopes and creeklines of the Billeranga system
- *Eucalyptus loxophleba, E. wandoo, E. salmonophloia* Woodland (Beard and Sprenger 1984) Darling, Wheatbelt, Southern Goldfields, Eastern South Coast, Northern Sandplain, South West Interzone (Hopkins *et al*. 1996).

Note that the last woodland type also occurs in the arid zone, but is predominantly temperate in distribution and thus has been excluded from this NEC.

There are 6 sub-communities included in this NEC (Table 1 and Map 1). These are derived from the NVIS 1:250 000 mapping which is based on the mapping by J. S. Beard. Note that the sub-communities are simply a listing of the communities identified in the available data that fit within this NEC. In some cases sub-communities may be very similar but given different names because they originate from different surveys. Western Australia is continuing to update their mapping (Shepherd et al 2001), and it is conceivable that some of these sub-communities will change with time. In particular, some of these sub-communities may be better described as *E. loxophleba* Mallee, as this is the main association that occurs in arid WA. Nevertheless, for the purpose of this assessment we have accepted them as woodlands.

The main associations in the NVIS mapping at a scale of 1:250,000 (those that cover the largest areas) are:

- Medium woodland; York gum (*E. loxophleba*), salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) (sub-community # 1)
- Medium-Low woodland; York gum (*E. loxophleba*) & cypress pine (*Callitris columellaris*) (sub-community # 2)

In this NEC, *E. loxophleba* may form low or medium-low woodlands with *Callitris columellaris* (Cypress pine). Co-dominants in the medium woodlands include *E. oleosa* (in the Yalgoo IBRA region), *E. salmonophloia*, *E. salubris* (which extend into temperate areas) or *E. lesouefii* (in the Kalgoorlie area) (Table 1). It may also form medium woodlands over *Acacia acuminata* and *A. ramulosa-A.linophylla* scrub.

In the arid zone, *E. loxophleba* woodlands are about 8m high (Beadle, 1981). In temperate regions this species may reach 20m (Yates et al. 1999). *E. loxophleba* has an unusual form, forking repeatedly from low down to resemble an overgrown mallee (Beard, 1981). Crown cover is in the range of 10-30% (Beard, 1981). In the semi-arid zone, both shrub and herbaceous layers are discontinuous. Herbaceous species are typical semi-arid species such as *Bassia diacantha*, *Salsola kali*, *Atriplex* spp. and *Zygopyllum* spp. (Beadle, 1981). On the fringe of the arid zone, *E. loxophleba* is a small tree forming a discontinuous upper-storey in which tall shrubs such as *Melaleuca uncinata* and *Casuarina campestris* are dominant. *E. loxophleba* forms ecotonal associations with *E. wandoo*, *E. redunca*, *E. oleosa* and *E. corrugata* (Beadle 1981).

The *E. loxophleba* Mallees are found on granite exposures (Burbidge et al. 1995). Associated with *E. loxophleba* are other mallees such as *E. occidentalis* and *E. gracilis*, tall shrubs such as *Acacia acuminata*, *Acacia* aff. *aneura*, *Cassia nemophila* var. *nemophila* and *Eremophila* spp. and low shrubs in the genera *Olearia* and *Sclerolaena*.

In general, *E. loxophleba* woodlands are found on slopes (Hobbs and Yates, 2000) and on yellow or red duplex soils, and yellow or red earths (Hobbs and Yates, 2000). Surface soils are sandy loams, slightly acidic and grey-brown, overlying clay subsoils (Beadle, 1981). Soils are mainly solodized-solonetz derived largely from granite and alluvium (Beadle, 1981).

Several significant fauna species are reported to occur in *E. loxophleba* woodlands included in this NEC (mainly within the Yalgoo IBRA region; Desmond, 2003b). These include *Leipoa ocellata* (Mallee Fowl) (sub-community # 1), *Cacatua leadbeateri* mollis (Major Mitchell's Cockatoo) and *Calyptorhynchus latirostris* (Glossy Black Cockatoo) (sub-communities #1 & 7).

## *National distribution*

Known natural distribution (including bioregions, conservation reserves)

This NEC mainly occurs in the Coolgardie IBRA region (subregion COO2; Southern Cross Subregion), but extends into the Yalgoo and Avon Wheatbelt IBRA regions (AW1; Ancient Drainage Subregion).

The estimated total current extent of this NEC is 565,500ha (estimated from the NVIS data). However, the current extent of each sub-community varies substantially ranging from 8,685ha for the Medium woodland; York gum (*E. loxophleba*) & red mallee (*E. oleosa* group) to 250,300ha for the Medium woodland; York gum (*E. loxophleba*), salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*). Extant areas and the percentage of pre-European areas remaining for each of the sub-communities in this NEC are listed in Table 1.

Overall, approximately 33% of the extant area of this NEC is reserved in CALM estate (229,800ha). This may be regarded as adequate reservation of an NEC as >15% of the

ecological community is reserved (Sattler and Creighton 2002). However, sub-communities # 4 and #5 are not reserved in CALM estate at all and sub-communities # 1 and #7 have <10% reserved (Table 1). Cowan et al. (2003) list sub-community #4 as a high priority for reservation. The reservation priority of the COO2 sub-region in which most of this NEC lies is Class 3 (Cowan et al. 2003). Although 14.18 % of its area is reserved (IUCN I-IV), the south-western parts have been cleared for wheat fields and salinity problems are emerging so Class 3 is considered more appropriate (Cowan et al. 2003).

Table 2 lists the reserves and national parks in which each of the sub-communities are represented.

## *Information contributing to the conservation status under the EPBC Act*

### Components under State or Territory legislation

Western Australia currently has no legislation dealing specifically with Threatened Ecological Communities (TECs). However, TECs that occur in WA may now be listed as nationally threatened under the EPBC Act (1999). None of the *Eucalyptus loxophleba* woodlands included in this NEC are listed as threatened under the EPBC act to date. The Western Australian Threatened Species and Communities Unit (WATSCU) keeps an informal list of TECs and other ecosystems regarded as at risk. None of the sub-communities listed in this NEC are listed as TECs or ecosystems at risk by CALM within the semi-arid and arid region (Cowan et al. 2003).

Several significant bird species are reported to occur in *E. loxophleba* woodlands included in this NEC (mainly within the Yalgoo IBRA region; Desmond, 2003b). These include the endangered[1] *Leipoa ocellata* (Mallee Fowl) (Sub # 1), the endangered *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) and specially protected *Cacatua leadbeateri* mollis (Major Mitchell's Cockatoo) (Sub #1 & 7).

Rare plants recorded in the arid woodlands of the COO2 subregion that may be relevant to this NEC include the endangered *Tetratheca paynteri, Gastrolobium graniticum, Eremophila virens* and *Myriophyllum lapidicola* and the vulnerable *Tetratheca harperi* and *T. aphylla* (Cowan et al. 2003). Most of these are recorded on granite outcrops.

### Decline in geographic distribution

Overall, approximately 63% of the pre-European extent of this NEC remains (Table 1). For all sub-communities > 30% remains (in most cases between 80-90% of the pre-European extent remains). In general, the *E. loxophleba* woodlands of the semi-arid and arid region of WA have not been extensively cleared (Yates et al. 1999).

It should be noted that the broad scale of mapping used to estimate current and pre-European extent means that the data must be interpreted with caution. More detailed mapping, would likely reduce the apparent extent of vegetation types. At present, we are unsure what uncertainty surrounds these estimates (ranges / bounds would be a more useful approach).

### Threats to the national ecological community

Within the Wheatbelt region, many of the *E. loxophleba* woodlands are degraded due to weed invasion, habitat fragmentation and grazing (Scougall, 1993; Hobbs and Yates, 1999). However, there is little data available on the condition of the *E. loxophleba* woodlands in the

[1]Conservation status according to the EPBC act.

Coolgardie IBRA region. From the synopses reports written for the National Land and Water Biodiversity Audit, we can conclude that the general condition of the vegetation units we have described is good, as no threatening processes are listed for these communities (Cowan et al. 2003). General threatening processes for the COO2 subregion in which most of this NEC occurs include grazing pressure, increasing fragmentation, changed fire regime, exotic weeds and feral animals.

The dominant land uses in the COO2 subregion are grazing – native pastures (17%), VCL & Crown Reserves (66.74%), cultivation - dryland agriculture (2.27%) and conservation reserves (11.53%) (Cowan et al. 2003).

### Loss or decline of functionally important species

No data available

### Reduction in ecological community integrity

No data available

### Rate of detrimental change

No data available

## *Summary and recommended category of threat under the EPBC Act*

From the data presented in this report, it can be concluded that the *E. loxophleba* woodlands within this NEC are not threatened at present. There is no evidence of a substantial decline in distribution (criterion 1), an estimated 63% of this NEC remains. These woodlands are overall well reserved within CALM estate (~ 33%). Unlike, the *E. loxophleba* woodlands of the temperate region, there is little evidence to suggest that there is a substantial reduction in ecological integrity (criterion 4). However, further data on the condition of the sub-communities within this NEC are needed to confirm these conclusions. It is difficult to assess which of the sub-communities listed by Beard as woodlands are more appropriately described as mallee communities.

### Outstanding issues

- We have excluded the *E. loxophleba* and *E. salmonophloia* woodlands (vegetation association no. 142) from this NEC because these also occur extensively in the temperate region of WA, where they are highly fragmented. This woodland type has also been significantly cleared (~ 9% of the pre-European extent remains) unlike the other *E. loxophleba* woodlands in the arid region included in this NEC. This sub-community may be more appropriately grouped in this NEC due to floristic similarities with other sub-communities.
- Further information on the condition of the *E. loxophleba* woodlands in the Coolgardie IBRA region would be useful.
- Are any of the sub-communities better described as mallees and not woodlands?

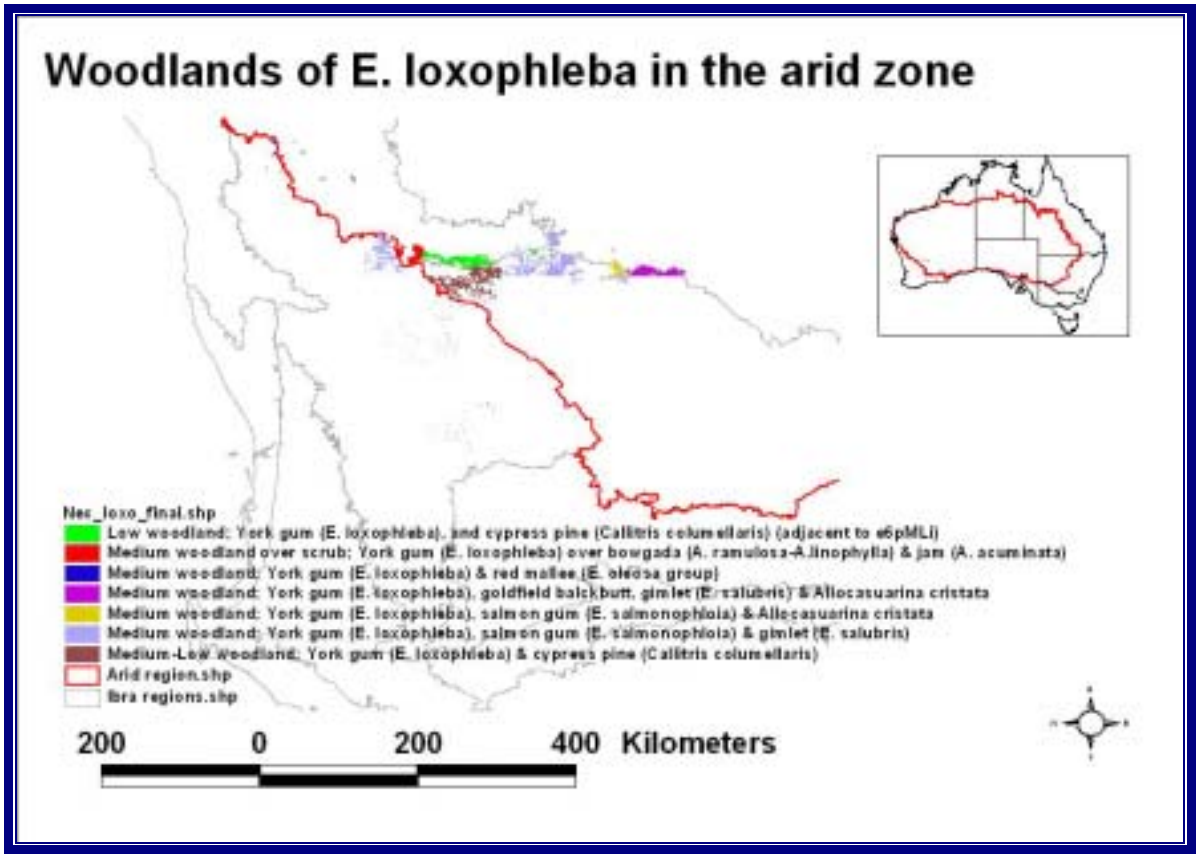
Further analysis of floristic similarities between the sub-communities in this NEC will be possible once the NVIS data is updated to include species composition data (currently underway at CALM).

***Table 1:*** *Sub-communities within the NEC:* E. loxophleba *woodlands of the semi-arid and / or arid zone of Western Australia. Data organised in decreasing order of current extent. Data were provided by D. Shepherd at Agriculture WA (2003).*

| Sub # | Sub-community name (level 5 description, NVIS) | | No.[2] | IBRA region | Current extent (ha) | Percent remaining | % total in CALM Estate[3] |
|---|---|---|---|---|---|---|---|
| 1 | Medium woodland; York gum (*E. loxophleba*), salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) | | 141 | COO, MUR & YAL | 250300 | 91 | 6 |
| 2 | Medium-Low woodland; York gum (*E. loxophleba*) & cypress pine (*Callitris columellaris*) | | 1063 | AW, COO & YAL | 127900 | 32 | 95 |
| 3 | Low woodland; York gum (*E. loxophleba*), and cypress pine (*Callitris columellaris*) (adjacent to e6pMLi) | | 256 | COO & YAL | 67900 | 86 | 52 |
| 4 | Medium woodland; York gum (*E. loxophleba*), goldfield blackbutt (*E. lesouefii*), gimlet (*E. salubris*) & *Casuarina cristata* | | 2904 | COO & MUR | 54800 | 88 | 0 |
| 5 | Medium woodland over scrub; York gum (*E. loxophleba*) over bowgada (*A. ramulosa-A.linophylla*) & jam (*A. acuminata*) | | 357 | COO & YAL | 38100 | 90 | 0 |
| 6 | Medium woodland; York gum (*E. loxophleba*), salmon gum (*E. salmonophloia*) & *Casuarina cristata* | | 143 | COO & MUR | 17800 | 87 | 96 |
| 7 | Medium woodland; York gum (*E. loxophleba*) & red mallee (*E. oleosa* group) | | 686 | YAL | 8685 | 47 | 5 |
| | **Totals and percentages** | | | | **565500** | **63** | **33** |

[2] Vegetation association number assigned for the NVIS database

[3] Percentage reserved is the percentage of current extent reserved in CALM estate (IUCN I-IV reserves and other CALM managed reserves)




*Map 1: Map illustrating distribution of sub-communities in the NEC:* Eucalyptus loxophleba *woodlands of the arid zone. Map is derived from the NVIS data (1:2500,000).*

***Table 2:*** *List of reserves and national parks in which each of the sub-communities is represented for the NEC:* E. loxophleba *woodlands of the semi-arid and / or arid zone of Western Australia.*

| **Description** | **Reserve Name** |
|---|---|
| Low woodland; York gum (*E. loxophleba*), and cypress pine (adjacent to e6pMLi) | Karroun Hill Nature Reserve |
| Medium woodland; York gum (*E. loxophleba*) & red mallee (*E. oleosa*) | Barrabarra Nature Reserve |
| Medium woodland; York gum (*E. loxophleba*) & salmon gum (*E. salmonophloia*) | Bendering Nature Reserve, Bokan Nature Reserve, Carlyarn Nature Reserve, Cartamulligan Well Nature Reserve, Elphin Nature Reserve, Jibberding Nature Reserve, Karroun Hill Nature Reserve, Lake Hinds Nature Reserve, Lake Ninan Nature Reserve, Long Pool Nature Reserve, Marindo Nature Reserve, Mollerin Nature Reserve, Mount Manning Nature Reserve, Pintharuka Nature Reserve, Plain Hills Nature Reserve, Walyormouring Nature Reserve, Xantippe Nature, Yarra Yarra Nature Reserve |
| Medium woodland; York gum (*E. loxophleba*), salmon gum (*E. salmonophloia*) & *Casuarina cristata* | Mount Manning Nature Reserve |
| Medium woodland; York gum (*E. loxophleba*), salmon gum (*E. salmonophloia*) & gimlet (*E. salubris*) | Beebeegnying Nature Reserve, Booraan Nature Reserve, Bruce Rock Nature Reserve, Burracoppin Nature Reserve, Carlyarn Nature Reserve, Craig Nature Reserve, East Wallambin Nature Reserve, Glenluce Nature Reserve, Goodlands Nature Reserve, Herndermuning Nature Reserve, Hines Hill Nature Reserve, Jura Nature Reserve, Karroun Hill Nature Reserve, Korbel Nature Reserve, Kwolyin Nature Reserve, Mount Manning Nature Reserve, Mournucking Nature Reserve, Nangeenan Nature Reserve, Noorajin Soak Nature Reserve, North Beacon Nature Reserve, North Wallambin Nature Reserve, Tank Hill Nature Reserve, Walk Walkin Nature Reserve, Warramuggan Nature Reserve |
| Medium-Low woodland; York gum (*E. loxophleba*) & cypress pine (*Callitris columellaris*) | Karroun Hill Nature Reserve |

# NEC 1.12: *Eucalyptus flocktoniae* and / or *Eucalyptus transcontinentalis* woodlands in the Coolgardie IBRA region of Western Australia

*Figure 1:* E. transcontinentalis *woodlands in the eastern Goldfields of Western Australia.*

Photo: Grant Pronk – Forest Products Commission

*Figure 2: Dense regrowth of* E. flocktoniae *woodlands. Site has been thinned by Forest Products Commission in WA. Timber was used for vineyard posts.*

# NEC 1.12: *Eucalyptus flocktoniae* and / or *Eucalyptus transcontinentalis* woodlands in the Coolgardie IBRA region of Western Australia

## *Description*

Introduction, key flora, fauna and abiotic elements

*Eucalyptus flocktoniae* and *Eucalyptus transcontinentalis* woodlands are grouped together in this NEC because these two eucalypts commonly occur together in the semi-arid region of WA. They are found on similar soil types; mainly pink floury calcareous soils (Beard, 1990) and on similar landforms; mainly mid-slopes and ridges (Beard, 1990). They are reported to form an alliance in the Coolgardie IBRA region (Beadle, 1981).

There are 5 sub-communities in this NEC (Table 1; Map 1). These are derived from the NVIS 1:250 000 mapping which is based on the mapping by J. S. Beard. Note that the sub-communities are simply a listing of the communities identified in the available data that fit within this NEC. In some cases sub-communities may be very similar but given different names because they originate from different surveys. Western Australia is continuing to update their mapping (Shepherd et al 2001), and it is conceivable that some of these sub-communities will change with time. The most extensive sub-community in this NEC (according to NVIS 1: 250,000 mapping / Beard nomenclature) is: medium woodlands *E. flocktoniae* and *E. transcontinentalis.*

*Eucalyptus transcontinentalis* forms minor associations with *E. lesouefii*, *E. dundasii*, *E. salmonophloia* and *E. salubris* (Beadle, 1981). *Eucalyptus flocktoniae* forms minor associations with *E. lesouefii* (Beadle, 1981). These species generally form low woodlands (7-15m) or woodlands (15-20m) in the goldfields region. *Eucalyptus flocktoniae* can grow up to 12m tall whilst *E. transcontinentalis* may reach 25m (Pronk, 1997) and woodlands may be dense (Beard, 1990). *Eucalyptus flocktoniae* may form mosaics with mallee scrub. Both species co-occur with *E. oleosa* in the far south-eastern corner of the Coolgardie IBRA region. Here, these woodlands may also form mosaics with shrublands dominated by *Dodonaea* spp. Towards the central Coolgardie IBRA region, *E. transcontinentalis* and *E. flocktoniae* occur together.

The prominent understorey species associated with these woodlands are provided in Table 3. This data was collated from the biological surveys of the eastern Goldfields region (McKenzie and Hall, 1992; Hall and McKenzie, 1993; Newbey et al. 1984; Keighery et al. 1995; Dell et al. 1985; Burbidge et al. 1995).

Typical tall shrubs include *Acacia* spp. *(A. acuminata, A. ancistrophylla, A. colletioides, A. hemiteles, A. ramulosa, A. saxatilis, A. tetragonophylla) Atriplex vesicaria, Cassia nemophila* var. *nemophila Daviesia benthamii* spp. *benthamii, Dodonaea angustissima, Eremophila* spp. *(E. latrobei, E. oppositifolia, E. paisleyi, E. scoparia), Grevillea pectinata, Melaleuca* spp. *(M. eleuterostachya, M. lanceolata, M. pauperiflora, M. uncinata), Pittosporum phylliraeoides, Santalum acuminatum, Santalum spicatum* and *Scaevola spinescens.*

Typical low shrubs include *Acacia hemiteles, Alyxia buxifolia, Atriplex vesicaria* spp. *variabilis, Cassia nemophila* var. *nemophila, Eremophila decipiens, Eremophila paisleyi, Maireana triptera, Olearia muelleri, Rhagodia crassifolia, Scaevola spinescens* and *Wilsonia humilis.*

Common ground flora include *Actinobole uliginosum, Aristida contorta, Astartea ambigua, Caladenia sigmoidea, Gnephosis tenuissima, Maireana carnosa, Millotia tenuifolia, Olearia muelleri, Podolepis capillaris, Ptilotus obovatum, Pultenaea arida, Austrostipa trichophylla, Triodia scariosa, Veilleia rosa* and *Waitzia acuminata*.

Fauna surveys were also conducted during the biological surveys of the eastern Goldfields and should be consulted for fauna lists.

## *National distribution*

Known natural distribution (including bioregions, conservation reserves)

The majority of this NEC occurs in the Coolgardie IBRA region (subregions: COO1, COO2 and COO3). This NEC also extends into the Mallee and Nullarbor IBRA regions.

The available mapping that indicates the extent of the community is derived from J.S.Beard's mapping (Shepherd, 2001; Map 1). In this, current vegetation is mapped at 1:250 000. There are many areas where the scale of ecological variation is smaller than the mapping scales. In part, this is covered by the mapping of mosaics (see Table 1 and Map 1). Thus the mapping is not detailed enough to properly estimate "area of occupancy" of the woodland community. The mapped polygons may be a reasonable indication of area of occupancy for some sub-communities, particularly those that are continuous over large areas. In other areas where woodlands and shrublands exist in mosaics or where the boundaries between the sub-communities are genuinely broad and diffuse, the polygon area is at the best an upper limit to the area occupied. In the mosaic description Beard listed the more prevalent association first (if one clearly occurred over a larger area). However, unfortunately there is no information on the proportion of each component of a mosaic within these units. On the other hand, the mapping has sufficient detail to be doing more than indicating extent of occurrence (defined in the EPBC Act, 1999 as "the total area contained within the shortest continuous boundary that can be drawn to encompass all the areas where the ecological community occurs"). These issues need to be kept in mind in interpreting the data presented here.

The total extant area of this NEC is estimated at ~ 3 million ha (Table 1). Regardless of whether this indicates area of occupancy or extent of occurrence, this is regarded as a large geographic distribution according to the EPBC criteria. Approximately 100,000ha of this total is comprised of mosaic map units. Extant areas for sub-communities range from 57,100ha for Medium woodland; redwood (*E. transcontinentalis*) & goldfields blackbutt (*E. lesouefii*) to 1,811,400ha for Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa* group).

A total of 10% of the extant area of this NEC is reserved in CALM estate. This may be regarded as inadequate reservation on a bioregional scale. In order to assess whether this is adequate reservation of this NEC, an indication of the reliability of this estimate is required. Of particular concern is that some sub-communities are not very well reserved (≤ 2%): sub-communities #2 and 4. Sub-community #4 is listed as high priority for reservation by CALM (Cowan et al. 2003). Sub-community #2 also requires further reservation within CALM estate.

Table 2 lists the reserves and national parks in which each of the sub-communities is represented.

## *Information contributing to the conservation status under the EPBC Act*

Components under State or Territory legislation

None of the *E. flocktoniae* and *E. transcontinentalis* woodlands are listed under the EPBC Act as threatened. In addition, none of these woodlands are listed as TECs on CALM's database. However, vegetation association no. 500 (sub #2) is recognised by CALM as an "ecosystem at risk" within the COO1 sub-region (Grant et al. 2003). Threatening processes listed within this sub-community include exotic weeds, changed fire regimes and grazing pressure (Grant et al. 2003).

A list of rare flora and priority 1-4 flora for the Coolgardie IBRA region is provided in Appendix B.

Decline in geographic distribution

Overall, an estimated 23% of the pre-European extent of this NEC remains (Table 1). This estimate is based on the percentage pre-European vegetation remaining for all sub-communities in this NEC

across their entire range / distribution. This low percentage is largely due to the clearing of 2 sub-communities that have 10-30% of the pre-European extent remaining. These communities are also those that cover the largest areas and extend into the temperate areas of WA. All other communities have >30% of the pre-European extent remaining, in most cases about 50% remains (Table 1).

- Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa* group)
- Medium woodland; redwood (*E. transcontinentalis*) & merrit (*E. flocktoniae*)

Most of the clearing of these vegetation types occurred in the wheatbelt region. A clearer picture of the decline in geographic distribution within the arid zone is gained by determining what percentage of the arid component of these sub-communities has been cleared (Table 1). Table 1 shows the percentage pre-European vegetation remaining in the arid zone for each sub-community. According to this data, none of the sub-communities included in this NEC have been cleared in the arid zone. However, it must be acknowledged that many of the areas clearfelled during the 1900's in the goldfields region that have regenerated (regrowth woodlands) are mapped in the NVIS data as uncleared vegetation types. This is misleading as these woodlands are modified by previous clearing, grazing and mining practices. They may be more appropriately mapped / classified as different vegetation types to those areas that are relatively unmodified (eg. uncleared).

As suggested for the *E. salmonophloia* and *E. salubris* NEC, the temperate components of the sub-communities included in this NEC may be more appropriately dealt with separately as past clearing and current threatening processes are substantially different.

It should be noted that the broad scale of mapping used to estimate current and pre-European extent means that the data must be interpreted with caution. More detailed mapping, would likely reduce the apparent extent of vegetation types. At present, we are unsure what uncertainty surrounds these estimates (ranges / bounds would be a more useful approach).

## Threats to the national ecological community

General threats to this NEC include past clearing, livestock grazing, weed invasion, changed fire regimes and feral animals (National Land and Water Resources Audit, 2001). Vegetation association no. 500 is listed informally by CALM as an "ecosystems at risk" within the COO1 sub-region (Grant et al. 2003). Threatening processes listed within this sub-community include exotic weeds, changed fire regimes and grazing pressure (Grant et al. 2003). It is poorly reserved within CALM estate. Further data on the above threats would be useful.

*Eucalyptus transcontinentalis* is also currently being investigated by the Forests Product Commission in WA (FPC) for its use as a speciality timber (mainly for musical instruments, furniture and flooring; Siemons and Kealley, 1999). Details of current harvesting protocol are provided in NEC 1.8. At present harvesting is restricted to regrowth areas and is a small-scale operation and does not pose a threat to this NEC. Dense regrowth in woodlands of *E. flocktoniae* have been thinned by FPC and the timber used for vineyard posts (Figure 2). Such thinning may encourage the development of larger trees resembling woodlands prior to disturbance.

## Loss or decline of functionally important species

No data available

## Reduction in ecological community integrity

No data available

## Rate of detrimental change

No data available

## *Summary and recommendations of category of threat under the EPBC Act*

From the data collated in this report, it may be concluded that this NEC is not eligible for listing under the EPBC act at present. Although there is evidence of a substantial decline in distribution (an estimated 23% of the pre-European extent remains), most of the clearing of these vegetation types occurred in the temperate regions of WA. It must be acknowledged that the *E. flocktoniae* and *E. transcontinentalis* woodlands cover a relatively large area in WA (~3 million ha) and thus do not have a small geographic distribution (Criterion 2). Furthermore, there appear to be large areas of relatively unfragmented examples of many of the sub-communities within this NEC in the arid zone (map 1). The apparent contiguity of the vegetation may be affected by mapping accuracy, and further research is required to verify its status. In particular, there are areas that have regenerated following previous clearing in the goldfields region. Many of these clearfelled areas have regenerated well but are modified by past clearing and grazing.

There is no evidence to demonstrate a substantial loss or decline of functionally important species (Criterion 3) or a significant reduction in community integrity (Criterion 4) of this NEC as a whole within the Coolgardie IBRA region. The exception to this is one sub-community affected by weed invasion, grazing and changed fire regimes in the COO1 sub-region. At present, we cannot see any reason for listing this sub-community as a separate ecological community. However, reservation of this sub-community should be a priority as it is currently poorly reserved.

These conclusions need to be qualified by the comment that alternative groupings may be more appropriate. For instance, it may be more appropriate to separate the sub-communities that have been substantially cleared, and group them with the merrit and redwood woodlands of the temperate regions that have also experienced significant decline in distribution. Alternatively, the arid component of these sub-communities may be best grouped within this NEC and the temperate components grouped with other temperate woodlands dominated by *E. flocktoniae* and *E. transcontinentalis*. In this latter case, the assessment of the temperate occurrences must acknowledge the existence of extensive areas of these vegetation types within the arid zone. Part of the difficulty in defining the best approach for this group is that the floristic and abiotic data for the different sub-communities is sketchy and not clearly linked to the NVIS sub-communities; more data are needed to confirm the most appropriate grouping.

### Outstanding issues

- Whether to include veg association no. 214 in this NEC.
- Is the decline in distribution of this NEC, sufficient data to recommend that this NEC be listed under the EPBC act?
- How reliable are the estimates of decline in distribution?
- Should the sub-communities most affected by clearing form a separate NEC?

**Table 1:** S*ub-communities in the NEC: woodlands of* Eucalyptus flocktoniae *and / or* Eucalyptus transcontinentalis *in the Coolgardie IBRA region of Western Australia.*

| Sub # | Sub-community (level 5 description, NVIS) | | No.[1] | IBRA region | Current extent (ha)[2] | Overall % remaining[3] | % remaining in arid zone[4] | % total in CALM Estate |
|---|---|---|---|---|---|---|---|---|
| 1 | Medium woodland; redwood (*E. transcontinentalis*) & goldfields blackbutt (*E. lesouefii*) | | 2009 | COO | 57100 | 43 | 100 | 21 |
| 2 | Mosaic: Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa* group) / Shrublands; *Dodonaea* scrub | | 500 | COO | 99500 | 43 | 100 | 1 |
| 3 | Medium woodland; redwood (*E. transcontinentalis*) & red mallee (*E. oleosa* group) | | 487 | COO & NUL | 590200 | 50 | 100 | 22 |
| 4 | Medium woodland; redwood (*E. transcontinentalis*) & merrit (*E. flocktoniae*) | | 522 | COO & MAL | 680600 | 21 | 100 | 2 |
| 5 | Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa* group) | | 482 | COO, MAL & NUL | 1811400 | 19 | 100 | 10 |
| | | | | **Total** | **3238900** | **23** | **100** | **10** |

***Table 2:*** *List of reserves and national parks in which each sub-community is represented for the NEC: Merrit and redwood woodlands.*

| Description | Reserve Name |
|---|---|
| Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa*) | Cape Arid National Park, Nuytsland Nature Reserve, Peak Charles National Park, Dundas Nature Reserve |
| Medium woodland; redwood (*E. transcontinentalis*) & red mallee (*Eucalyptus oleosa*) | Dundas Nature Reserve |
| Mosaic: Medium woodland; merrit (*E. flocktoniae*) & red mallee (*E. oleosa*) / Shrublands; *Dodonaea* scrub | Dundas Nature Reserve |
| Medium woodland; redwood (*Eucalyptus transcontinentalis*) & merrit (*E. flocktoniae*) | Victoria Rock Nature Reserve, Binaronca Nature Reserve, Boorabbin National Park, Jilbadji Nature Reserve, Scahill Timber Reserve, Victoria Rock Nature Reserve |
| Medium woodland; redwood (*Eucalyptus transcontinentalis*) & goldfields blackbutt (*E. lesouefii*) | Scahill Timber Reserve |

[1] Vegetation association number assigned for NVIS database
[2] Pre-European, current extent and % reserved data were supplied by Agriculture WA (D. Shepherd, 2003).
[3] This data is an estimate of the percentage area of pre-European vegetation remaining for the NVIS sub-community across its entire distribution (including arid and temperate regions).
[4] This data is an estimate of the percentage area of pre-European vegetation remaining for the NVIS sub-community within the arid zone only. Sub-communities that have regenerated following clearing during the 1900's are mapped in the NVIS data as uncleared vegetation units.

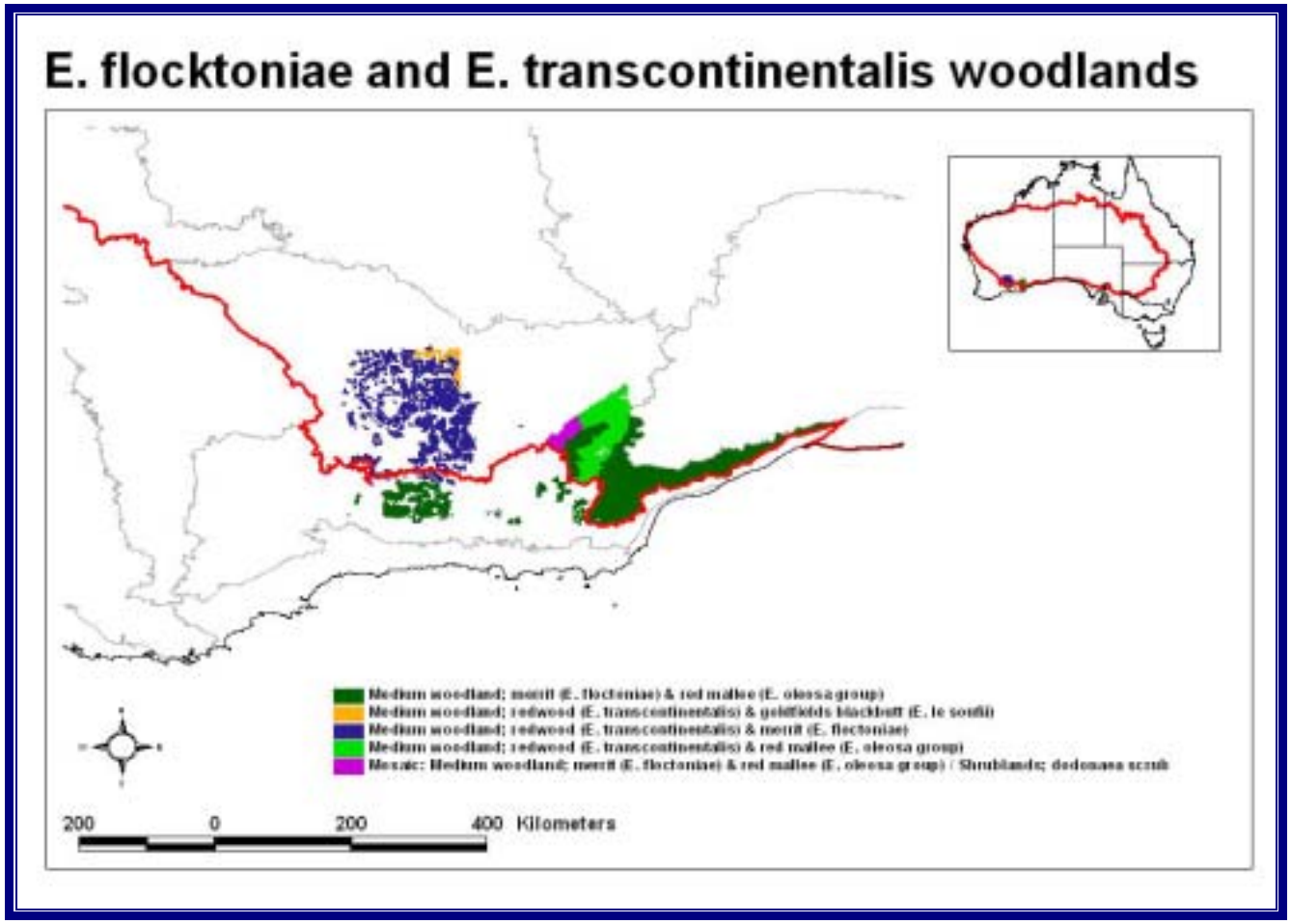



*Figure 1: Distribution of* E. flocktoniae *and* E. transcontinentalis *woodlands of the semi-arid and arid regions of WA.*

*Map is from the NVIS data for current extent (1:250 000).*

***Table 3:*** *Summary of floristic data recorded for the* E. flocktoniae *and* E. transcontinentalis *woodlands within the biological surveys of the eastern Goldfields region of WA.*

**Norseman – Balladonia survey area (Hall and McKenzie, 1993)**

**Comments:** *E. flocktoniae* and *E. transcontinentalis* low woodlands or woodlands are found on calcareous plains / flat and undulating plains, aeolian dunes, aeolion sheet deposits and broad valleys within this region. Some of these are described below.

| | | | | |
|---|---|---|---|---|
| **Woodland type** | *E. flocktoniae* low woodlands | | | |
| **Landforms:** | calcareous plains / flat and undulating plains | | | |
| **Soil types:** | calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. flocktoniae* | | *Atriplex vesicaria, Eremophila scoparia, Melaleuca pauperiflora, Acacia hemiteles* (more common to east) | Not provided | Not provided |
| **Woodland type:** | *E. flocktoniae* low woodland | | | |
| **Landforms:** | aeolion sheet deposits | | | |
| **Soil types:** | aeolion sands | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. flocktoniae* | | *Grevillea pectinata* | Not provided | Not provided |
| **Woodland type:** | *E. transcontinentalis* woodland | | | |
| **Landforms:** | calcareous plains | | | |
| **Soil types:** | shallow loamy sand over sandy clay | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. Transcontinentalis* | *E. diptera, E. eremophila, E. gracilis, E. longicornis* | *Acacia ancistrophylla, Acacia saxatilis, Melaleuca uncinata, Melaleuca lanceolata* | *Wilsonia humilis* | *Astartea ambigua, Olearia muelleri, Pultenaea arida* |

**Jackson-Kalgoorlie survey area (Dell et al. 1985)**

**Comments:** small area of *E. transcontinentalis* on minor drainage line. Common on where soil pH was 7.0-7.5 and consisted of a loamy sand.

| | | | | |
|---|---|---|---|---|
| **Woodland type** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | undulating plains, greenstone, minor drainage lines | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | | *Acacia acuminata, Acacia tetragonophylla, Cassia nemophila* var. *nemophila* | *Atriplex vesicaria* spp. *variabilis, Rhagodia crassifolia* | |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | broad valleys, valley bottoms | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | | *Dodonaea angustissima, Eremophila paisleyi, Pittosporum phylliraeoides, Santalum acuminatum.* In southern areas *Acacia hemiteles, Acacia colletioides* and *Daviesia benthamii* ssp. *benthamii* were common, whilst in northern areas *Eremophila latrobei* was sometimes present. | *Atriplex vesicaria* ssp. *variabilis, Cassia nemophila* var. *nemophila, Maireana triptera, Olearia muelleri* | *Maireana carnosa, Austrostipa trichophylla* |

**Widgiemooltha-Zanthus survey area (Newbey et al. 1984)**

**Comments:** *E. transcontinentalis* low woodlands are the main vegetation on broad valleys of this study area. These woodlands occur on sandy loams over a calcareous B horizon.

| | | | | |
|---|---|---|---|---|
| **Woodland type** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | calcareous plains | | | |
| **Soil types:** | aeolion sands | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | | *Eremophila paisleyi* | Not provided | Hummock grasses: *Triodia scariosa* |

| | | | | |
|---|---|---|---|---|
| **Woodland type:** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | Broad valleys | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | | *Melaleuca pauperiflora, Daviesia benthamii* ssp. *benthamii, Santalum acuminatum* | *Scaevola spinescens, Olearia muelleri* | *Millotia tenuifolia, Actinobole uliginosum, Caladenia sigmoidea, Triodia scariosa* |

**Boorabbin – Southern Cross survey area (Keighery et al. 1995)**

**Comments:** *E. transcontinentalis* and *E. florcktoniae* low woodlands occur on broad valleys and undulating plains. Data is only provided for the *E. transcontinentalis* woodlands. Sandy loams support *E. transcontinentalis* low woodlands, which are replaced by *E. transcontinentalis* Mallee near the lower western boundary of the study area.

| | | | | |
|---|---|---|---|---|
| **Woodland type** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | broad valleys (valley floors, slopes and aeolion sand sheets) | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | *E. flocktoniae, E. salmonophloia, E. salubris, E. gracilis* | *Melaleuca pauperiflora, Daviesia benthamii* ssp. *benthamii, Alyxia buxifolia* | *Acacia hemiteles, Acacia merrallii, Scaevola spinescens, Eremophila caerula* | *Podolepis capillaris* |

**Barrlee – Menzies survey area (Burbidge et al. 1995)**

**Comments:** *E. transcontinentalis* low woodlands are common in southern half of study area. These occur on undulating plains, greenstone (colluvial flats) and broad valleys (flat and gentle undulating plains).

| | | | | |
|---|---|---|---|---|
| **Woodland type** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | broad valleys (flat and gentle undulating plains) | | | |
| **Soil types:** | aeolion loams | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | *E. concinna* | *Eremophila paisleyi, Cassia nemophila, Scaevola spinescens, Acacia ramulosa* | | *Ptilotus obovatum.* Ground stratum is sparse, despite sandy soil very few *Triodia* present. |

**Kurnalpi – Kalgoorlie survey area (McKenzie and Hall, 1992)**

**Comments:** *E. transcontinentalis low* woodland occurs on sandplains. *E. transcontinentalis - E. flocktoniae* low woodland occurs on broad valleys

| | | | | |
|---|---|---|---|---|
| **Woodland type** | *E. transcontinentalis* low woodland | | | |
| **Landforms:** | sandplains | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis* | *E. gracilis, Casuarina cristata* | *Santalum spicatum, Eremophila oppositifolia, Melaleuca eleuterostachya* | *Scaevola spinescens, Eremophila paisleyi, Acacia hemiteles, Alyxia buxifolia, Eremophila decipiens* | *Actinobole uliginosum, Aristida contorta, Gnephosis tenuissima, Waitzia acuminata* |
| **Woodland type** | *E. transcontinentalis - E. flocktoniae* low woodland | | | |
| **Landforms:** | broad valleys | | | |
| **Soil types:** | deep calcareous earths | | | |
| **Dominant trees** | **Other trees / mallees** | **Dominant tall shrubs** | **Dominant low shrubs** | **Common ground flora** |
| *E. transcontinentalis, E. flocktoniae* | | *Acacia hemiteles, Acacia acuminata* | Not provided | *Veilleia rosa* |

# NEC 1.13a: Woodlands of *Eucalyptus formanii* of the semi-arid and arid regions of Western Australia

## *Description*

Key flora, fauna and abiotic components

*Eucalyptus formanii* is a tree (occasionally mallee), 3–11 m high, with flaky and fibrous bark on the trunk. It is found on red sands and ironstone slopes within the Coolgardie, Murchison and Yalgoo IBRA regions to the west of Kalgoorlie (Western Australian Herbarium, 2003). It is listed as a priority 4 species by CALM due to its limited distribution[1].

Low woodlands of *E. formanii* were described in the biological surveys of the eastern Goldfields in the Barlee – Menzies survey area (Burbidge et al. 1995). These woodlands cover a substantial part of the base of the Mt Manning Nature Reserve occurring on flat sandy plains in broad valleys (soil type sandy loams). The low woodlands on plains (sands / loams) consisted of 10m high trees over an understorey of *Plectrachne rigidissima*. *Eucalyptus formanii* sometimes resembled mallees branching low down. Floristic composition was complex with several intermediate strata of tall and low shrubs. Shrubs consisted of *Grevillea acuaria, Bossiaea walkeri* and *Eremophila* spp.

An unusual form of this woodland was also sampled at the west base of Mt Manning Range. This form was restricted in distribution covering 1-3ha (Burbidge et al. 1995). Within this community understorey species were diverse and included tall shrubs (up to 4m) such as *Acacia* spp. (*A. ramulosa, A. burkittii, A. colletoides*), *Eremophila paisleyi, Santalum acuminatum* and *Santalum spicatum*. Other trees species included *Callitris columulleris, Eucalyptus concinna, E. ebbanoesnsis, E. oleosa, E.* aff. *lesouefii, Acacia aneura* and *E. transcontinentalis* (Burbidge et al 1995); trees were 6-10m tall. Low shrubs included *Phebalium filifolium, Westringia cephalantha, Alyxia buxifolia* and *Cassia nemophila*. Grasses and small shrubs included *Plectrachne rigidissima*, *Dampiera incana*, *Dianella revoluta* and *Maireana trichoptera*.

## *National distribution*

Known natural distribution

This NEC occurs where the Coolgardie (subregion COO2), Murchison (subregion MUR1) and Yalgoo IBRA regions meet. The low woodlands of *E. formanii* are virtually restricted to the Barlee – Menzies study area (Burbidge et al. 1995), within the Mt Manning Range area. The Mt Manning Range contains a substantial proportion of the total area of this vegetation type and total population of the species *E formanii* (Burbidge et al.1995).

There is no mapping data available to show the extent of occurrence of woodlands dominated by *E. formanii*. *Eucalyptus formanii* low woodlands are represented in the Mt Manning Nature Reserve.

[1] Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

## *Information contributing to the conservation status under the EPBC Act*

### Components listed under State or Territory legislation

Mount Manning Range vegetation complex is recognised as an ecosystem at risk by CALM (Cowan et al. 2003). It is subject to imminent exploration programs for iron ore mining (Portman mining Co.). Other threats are listed below. This vegetation complex is likely to include the *E. formanii* woodlands (however, this needs clarification).

CALM regard reservation of the Mount Manning Range vegetation complex as a high priority (Cowan et al. 2003).

### Decline in geographic distribution

No data is available.

### Threats to national ecological community

Specific threats listed for the Mt Manning vegetation complex include mining, changed fire regimes, feral animals (rabbits) and exotic weeds (Cowan et al. 2003). No further details are provided in the above cited synopsis report.

### Loss or decline of functionally important species

No data available

### Reduction in ecological community integrity

No data available

### Rate of detrimental change

No data available

## *Summary & recommendations re: category of threat under the EPBC Act*

The *E. formanii* woodlands may be eligible for listing as threatened under the EPBC act, as they are restricted in distribution and subject to threatening processes. These woodlands are also regarded by CALM as an "ecosystem at risk". However, further information is required regarding the effects of mining exploration, feral animals, exotic weeds and changed fire regimes within this community type. Furthermore, the current distribution of these woodlands requires investigation.

### Outstanding issues

- Are the *E. formanii* woodlands included in the Mt Manning Vegetation complex recognised by CALM as an ecosystem at risk?
- Further information on threatening processes and current distribution are needed to assess this community appropriately.

# NEC 1.13b: Woodlands of *Eucalyptus melanoxylon* in the goldfields region of Western Australia

## *Description*

Key flora, fauna and abiotic components

*Eucalyptus melanoxylon* may be found in both temperate and arid regions of Western Australia. Within the goldfields region it forms low woodlands of which the most extensive examples are found in the Boorabbin – Southern Cross survey area described in the biological surveys of the eastern Goldfields (Keighery et al. 1995). These are confined to the low Yilgarn Hills on colluvial flats. Some of these hills have been cleared for agriculture and may have been disturbed by mining exploration or grazing (Keighery et al. 1995). Low woodlands of *E. melanoxylon* are also reported in the Norseman – Balladonia survey area on calcareous plains (loamy sands) (Hall and McKenzie. 1993).

Within the Yilgarn Hills, *E. melanoxylon* trees are 8-10m high with a crown cover of 12%. Prominent tall shrubs include *Melaleuca pauperiflora* and *Santalum acuminatum*. Low shrubs include *Eremophila scoparia, Atriplex nummularia* spp. *spathulata, Acacia merallii,* and *Atriplex vesicaria* ssp. *variabilis*. Annuals may include *Asteridea athrixiodes, Eriochiton sclerolaenoides* and *Zygophyllum apiculatum* (Keighery et al. 1995).

These woodlands occur on undulating plains (colluvial flats) over greenstone. Soils are deep calcareous earths (surface soils are sandy loams and subsoils are clay loams) (Keighery et al. 1995). These woodlands are found along the greenstone belt running through Southern Cross (2-1,000 ha, dominant) (Keighery et al. 1995).

## *National distribution*

Known natural distribution (including bioregions and conservation areas)

No mapping data is available at present for this NEC. These woodlands are not mapped in the current NVIS data due to their small size. The distribution of *E. melanoxylon* is available through the Western Australian Herbarium (2003). Within the Boorabbin – Southern Cross area these woodlands are confined to the Yilgarn Hills.

## *Information contributing to the conservation status under the EPBC Act*

Components listed under State or Territory legislation

The Yilgarn Hills vegetation complex in which some of the *E. melanoxylon* woodlands occur is recognised as an ecosystem at risk by CALM (Cowan et al. 2003). Threatening processes include mining, feral animals (rabbits), exotic weeds and changed fire regimes (Cowan et al. 2003).

Rare flora or fauna are likely to occur within these communities, however, this is difficult to assess from the synopsis reports produced by CALM for the National Land and Water Biodiversity Audit (2001).

### Decline in geographic distribution

No data is available regarding the distribution of these woodlands prior to clearing in the goldfields region.

### Threats to national ecological community

Specific threats listed for the Yilgarn Hills vegetation complex include mining, changed fire regimes, feral animals (rabbits) and exotic weeds (Cowan et al. 2003).

### Loss or decline of functionally important species

No data available

### Reduction in ecological community integrity

No data available

### Rate of detrimental change

No data available

## *Summary & recommendations re: category of threat under the EPBC Act*

In summary, overall the low woodlands of *E. melanoxylon* in the goldfields region of WA do not appear threatened at present. However, the woodlands within the Yilgarn Hills are subject to a number of threatening processes and regarded as "at risk" by WA. Further assessment of this NEC is needed (in particular an investigation of the current distribution of the *E. melanoxylon* woodlands).

### Outstanding issues

- Further information regarding the threats listed in this report is required.