

## Nomination for listing a threatened ecological community under the Environment Protection and Biodiversity Conservation Act 1999

This is a nomination for the ecological community “Inland Grey Box Woodland” that is found in New South Wales, Victoria, Queensland and to a lesser extent in South Australia. Inland grey box woodland is a distinct ecological community recognisable by certain biotic and abiotic characteristics on a national scale, although at the smaller scales used by states’ administrative bodies fine differences emerge enabling smaller ecological units to be defined. For the purposes of Commonwealth law analysis must by definition be made on the larger national scale, with further descriptions available through finer examinations, which are presented in the various formats adopted by the different states. Thus this nomination is presented as a single community, with detailed descriptions provided on a state-by-state basis.

**Note:** The NSW Scientific Committee has made a Preliminary Determination to list the “inland grey box woodland” community in NSW as endangered under the *Threatened Species Conservation Act 1995*. The Committee’s Determination is provided in Appendix 1.

### Generally accepted name (if any) of the ecological community

The community is recognised generically as inland grey box woodland (Prober and Thiele 2004, Benson 2006). Community classification on a national level must by definition be on a large scale which allows the common characteristics to emerge. Within this large-scale community there will be inevitable regional differences resulting from varying biotic and abiotic conditions. The different States have developed their own systems of classification and vegetation mapping which provide community descriptions on these finer scales.

In New South Wales six varieties of Inland Grey Box Grassy Woodland have been described, according to the vegetation classification of Benson (2006). These are:

- i) Inland grey box grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (ID76 in Benson 2006; Appendix 2)
- ii) Inland grey box – white cypress pine tall woodland on sandy loam on alluvial plains of NSW South-western Slopes and Riverina Bioregion (ID80 in Benson 2006; Appendix 3)
- iii) Inland grey box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (ID81 in Benson 2006; Appendix 4)
- iv) Inland grey box – Poplar Box – White cypress pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (ID82 in Benson 2006; Appendix 5)
- v) Inland grey box – black cypress pine shrubby woodland on stony slopes in the NSW South Western Slopes and Riverina Bioregions (ID110 in Benson 2006: Appendix 6)
- vi) Riverine inland grey box grassy woodland of the semi-arid (warm) climate zone (ID 237 in Benson 2006; Appendix 7).

Native vegetation in Victoria has been classified according to Ecological Vegetation Classes (EVCs). There are approximately 300 EVCs statewide (DSE 2005), and two fall within the Inland grey box woodland community definition:

- i) Plains woodland (EVC 803 in DSE 2006; Appendix 8)
- ii) Slopes box grassy woodland (EVC 175\_1 in DSE 2006; Appendix 9)

In Queensland the EPA has defined a system of Regional Ecosystems (2005) in which Inland grey box woodland is classified as '*Eucalyptus melliodora* and/or *Eucalyptus microcarpa*/*E. moluccana* woodland on metamorphics' (Regional Ecosystem ID 13.11.8). A mapping study in south-eastern Queensland defined grey box woodland as 'grey box/ yellow box/ fuzzy box woodlands on Main Range' (Bean *et al.* 1998).

In South Australia there are a number of communities dominated by grey box (*Eucalyptus microcarpa*) but no coherent system classifying and mapping vegetation throughout the state, although a study from south-eastern Queensland identified a comparable 'Grey box/ Yellow box/ Fuzzy box woodland' (Bean *et al.* 1998). Two further lists provide brief descriptions of vegetation communities in the state and their conservation status (Neagle 1995, DEH in progress).

A description of the ecological community that distinguishes it from any other ecological community, including:

### **i) its biological and non-biological components**

The inland grey box community throughout Australia is characterised as follows:

- Grey box (*Eucalyptus microcarpa*) is dominant, although in Queensland *E. melliodora* (yellow box) and *E. moluccana* (grey box) may be equally dominant (EPA 2005).
- Structurally it is mid-high to tall woodland, with trees up to 25 m tall and a sparse shrub layer (EPA 2005, Benson 2006, DSE 2006).
- Characteristic tree species include *Callitris glaucophylla* (white cypress pine), *Eucalyptus melliodora* (yellow box), *Allocasuarina luehmannii* (buloke) (EPA 2005, Benson 2006, DSE 2006, NSW Scientific Committee 2006). In some areas of NSW, Queensland and Victoria *Eucalyptus albens* (white box) is also typical (Seddon *et al.* 2002, DSE 2006, NSW Scientific Committee 2006). Other species associated with the community and the sub-communities in which they are found are presented in Table 1.
- The community has a sparse shrub layer, and the species represented in the shrub layer are far more variable than the tree layer. Grazing is an intense pressure on the lower vegetation throughout the community. There is a severe lack of information about the native understorey that is a direct result of the paucity of intact representative areas and that greatly hinders conservation efforts (Prober and Thiele 2004). Some typical shrubs of the community are presented in Table 2.
- Inland Grey Box occurs on productive alluvial or colluvial mostly loamy soils (Prober and Thiele 2004, EPA 2005, Benson 2006, DSE 2006).

The ground layer of the community is often sparse or grassy (Bean *et al.* 1998, Benson 2006), with species including *Enteropogon ramosus*, *austrostipa scabra* (Prober and Thiele 2004), *Cymbopogon refractus* (Bean *et al.* 1998). *Austrostipa scabra* is common in the community (Prober and Thiele 2004, Benson 2006).

**Table 1:** Common tree species in the nine sub-communities of inland grey box woodland (EPA 2005, Benson 2006, DSE 2006)

Species	Sub-community present in								
	N <sup>1</sup>	N <sup>2</sup>	N <sup>3</sup>	N <sup>4</sup>	N <sup>5</sup>	N <sup>6</sup>	V <sup>1</sup>	V <sup>2</sup>	Q
<i>Eucalyptus microcarpa</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Allocasuarina luehmanii</i>	Y	Y		Y		Y		Y	
<i>Callitris glaucophylla</i>	Y	Y	Y	Y	Y			Y	
<i>Eucalyptus melliodora</i>	Y	Y	Y			Y		Y	Y
<i>Brachychiton populneus</i>		Y	Y	Y					
<i>Eucalyptus albens</i>								Y	Y
<i>E. camaldulensis</i> subsp. <i>camaldulensis</i>						Y			
<i>Callitris endlicherii</i>					Y				
<i>E. crebra</i>									Y
<i>E. dealbata</i>									Y
<i>Pittosporum angustifolium</i>		Y							
<i>E. largiflorens</i>						Y			
<i>E. leucoxydon</i>								Y	
<i>E. macrorhyncha</i>							Y		
<i>E. polyanthemos</i>							Y		
<i>E. melanophloia</i>									Y

**Community key:**

N<sup>1</sup> – NSW, Inland grey box tall grassy woodland on alluvial loam and clay soils ID76 (Benson 2006)

N<sup>2</sup> – NSW, Inland grey box- white cypress pine tall woodland on sandy loam soil ID80 (Benson 2006)

N<sup>3</sup> – NSW, Inland grey box tall grassy woodland on clay soils ID 81 (Benson 2006)

N<sup>4</sup> – NSW, Inland grey box – poplar box – white cypress pine tall woodland on red loams ID82 (Benson 2006)

N<sup>5</sup> – NSW, Inland grey box – black cypress pine shrubby woodland on stony slopes ID110 (Benson 2006)

N<sup>6</sup> – NSW, Riverine inland grey box grassy woodland ID237 (Benson 2006)

V<sup>1</sup> – Plains woodland (dominated by grey box) EVC803 (DSE 2006)

V<sup>2</sup> – Slopes box grassy woodland EVC 175\_1 (DSE 2006)

Q – *Eucalyptus melliodora* and/or *Eucalyptus microcarpa*/ *E. moluccana* woodland on metamorphics 13.11.8 (EPA 2005)

**Table 2:** Common shrub species in the nine sub-communities within the Inland Grey Box community (EPA 2005, Benson 2006, DSE 2006)

Species	Sub-Community	Species	Sub-Community
<i>Dodonea viscosa</i>	N <sup>1</sup> , N <sup>4</sup> , N <sup>5</sup> , V <sup>2</sup>	<i>Beyeria viscosa</i>	N <sup>5</sup>
<i>Acacia buxifolia</i>	N <sup>1</sup> , N <sup>5</sup>	<i>Cassinia arculata</i>	N <sup>5</sup> , V <sup>1</sup> , V <sup>2</sup>
<i>Acacia acinacea</i>	N <sup>1</sup> , N <sup>6</sup> , V <sup>1</sup> , V <sup>2</sup>	<i>Ozothamnus obcordatus</i> Subsp. <i>obcordatus</i>	N <sup>5</sup>
<i>Acacia hakeiodes</i>	N <sup>1</sup> , N <sup>3</sup> , V <sup>2</sup>	<i>Maireana enchylaenoides</i>	N <sup>6</sup>
<i>Bursaria spinosa</i>	N <sup>1</sup> , N <sup>3</sup> , V <sup>2</sup>	<i>Acacia montana</i>	V <sup>2</sup>
<i>Maireana microphylla</i>	N <sup>2</sup>	<i>Pittosporum phylliraeoides</i>	V <sup>2</sup>
<i>Acacia armata</i>	N <sup>3</sup>	<i>Eremophila longifolia</i>	V <sup>2</sup>
<i>Acacia penninervis</i> Subsp. <i>longiracemosa</i>	N <sup>3</sup>	<i>Acacia implexa</i>	V <sup>1</sup>
<i>Cassinia quinquefaria</i>	N <sup>3</sup>	<i>Acacia pycnantha</i>	V <sup>1</sup>
<i>Geijera parviflora</i>	N <sup>3</sup> , N <sup>4</sup>	<i>Eremophila mitchellii</i>	N <sup>4</sup>
<i>Acacia deanii</i>	N <sup>4</sup> , N <sup>5</sup>	<i>Olearia pimelioides</i>	N <sup>4</sup>
<i>Acacia paradoxa</i>	N <sup>5</sup>		

**Community key:** as above for Table 1.

In New South Wales the grey box woodland is more similar to Brimble box woodland than other types, yet is clearly differentiated by its understorey composition. There is an increase of chenopods, annual daisies and other natives and a marked loss of species more typical of more eastern woodlands (Prober and Thiele 2004). There are so few undisturbed remnants of this community that assessing trends in abundance of native shrub abundance is difficult – however, it appears that shrub diversity and abundance are higher in western woodlands than more eastern ones (Prober and Thiele 2004). Only few remaining sites show the range and possible diversity of the shrub layer (Berwick *et al.* in prep.) Where tall shrubs have been eliminated by grazing, in NSW the low shrub *Maireana microphylla* is often the most common (Benson 2006). Throughout its range it is clear that the understorey of this community, although once diverse, is now enervated because of continued grazing eliminating many shrub and herb species.

The inland grey box woodland exists in similar areas to other woodland communities with different box species dominant. For example, in New South Wales it is distinct from nearby woodlands dominated by White Box, Yellow Box or Red Gum, as a result of the change from non-alluvial parent material to alluvial parent material (Prober and Thiele 2004). Several communities are listed by Benson (2006) as grading into the six sub-communities described by him which fall within the inland grey box community, including inland grey box-white cypress pine-buloke community (ID80); yellow box-pine community (ID 75) on sandier soils; *Eucalyptus blakeyi* and *E. melliodora* communities at higher altitudes; *Eucalyptus dwyeri*-*Acacia doratoxylon*-*Allocasuarina verticillata* low woodland (ID 185); black box woodland (ID 13). In Victoria the community borders the box-ironbark forest and forms part of the overall box-ironbark extended woodland (Kelly and Mercer 2005).

ii) the processes by which these processes interact (if known)

iii) its known natural distribution

As previously mentioned, inland grey box woodland occurs in New South Wales, Victoria, Queensland and South Australia. It is found in areas with an average annual rainfall of 400-800 mm (Prober and Thiele 2004, EPA 2005, Benson 2006, Berwick *et al.* in prep). It is found on the fertile soils of alluvial plains and low slopes (Benson 2006, Berwick *et al.* in prep.) on red brown earths (Prober and Thiele 2004, Benson 2006).

In New South Wales, there are six described varieties of inland grey box grassy woodland (Benson 2006), and each have differing natural distributions and occur in different bioregions. These are described below.

▪ **ID76 in Benson 2006:**

Approximately 92% of this ecological community has been cleared throughout its range and it is estimated that approximately 30,000 ha of the community remains (Benson 2006). It now exists only as small remnants, along the floodplains of the Murrumbidgee and Murray Rivers in the NSW South Western Slopes and Riverina bioregions (Benson 2006).

The Western Riverina draft RVM Plan pre-European mapping indicates that 2.7% (14,700 ha from 544,500 ha) of its inland grey box vegetation remains in that planning region (Benson 2006). Only 8% grassy box woodland remains in the Murray Catchment (this includes several additional box woodland communities) (Murray 2001 in Benson 2006), and it is estimated that 3% (4600 ha) remains in the central Lachlan region (Austin *et al.* 2001 in Benson 2006). The community has been mapped as part of a broad unit by Moore (1953), mapped as part of a broad inland grey box community by Porteners (1993) and modelled for Wagga Wagga Shire by Priday (2004) (Benson 2006).

This community occurs in the Flagstaff Memorial Nature Reserve (18 ha), and Wiesners Swamp Nature Reserve (20 ha) (Benson 2006).

- **ID80 in Benson 2006:**

It is estimated that the current extent of this community is 100,000 ha (Benson 2006). The Western Riverina draft RVM Plan pre-European mapping indicates that only 2.7% remains for that planning region (14 700 from an original 544 500) but that this community is more common further north of this region (Benson 2006). This type of inland grey box woodland was originally considered to be the most common of the other types described in this nomination (Moore 1953 *in* Benson 2006).

The community has been mapped as part of a broad inland grey box (Moore 1953), mapped as part of a broad inland grey box community in the Murray Catchment (Murray Catchment Trust 2001), surveyed by Bos & Lockwood (1996), and grouped into a broader box woodland type by Siversten & Metcalfe (1995) (Benson 2006).

The community is mainly restricted to the eastern section of the Riverina Bioregion and the western section of the NSW South Western Slopes Bioregions. A total of 182 ha occur in the following reserves: Wilbertoy Flora Reserve (22 ha), Buckingbong Flora Reserve (155 ha), Gubbata Nature Reserve (5 ha) (Benson 2006).

- **ID81 in Benson 2006:**

It is estimated that 12,000 ha of this community remains in NSW (Benson 2006). In the area north of Dubbo, 16% of the original community remains (Kerr *et al.* 2003 *in* Benson 2006). The community is mostly cleared for grazing or cropping with remnants on roadsides or in Travelling Stock Reserves and Routes (Benson 2006).

It is most common in the Coonabarabran Shire to Gilgandra in the south, in some valleys and to the north of Mount Kaputar, and also occurs on the Liverpool Plains. It is mainly confined to the Brigalow Belt South Bioregion with some occurrences further east in the Nandewar Bioregion (Benson 2006).

A total of 47 ha occur in the following conservation areas: Wongarbon Nature Reserve (20 ha), Coolbaggie Nature Reserve (7 ha), and Warrumbungle National Park (20 ha) (Benson 2006).

- **ID82 in Benson 2006:**

It is estimated that 80,000 ha remains in NSW (Benson 2006). It is distributed in central western NSW mostly in the eastern section of the Cobar Peneplain Bioregion near Nymagee, Tottenham and Boona and extending south (Benson 2006).

There are 30,000 ha in map unit PNP2 and 6000 ha in map PNP3, in Lewer *et al.* (2003 *in* Benson 2006). Sivertsen & Metcalfe (2001) mapped 60,000 ha in the Marromine and Dubbo regions, Pickard & Norris (1994) mapped 43,200 ha in area partially overlapping the area mapped by Sivertsen & Metcalfe (2001), and Dykes (2002) mapped 1,740 ha in the south-eastern section of Cobar Shire (Benson 2006). Additional areas to the south are unmapped. The community is mostly cleared in the Central Division but some areas remain in the Western Division (Benson 2006).

A total of 340 ha occur in the following conservation areas: Woggoon Nature Reserve (240 ha), Round Hill Nature Reserve (70 ha), and Strahorn Flora Reserve (30 ha) (Benson 2006).

- **ID110 in Benson 2006:**

It is estimated that 10,000 ha of the community remains (Benson 2006). It is distributed mainly on the NSW South Western Slopes Bioregion with some areas in the Cobar Peneplain Bioregion (Cocopara National Park) (Benson 2006).

Benson (2006) notes that while the current extent has not been mapped and/or modelled, it was partly surveyed by Bos & Lockwood (1996), mapped in Cocopara Nature Reserve and National Park by Whiting (1997) and has also been mapped in other reserves such and Nangar National Park.

A total of 288 ha occur in the following conservation areas: Cocopara National Park (100 ha), Cocopara Nature Reserve (41 ha), Nanga National Park (17 ha), and The Rock Nature Reserve (130 ha) (Benson 2006).

▪ **ID 237 in Benson 2006:**

It is estimated that only 4,000 ha of the community remains (Benson 2006). Benson (2006) states that Margules & Partners (1990) mapped approximately 6,000 ha of mixed box woodland along the Murray River, however, it is likely that only half of the area is this community (the other half being yellow box woodland, ID74 in Benson 2006). Other areas occur along the Murrumbidgee River.

The community occurs on floodplains dominated by river red gum forests mainly along the Murray and Murrumbidgee Rivers of south-western NSW from near Albury in the east to west of the Millewa forests near Deniliquin (Benson 2006).

A total of 38 ha occur in the following conservation areas: Flagstaff Memorial Nature Reserve (18 ha), and Wiesners Swamp Nature Reserve holds (20 ha) (Benson 2006).

In Victoria, the plains woodland community (EVC 803), dominated by grey box, occurs in the Riverina and North East bioregions. Here it occurs across the north end of the catchment to as far south as Nagambie (approximately). This is the predominant EVC across the northern plains (or Riverina) area of the lower catchment (Berwick *et al.* in prep). According to [REDACTED] the community also occurs west of these areas, as part of the North-west EVC mapping project. Information on the natural distribution of the floristic slopes box grassy woodland community (EVC 175) in Victoria is limited, however the community has been described as occurring in the North-east region and in the middle section of the catchment around Merton, Yea, Seymour, Glenaroua and Tooberac (Berwick *et al.* in prep). A map of the pre-European and the current distribution and extent of both EVC 175 and EVC 803 is provided in Appendix 10. These communities would only form a part of the mapped EVC.

In Queensland, the community occurs in the New England Tableland bioregion (bioregion 13 in EPA 2005), and in landzone 11 (which is defined in EPA 2005 as being hills and lowlands on metamorphic rocks). In September 2003, the remaining extent was less than 10,000 ha and only 10-30% of the pre-clearing area remained (EPA 2005). Small patches of the community also occur in Sundown National Park and Sundown Regional Reserve (EPA 2005).

In South Australia, the community has a limited distribution in the Bordertown-Frances area, and to a limited extent in the southern Lofty Ranges, south of Adelaide (DEH in progress).

Justification for this nomination
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**Criterion 1 – Decline in geographic distribution**

All inland grey box varieties in Australia have shown a measurable decline in geographic distribution. Of the six varieties in New South Wales, four have shown a substantial decline of over 70% (ID80, ID81, ID82 and ID110 in Benson 2006), while one has shown a severe decline of over 90% in geographical distribution

(ID76 in Benson 2006). The pre-European extent of inland grey box in NSW is estimated to be 1,532,000 ha, and has since been reduced to 236,000 ha (Benson 2006). This means that the NSW community has undergone an 85% decline in geographic distribution. Similarly, in Victoria, both varieties of inland grey box have shown a severe decline of over 90% in geographical distribution (DSE 2005), while inland grey box in Queensland has shown a substantial decline in geographic distribution of over 70% (EPA 2005). Declines in geographic distribution of each inland grey box variety are discussed below.

▪ **ID76 in Benson 2006:**

Benson (2006) estimates the pre-European extent to be 400,000 ha. Of this, it is estimated that only 30,000 ha remain (Benson 2006). This means that the community has undergone a 93% decline in geographic distribution.

Prior to European settlement, there was an extensive community on the South Western Plains and western part of the South Western Slopes Botanical Divisions (Benson 2006). Over 500,000 ha of inland grey box were modelled prior to European settlement, however this figure covers several communities (WRRVC 2001 *in* Benson 2006). A pre-European extent of 155,200 ha for the central Lachlan region was also modelled (Austin *et al.* 2000 *in* Benson 2006).

The Western Riverina draft RVM Plan pre-European mapping indicates that 2.7% (14,700 ha from 544,500 ha) of its inland grey box vegetation remains in that planning region (Benson 2006). Only 8% of grassy box woodland remains in the Murray Catchment (this includes several box woodland communities) (Murray 2001), and it has been estimated that only 3% (4600 ha) remains in the central Lachlan region (Austin *et al.* 2001).

▪ **ID80 in Benson 2006:**

An estimated 100,000 ha remain from an original extent of 700,000 ha (Benson 2006). This constitutes an 86% reduction in geographic distribution.

This estimation of pre-European extent is based on half of the broad Inland Grey Box alliance mapped by Moore (1953 *in* Benson 2006) and areas mapped by White (2002 *in* Benson 2006) for the Western Riverina region.

▪ **ID81 in Benson 2006:**

An estimated 12,000 ha remain from an original 80,000 ha (Benson 2006). Thus the community has undergone an 85% reduction in geographic distribution.

Benson (2006) notes that Whitehead (2000) estimates the pre-European extent in the Coonabarabran Shire to be 14,767 ha, and that Kerr *et al.* (2003) mapped 116,000 ha in the area north of Dubbo (this estimate also includes the pilliga box – poplar box community (ID88 in Benson 2006)).

▪ **ID82 in Benson 2006:**

The pre-European extent is estimated to be 300,000 ha, and of this, only 80,000 ha remain (Benson 2006). This is a reduction in geographic distribution of 73%.

This community was much more widespread before clearing. Benson's (2006) pre-European estimation was made with the assumption that 80% has been cleared in the Central Division and 50% in the Western Division.

▪ **ID110 in Benson 2006:**

The pre-European extent of this community was estimated to be 40,000 ha (Benson 2006). While this figure was obtained from an expert estimate, there has not been any detailed mapping or modelling of this community to date. It is estimated that only 10,000 ha remain (Benson 2006). Thus the community is likely to have undergone a reduction of 75% reduction in geographic distribution.

▪ **ID 237 in Benson 2006:**

Benson (2006) estimates the pre-European extent to be 12,000 ha. This figure was based on an expert estimate, as there has been no detailed mapping on the pre-European extent. It is estimated that 4,000 ha remain (Benson 2006), which is a reduction of 67% in geographic distribution.

In Victoria, inland grey box woodland has been mapped as part of a boarder EVC. This presents problems in determining the exact extent and distribution of the community. Information on the pre-European and current distribution and extent of this community type is not available, so the following refers to the whole of EVCs 803 and 175. Appendix 10 provides a map of the pre-European and current distribution and extent of EVC 803 plains woodland and EVC 175 grassy woodland. Also provided in Appendix 11 is an Excel spread sheet of the depletion values (pre-1750 vs extant area) for all EVCs in Victoria by bioregion (██████████, Department of Sustainability & Environment). From the depletion values, EVC 803 and EVC 175 have been classified as endangered by the DSE (2006) (in the DSE database: *Bioregional Conservation Status of EVCs*). In this database, 'endangered' is defined as:

*“less than 10% of former range OR less than 10% of pre-European extent remains (or a combination of depletion, loss of quality, current threats and rarity that gives a comparable status e.g. 10 to 30% pre-European extent remains and severely degraded over a majority of this area; OR naturally restricted EVC reduced to 30% or less of former range and moderately degraded over a majority of this area; OR rare EVC cleared and/or moderately degraded over a majority of this area)”*

According to the DSE (2005) more than 97% of plains grassy woodlands in the Goulburn Broken Catchment have disappeared.

Limited information on the status of inland grey box woodland in South Australia is available, however, a recent assessment of the community found a declining trend in geographic distribution, and the community is classified as endangered in South Australia (DEH in progress).

Australia-wide, this loss of grey box inland habitat across New South Wales, Victoria, Queensland and South Australia represents an average decline of at least 83% in geographic distribution of the inland grey box community, indicating that it qualifies as a vulnerable community.

## **Criterion 2 – Restricted geographic distribution coupled with demonstrable threat**

Inland grey box woodland in New South Wales and Queensland has a limited geographic distribution, occupying a total area of only 246,000 ha inclusive (EPA 2005, Benson 2006). Although no figures of the actual extent of inland grey box in Victoria and South Australia are available, the evidence of a severely declining population in these States (Neagle 1995, DSE 2006, DEH in progress) presents convincing evidence of a restricted distribution of this ecological community Australia-wide.

Each variety constituting the inland grey box community is restricted in geographic distribution, occupying an area less than 100 km<sup>2</sup>. This makes it likely that the action of a threatening process could cause any of them to be lost in the near future. This is exacerbated by the highly fragmented nature of the community.

Threatening processes affecting the inland grey box community are (DSE 2005, Benson 2006):

- clearing for agriculture
- cropping and horticulture
- salinity
- unsustainable grazing and trampling by stock (leading to loss of native species, the hindering of native plant regeneration, soil disturbance and increased nutrient levels)
- unsustainable grazing by feral animals (leading to increased fragmentation and isolation, thereby restricting the movement of native fauna)
- lack of native understorey and ground layer (which attracts insect eating birds helping keep the overstorey healthy and improve soil health through nitrogen fixation)
- inappropriate fire regimes
- soil erosion
- weed invasion

The restricted geographic distribution of each inland grey box variety and their susceptibility to the aforementioned threatening processes are described below.

### **▪ ID76 in Benson 2006:**

The remaining total extent of this variety is 30,000 ha (Benson 2006). A total of 290 ha (<1% of the community) is protected in reserves and conservation agreements (18 ha in Flagstaff Memorial Nature Reserve, 20 ha in Wiesners Swamp Nature Reserve, 252 ha in PAs or PCAs) (Benson 2006). There are currently no stands protected under property agreements (Benson 2006). This leaves the remaining stands vulnerable to further clearing.

This variety of inland grey box woodland exists as highly fragmented small stands with a high edge to area ratio (Benson 2006). Fragmentation makes the community particularly vulnerable to threats such as weed invasion. Community composition has been significantly altered, with the shrub understorey largely eliminated by grazing, and with the proliferation of weeds on the ground cover (Benson 2006). The level of weed invasion is 'high' and the community is in 'poor' health (Benson 2006). Salinity is likely to increasingly affect some areas in the Riverina (Benson 2006).

### **▪ ID80 in Benson 2006:**

An estimated 100,000 ha of this variety remains (Benson 2006). This variety occupies areas exposed to cropping and horticulture, grazing and timber production. It is poorly protected with only 392 ha (<1% of the community) in reserves and property agreements (22 ha in Wilbertroy Flora Reserve, 155 ha in

Buckingbong Flora Reserve, 5 ha in Gubbata Nature Reserve and 210 ha in PAs or VCAs) (Benson 2006). Thus the remaining stands are vulnerable to further clearing and grazing.

Benson (2006) states that this variety occurs in state forest areas that have been ‘timber stand improved’ to reduce eucalypts in favor of cypress pine, and is subject to clearing under the Lachlan, Murrumbidgee and Murray Catchment Management Plans (Benson 2006).

This variety is highly fragmented with a high edge to area ratio. It is in ‘poor’ health with a ‘medium’ level of weed invasion (Benson 2006).

- **ID81 in Benson 2006:**

Benson (2006) estimates that the total extent of this community is 12,000 ha. This variety occupies rich soils on valley bottoms and lower slopes and continues to be exposed to a high level of cropping, horticulture and grazing (Benson 2006). Only 47 ha (<1%) of the community is fully protected from further clearing and grazing in reserves (20 ha in Wongarbon Nature Reserve, 7 ha in Coolbaggie Nature Reserve, and 20 ha in Warrumbungle National Park). There are currently no property agreements protecting any stands (Benson 2006).

This variety is highly fragmented with a high edge to area ratio. The community is in ‘poor’ health as the structure and composition of vegetation is significantly altered, and the level of weed invasion is ‘medium’ (Benson 2006).

- **ID82 in Benson 2006:**

It is estimated that 80,000 ha of this variety remains (Benson 2006). This community is highly threatened by further clearing and occurs in what was previously one of the hotspots for clearing in NSW between 1990 and 2003 (Benson 2006). A total of 383 ha (<1% of the community) is protected in reserves or property agreements (240 ha in Woggoon Nature Reserve, 70 ha in Round Hill Nature Reserve, 30 ha in Strahorn Flora Reserve and 43 ha in PAs or VCAs) (Benson 2006). This leaves the remaining habitat vulnerable to further clearing.

Grazing causes soil erosion, weed invasion and loss of understorey. This variety is highly fragmented with a high edge to area ratio. It is in ‘poor’ health as the structure and / or composition is significantly altered and it has a ‘medium’ level of weed invasion (Benson 2006).

- **ID110 in Benson 2006:**

Approximately 10,000 ha remain of this variety (Benson 2006). Most of the footslopes and lower slopes of this variety have been cleared. Only 288 ha (3% of the community) are fully protected from further clearing (17 ha in Nangar National Park, 100 ha in Cocopara National Park, 41 ha in Cocopara Nature Reserve, 130 ha in The Rock Nature Reserve). There are currently no stands protected through property agreements (Benson 2006).

This community is highly fragmented, with a high edge to area ratio. Grazing has led to a major alteration of the understorey (Benson 2006). It is in ‘moderate’ health, with the structure and / or composition altered, and it has a ‘low’ level of weed invasion (Benson 2006).

▪ **ID 237 in Benson 2006:**

Only 4,000 ha of this community remains (Benson 2006), giving it a very restricted geographic distribution.

Grazing and weed invasion are ongoing threats affecting most stands (Benson in prep). Grazing by stock and rabbits has largely eliminated the shrub understory of the remnants. Annual weeds including *Heliotropium europaeum* invade the ground cover, and salinity is likely to increasingly affect some areas in the Riverina (Benson 2006).

A total of 18 ha (<1% of the community) is protected in reserves (2 ha in Billabong Flora Reserve, 3 ha in Sanddune Pine Flora Reserve and 13 ha in Toupna Creek Flora reserve). These are only small fragmented remnants. There are currently no stands protected by property agreements (Benson 2006) and the remaining community is vulnerable to further clearing and grazing.

The community is in 'poor' health as the structure and / or composition is significantly altered and the level of weed invasion is 'high' (Benson 2006).

The broad mapping of inland grey box varieties in Victoria (EVCs 803 and 175) presents problems in determining their distributions, however, they are likely to be geographically small and fragmented. The most common way that plains woodlands still occur is in relatively dense stands of scattered old trees within pasture, rather than in clearly defined vegetation remnants. These scattered patches are often less consistently protected and therefore their health may be more at risk (Department of Natural Resources and Environment 2002a). The management plan for the mid-Murray Forest Management Area, indicates that grey box vegetation types are undergoing significant decline in range or condition due to effects of current or historical land uses (Department of Natural Resources and Environment 2002b). Many of the areas that once carried plains woodland have been cleared for agriculture and only fragmented remnants remain on private land, roadsides and the fringes of larger public land blocks (Department of Primary Industries 2006).

In Queensland, only 10,000 ha of inland grey box remain (EPA 2005). The community is classified as endangered and the recruitment of canopy species is restricted by grazing pressure (EPA 2005).

In South Australia, inland grey box woodland is classified as endangered, owing to the heavily modified and fragmented nature of the remaining community (DEH in progress). Fragmentation and degradation have been the result of urban spread, weed invasion, and clearance for cropping and grazing. Only a few degraded examples exist in reserves (DEH in progress).

#### **Criterion 4 – Reduction in community integrity**

Grey box woodlands have been classified as one of the most poorly conserved ecological communities in Australia (Specht 1981, Benson 1991 *in* Prober & Thiele 2004). Most have been cleared for agriculture because they occur on productive soils. Uncleared areas have been modified to varying degrees by livestock grazing and other disturbances. Some remnants in NSW have trees either wholly or partly removed, while some have trees largely intact but shrub or ground layers are degraded to varying degrees through grazing or pasture modification (NSW Scientific Committee 2006). These significant alterations pervade the structure and / or composition of inland grey box woodlands, leading to the poor health and high level of weed invasion evidenced in this community Australia-wide.

## **Criterion 5 – Rate of continuing detrimental change**

The threatening processes outlined for Criterion 2 have accelerated the degradation of the inland grey box community and led to a large reduction in ecological function. Further, these processes are ongoing (NSW Scientific Committee 2006):

- Further small scale clearing for cropping, pasture improvement or other developments
- Firewood cutting, increased livestock grazing, weed invasion, inappropriate fire regimes, soil disturbance and increased nutrient loads
- Degradation of the landscape in which remnants occur, including soil acidification, salinisation, extensive erosion scalding and loss of connectivity

The cumulative effects of these processes have led to the 83% decline in inland grey box (described in Criterion 2) that has occurred since pre-European settlement. This continuing detrimental change is likely to continue while these threatening processes continue in inland grey box woodland habitats.

## **Recommendations for Recovery**

While the inland grey box community is invariably fragmented and in poor health, in most cases sufficient biota remains for natural regeneration if causal factors and secondary impacts are removed (Benson 2006). Accordingly, detailed surveying and protection of remaining areas is required, and areas in good or reasonable condition should be fenced off. Reservation and other protection under property agreements, where appropriate, should be investigated.

Clearing of this community under catchment plans must cease and be replaced by priority protection measures. Examples of management plans that need modification include the:

- Lachlan, Murray, Murrumbidge and Lachlan Catchment Management Plans.
- Murray Valley Regional Environmental Plan.
- Central West and Namoi Catchment Management Plans.

Key sites for protection include (Benson 2006):

- those occurring on the Travelling Stock Reserve and roadsides; and excellent stands with intact ground cover along Shoards Crossing Lane, west of Young (ID 76 in Benson 2006).
- State Forests such as Wahgunyah, Buckingham and Yarranjerry Forest; and areas occurring between Boginderma and Temora on the southwest slopes (ID80 in Benson 2006).
- a selection of Western Lands Leases on the eastern edge of the Western Division. Targeted surveys are required to determine key sites for protection in the Nymagee region (ID82 in Benson 2006).
- the stands occurring in several state forests between Forbes and Naranderra and at the base of some rocky outcrops, stands occurring in Pleasant Hills south-west of Wagga, and stands occurring on the footslopes of Mount Boormanooma, near the Murray River (ID110 in Benson 2006).
- areas on the Murray River floodplain including in a number of state forests such as Gulpi State Forest (ID237 in Benson 2006).

Further mapping and surveying is required to determine key sites for protection in Victoria, Queensland and South Australia.

## **Other grey box communities**

There are additional grey box (*Eucalyptus macrocarpa*) communities in Queensland and Victoria that have not been included in this nomination. While they exhibit some similarities with the nominated communities, they are significantly different in structure and occurrence (xxxxxxxxxxxxxx). In order for the TSSC to make their own assessment, information on these communities is provided in Appendix 12.

## References

- Bean, A.R., Sparshott, K.M., McDonald, W.J.F. & Nelder, V.J. (Eds) (1998). *Forest Ecosystem Mapping and Analysis of South-Eastern Queensland Biogeographic Region. A. Vegetation Survey and Mapping*. Report for Queensland CRA / RFA Steering Committee. Queensland Herbarium, Queensland Department of Environment and Heritage, and Environment Australia, Commonwealth Department of the Environment, Sport and Territories, Brisbane.
- Benson, J. (2006) New South Wales vegetation classification and assessment: introduction – the classification, database, assessment of protected areas and threat status of plant communities. *Cunninghamia* 9(3): 331-380.
- Berwick *et al.* (in prep). *North-East Region Pre 1759 EVC Mapping Project: Draft Project Report*. Department of Natural resources and Environment, Benalla, North East Region.
- Department of Environment and Heritage (in progress). *Provisional list of threatened ecosystems of South Australia*. Department for Environment and Heritage, South Australia.
- Department of Natural Resources and Environment (2002a). *Native Vegetation Management: A Framework for action*. URL:  
[http://www.dse.vic.gov.au/CA256F310024B628/0/C2E5826C9464A9ECCA2570B400198B44/\\$File/Native+Vegetation+Management+-+A+Framework+for+Action.pdf](http://www.dse.vic.gov.au/CA256F310024B628/0/C2E5826C9464A9ECCA2570B400198B44/$File/Native+Vegetation+Management+-+A+Framework+for+Action.pdf)
- Department of Natural Resources and Environment (2002b). *Forest Management Plan for the Mid-Murray Forest Management Area* (Chapter 3 Biodiversity Conservation). URL:  
<http://www.dse.vic.gov.au/DSE/nrenfor.nsf/FID/-08E43641FEC28FCCCA256BB9001B91E5?OpenDocument>
- Department of Primary Industries (2006), *Victorian Resources Online: Plains Grassy Woodlands*. URL:  
[http://www.dpi.vic.gov.au/DPI/Vro/wimreg.nsf/pages/natres\\_veg\\_plains](http://www.dpi.vic.gov.au/DPI/Vro/wimreg.nsf/pages/natres_veg_plains)
- Department of Sustainability and Environment (2005). Plains Grassy Woodland: Endangered in the Goulburn Catchment. URL: <http://www.gbema.vic.gov.au/downloads/EVCs/PlainsGrassyWoodland.pdf>
- Department of Sustainability and Environment (2006), *Native Vegetation Information for Victoria*. URL:  
<http://www.dse.vic.gov.au/DSE/nrence.nsf/LinkView/DED128E11A362A51CA256FFF001CAB6C544ABC860B2506F7CA257004002550CC>
- Environmental Protection Agency (EPA) (2005). *Regional Ecosystem Description Database (REDD). Version 4.2*. Updated March 2005. URL: <http://www.epa.qld.gov.au/projects/redd/index.cgi>
- Kelly, M. & Mercer, D. (2005). Australia's box-ironbark and woodlands: saving the fragments of a threatened ecosystem. *Australian Geographer* 36(1): 19-37.
- Neagle, N. (1995). *An update of the conservation status of the major plant associations of South Australia*. Department of Environment and Natural Resources, South Australia.
- NSW Scientific Committee (2006). Inland grey box woodland in the Riverina, New South Western Slopes, Cobar Penplain, Nandewar and Brigalow Belt South Bioregion – Preliminary Determination.
- Prober, S.M. & Thiele, K.R. (2004). Floristic patterns along an east-west gradient in grassy box woodlands of central New South Wales. *Cunninghamia* 8(3): 306-325.

Queensland Herbarium (1998). *Forest Ecosystem Mapping and Analysis of South-Eastern Queensland Biogeographic Region*. A. Vegetation Survey and Mapping Department of Environment and Heritage. URL: [http://www.affa.gov.au/corporate\\_docs/publications/pdf/forestry/rfa/qld/qld\\_se\\_eh12a.pdf](http://www.affa.gov.au/corporate_docs/publications/pdf/forestry/rfa/qld/qld_se_eh12a.pdf)

Seddon, J., Briggs, S. & Doyle, S. (2002). Little River Catchment Biodiversity Assessment – a report for the TARGET project.

Specht, R.L. (1981). Conservation of vegetation types. Pp. 393-410. *In*: Groves, R.H. (Ed.) *Australian Vegetation*. Cambridge University Press: Sydney.

## Other sources of information

In regards to the communities in NSW, this nomination relies heavily on analysis done by Benson (2006). The following is a list of sources used by Benson (2006) in his analysis.

Austin, M.P., Cawsey, E.M., Baker, B.L., Yialeloglou, M.M., Grice, D.J. & Briggs, S.V. (2000) *Predicted vegetation cover in the central Lachlan region. National Heritage Trust Project AA 1368.97*. (CSIRO Division of Wildlife and Ecology: Canberra).

Benson, D.H. (1979) *Vegetation of Wongarbone Nature Reserve*. Unpublished report to NSW National Parks and Wildlife Service: Sydney.

Benson, J.S. (1999-2004) *Unpublished field note books recording species at various locations in western NSW*. (Royal Botanical Gardens Domain Trust: Sydney).

Bos, D. and Lockwood, M. (1996) *Flora, fauna and other features of the south west slopes biogeographic region, NSW. Report No. 59*, Johnson Centre of Parks, Recreation & Heritage. (Charles Sturt University: Albury).

Brickhill, J. (1976) *Investigation report: Pucawan Nature Reserve proposal. File note RN 18*. (NSW National Parks and Wildlife Service: Griffith).

Brickhill, J. (1978) *Information sheet on Flagstaff Memorial Nature Reserve. RN 39*. (NSW National Parks and Wildlife Service: Griffith).

Dykes, P. (2002) *Vegetation communities of the Cobar Shire*. Unpublished report. (Department of Land and Water Conservation, Far West Region).

ERM Mitchell McCotter Pty. Ltd. (1996) *Bathurst vegetation survey for NSW National Parks and Wildlife Service: Bathurst District covering Winburndale NR, Nangar NP, Conimbla NP and Weddin Mountains NP*. (NSW National Parks and Wildlife Service: Bathurst).

Fleetwood, R. (1987) *Abundance and distribution ratings of vegetation in Gubatta Nature Reserve*. Unpublished file note RN 60. (NSW National Parks and Wildlife Service: Griffith).

Forestry Commission of NSW (1989) *Forest preservation in state forests of New South Wales*. Research Note No. 47. (Forestry Commission of NSW: Sydney).

Lewer, S., Ismay, K., Grounds, S., Gibson, R., Harris, M., Armstrong, R., Deluca, S. & Ryan, C. (2003) *Native vegetation map report Bogan Gate, Boona Mount, Condobolin, Dandaloo, Tottenham and Tullamore 1:100 000 map sheets*. (NSW Department of Infrastructure, Planning and Natural Resources).

- Margules & Partners (1990) *River Murray Riparian Vegetation Study*, (Murray-Darling Basin Commission: Canberra).
- Miles, C. (2001) *NSW Murray Catchment: biodiversity action plan*. (Nature Conservation Working Group Inc.:Albury).
- Moore, C.W.E. (1953) The vegetation of the south-eastern Riverina, New South Wales 1: the climax communities. *Australian Journal of Botany* 1: 485-547.
- Mulham, W.E. (1994) *Roadside vegetation: survey and management guidelines Corowa Shire*. (Central Murray Roadside Vegetation Management Group: Deniliquin).
- Norris, E.H. & Thomas, J. (1991) Vegetation on rocky outcrops and ranges in central and south-western New South Wales. *Cunninghamia* 2(3):411-442.
- Pickard, J. & Norris, E.H. (1994) The natural vegetation of north-western New South Wales: notes to accompany the 1:1 000 000 vegetation map sheet. *Cunninghamia* 3(3): 423-464.
- Portners, M.F. (2001) *Vegetation survey of Woggoon and Tollingo Nature Reserves*. Report for the NSW National Parks and Wildlife Service.
- Friday, S (2004) *The native vegetation and threatened species of Wagga Wagga Shire*. Unpublished report. (NSW National Parks and Wildlife Service, Southern Region: Queanbeyan).
- Siversten, D. & Metcalfe, L. (2001) *Northern wheatbelt vegetation mapping*. Unpublished 1:250 000 scale vegetation maps and vegetation descriptions covering northern NSW wheatbelt. (NSW National Parks and Wildlife Service: Hurstville).
- Western Riverina Regional Vegetation Committee (2001) *Draft Western Riverina Regional Vegetation Management Plan*. (Western Riverina RVC: Deniliquin).
- White, M. (2002) *Pre-European mapping of the Riverina*. Unpublished GIS map. (Ecology Australia: Fairfield, Victoria).
- Whitehead, J. (2000) *Coonabarabran Shire Council: Vegetation Management Plan*. (Coonabarabran Shire Council: Coonabarabran).
- Whiting, E. (1997) *Vegetation survey of Cocopara National Park and Cocopara Nature Reserve*. Unpublished Report to NSW National Parks and Wildlife Service: Griffith.