Australian Government
Department of Climate Change, Energy, the Environment and Water

Approved Conservation Advice for Grey box-grey gum wet forest of subtropical eastern Australia

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 11 August 2022.

This document combines the conservation advice and listing assessment for the threatened ecological community. It provides a foundation for conservation action and further planning.

An example of the ecological community in Bald Knob State Forest NSW. © Rob Price

The Grey box-grey gum wet forest of subtropical eastern Australia occurs within Country (the traditional lands) of the Gumbaingirr, Bundjalung, Githabul, Yugambeh, Yuggera and Barunggam peoples. We acknowledge their culture and continuing link to the ecological community and the Country it inhabits.

Conservation Status

The Grey box-grey gum wet forest of subtropical eastern Australia is listed in the Endangered category of the threatened ecological communities list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from 11 August 2022.

The ecological community was assessed by the Threatened Species Scientific Committee to be eligible for listing as Endangered under criteria 2 and 4. The Committee's assessment is at Section 6.

The main factors that make the threatened ecological community eligible for listing in the Endangered category are the restricted nature of its distribution and ongoing reduction in community integrity coupled with a range of major threats or past impacts, such as climate change-driven modification to drought patterns and fire regimes and their interactions with overgrazing, invasive species and past land clearing.

Ecological communities can also be listed as threatened under state and territory legislation. At the time of this Conservation Advice, the ecological community corresponds most closely with the State listed Grey Box-Grey Gum Wet Sclerophyll Forest in the NSW North Coast Bioregion. More information is at section 2.3

Recovery Plan Decision

The Minister decided, in line with the Committee's recommendation, that a recovery plan is not required at this time. The Committee's recommendation is at section 6.3.

Conservation Advice for the Grey box-grey gum wet forest of subtropical eastern Australia

About this document

This document describes the ecological community and where it can be found (section 1); outlines information to assist in identifying the ecological community and important occurrences of it (section 2); and describes its cultural significance (section 3).

In line with the requirements of section 266B of the EPBC Act, it sets out the grounds on which the ecological community is eligible to be listed as threatened (section 6); outlines the main factors that cause it to be eligible for listing (section 4); and provides information about what could appropriately be done to stop its decline and/or support its recovery (section 5).

CONTENTS

1 Ecological community name and description

1.1 Name

The name of the ecological community is Grey box-grey gum wet forest of subtropical eastern Australia (hereafter referred to as the "Grey box-grey gum wet forest" or "the ecological community"). The name refers to the typical dominant canopy species, vegetation structure, climate zone and geographic area that characterizes the ecological community.

The ecological community was originally placed on the 2020 Finalised Priority Assessment List as the 'Grey Box-Grey Gum Wet Sclerophyll Forest in northern NSW and southern Queensland' and underwent consultation as the 'Grey Box (*Eucalyptus moluccana*) - Grey Gum (*Eucalyptus propinqua*) Wet Forest of Subtropical Eastern Australia'.

1.2 Description of the ecological community and the area it inhabits

The EPBC Act defines an ecological community as an assemblage of native species that inhabits a particular area in nature. This section describes the species assemblage and area in nature that comprises the Grey box-grey gum wet forest.

The ecological community described in this conservation advice is an assemblage of plants, animals and other organisms constituting a type of forest with a canopy dominated by its characteristic *Eucalyptus* species with or without *Araucaria cunninghamii* (hoop pine) and with an understorey that typically includes significant cover of species with drier vine-forest (rainforest) affiliations[1].

Where disturbance to the understorey has occurred, especially from fire, the understorey vine-forest elements may be temporarily absent, or present as regenerating plants together with open grassy forest species including shade-intolerant grasses. Other temporary or localised variations in environmental conditions can also mean there may be areas of the understorey temporarily dominated by grassy open forest affiliated species.

The canopy always contains *Eucalyptus moluccana* (grey box) and/or a grey gum species (*E. propinqua* (small-fruited grey gum) and/or less commonly *E. punctata*[2] (grey gum)). Other canopy species often present include *E. siderophloia* (grey ironbark) and/or *Araucaria cunninghamii* (hoop pine). In some areas any of these canopy species may be locally dominant. Other tree species may occur in the canopy less frequently. The ecological community is found from near Coffs Harbour in NSW to the border and adjacent regions of south-eastern Queensland, predominately on the escarpment slopes and foothills of inland hinterland ranges. It is most common in localities where there is a mosaic of grassy eucalypt forests with drier vine-forest associations.

This section primarily describes the assemblage of flora and fauna species and the areas of habitat that represent the typical range of natural states of the ecological community. More information to assist in identifying patches of the ecological community is provided in section 2. Because of past loss or degradation, not all current patches of the ecological community are in a completely natural state and some (not all) of the variation due to that is also described in this

[1] Species typically associated with dry vine-forests and related rainforest, thicket or scrub communities have been annotated with # in Appendix A - Species lists

[2] May be named *Eucalyptus biturbinata* in some jurisdictions.

section. Section 2.3 provides information to identify which patches retain sufficient conservation values to be considered a matter of national environmental significance.

1.2.1 Location and physical environment

The ecological community is limited to the New South Wales north coast and south eastern Queensland IBRA Bioregions[3] from near Coffs Harbour in NSW to the southern areas of south-east Queensland. Within these areas it occurs in the Moreton Basin, Scenic Rim, Woodenbong, Cataract, Rocky River Gorge, Washpool, Dalmorton, Clarence Sandstones and Chaelundi IBRA subregions. It occurs mainly in the Richmond and Clarence River Catchments NSW (DEC 2008) with some occurrences in other catchments.

Major occurrences are in the hilly to mountainous inland areas of north-eastern NSW in the Woodenbong and Cataract IBRA subregions from around the towns of Malanganee and Drake NSW northwards to the border ranges north-west of Kyogle NSW. In these areas significant occurrences are known particularly from around the town of Woodenbong, in Mt. Lindsay, Unumgar and Bald Knob State Forests and their surrounds.

The ecological community typically occurs on escarpment slopes and foothills, on inland hills and ranges between 100m and 600m altitude. It is mainly associated with areas where mean annual rainfall exceeds approximately 1000mm (DECC 2008a) and does not exceed 1260mm (DPIE 2021). It may occur in areas with somewhat lower or higher rainfall than this where topography or other factors create a suitable microclimate.

Soils that support the ecological community are relatively fertile, well drained (NSW TSSC 2011) and are derived mostly from fine-grained sedimentary rocks, sometimes with local volcanic influence. The ecological community may occur on soils derived from other geologies especially where they have fine grained sedimentary or volcanic influence. It does not occur on broader alluvial landforms (including floodplains, alluvial flats, older floodplain terraces and periodically flooded depressions), where it is replaced by other ecological communities such as the *Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions*, but may occur on shallower alluvial soils on the margins of the floodplain and in the smaller narrow alluvial systems.

1.2.2 Description of the assemblage

1.2.2.1 Vegetation Structure

The Grey box-grey gum wet forest at maturity typically has a tall to very tall open canopy dominated by its characteristic *Eucalyptus* species with or without hoop pine (*Araucaria cunninghamii*). It can have a simple to structurally complex understorey (consisting of all vegetation below the canopy, including juvenile trees and the ground layer). The understorey typically includes flora with drier vine-forest (rainforest) affiliations[4], with vines often prominent. These vine-forest elements sometimes occur in combination with grassy open forest affiliated flora including juvenile eucalypts. This can include areas, within a broader patch, that are dominated by grassy open forest flora, where intense disturbance has occurred recently.

Drier vine-forest life-forms typically present in the understorey include trees, shrubs and vines (including lianas). Palms and tree-ferns are typically absent and whilst palm-lilies are typically

[3] Interim Biogeographical Regionalisation of Australia Version 7 (DoE 2012)

[4] Species typically associated with dry vine-forests and related rainforest, thicket or scrub communities have been annotated with # in Appendix A - Species lists

absent or uncommon they may be common in some sites. If left undisturbed for long periods these drier vine-forest life-forms will typically develop into a layered, closed, complex understorey with numerous lianas and a sparse ground layer with high leaf-litter cover, often with ferns, bryophytes, shade tolerant graminoids, forbs, and seedlings of the woody vegetation layers. Where disturbance has occurred recently, opening up the canopy and understorey, the ground layer may support areas of shade-intolerant grasses and other open grassy forest flora at high densities temporarily. Epiphytes and lithophytes, including ferns, orchids and bryophytes, may be sparse to abundant.

By the Walker and Hopkins (1990) classification the ecological community is a tall to extremely tall mid-dense to dense forest. The Benson (2006) equivalent is Rainforest: Dry (RD) and *Eucalyptus* Tall Wet Shrub Forest of Eastern Coastal Lowlands on Soils of Higher Fertility (TWFEC).

Areas lacking canopy cover and/or tree regrowth are not considered part of this ecological community on their own. However, where a treeless area represents a small gap in a larger patch of the forest, or where the tree layer is sparse between treed areas across a short distance, they are part of the ecological community (see also Section 2.2).

1.2.2.1.1 Influence of disturbance on structure

The structure varies between sites depending on the nature, timing, and intensity of past disturbances including fires, storms and logging.

Long undisturbed sites typically have a well-developed, closed, structurally complex understorey of drier vine-forest (rainforest) species with large eucalypts +/- hoop pine (and occasionally other rainforest species) above them in the canopy.

After disturbances such as logging and fire the understorey may be simplified (NSW TSSC 2011) or temporarily absent. In such disturbed areas the understorey may regenerate with an abundance of shade-intolerant grassy open forest flora such as shade intolerant graminoids, forbs, sclerophyll shrubs and twiners whose recruitment and growth are promoted by open conditions. These grassy open-forest elements may dominate temporarily in areas adjacent to or amongst areas dominated by drier vine-forest flora or they may occur in combination with regenerating vine-forest species. After fire there is often evidence of a significant proportion of vine-forest species resprouting from the base of burned stems killed by fire. Resprout regeneration is an ecological strategy based on persistence and a range of rainforest species are known to resprout after fire (Fensham et al. 2003). Following fire, seedlings or saplings of canopy eucalypts may also be prominent.

Where the canopy and understorey are disturbed, lantana or other shade intolerant weeds may develop dense stands where light levels are high. If sufficient recovery of the canopy and/or understorey occur, the density of such weeds should decline with increasing shade. However, where canopy and understorey trees have been removed or killed, dense stands of lantana or other invasive species may persist and inhibit regeneration of the ecological community.

1.2.2.2 FLORA

1.2.2.2.1 Canopy species

The canopy of the ecological community is dominated by one or a combination of species and includes *Eucalyptus moluccana* (grey box) and/or one or both of *E. propinqua* (small-fruited grey

gum) or *E. punctata*[5] (grey gum). In addition, it often includes *E. siderophloia* (grey ironbark) and/or *Araucaria cunninghamii* (hoop pine) (DECC 2008a). Other eucalypt and rainforest species may occur in the canopy less frequently.

A comprehensive list of canopy species known to occur in the ecological community, is provided in Appendix A - Species lists.

1.2.2.2.2 Understorey species

The understorey flora species typically have drier vine-forest (rainforest) affiliations[6] but particularly following disturbance they may also include species with grassy open forest affiliations such as *Acacia* spp. and *Dodonaea* spp. and shade intolerant grasses. The understorey may support *Eucalyptus* species depending upon the stage of regeneration.

Understorey species composition is highly variable, however species frequently recorded include the small to medium-sized trees *Psydrax odorata* (shiny-leaved canthium), *Denhamia bilocularis* (orange bark) and *Cupaniopsis parvifolia* (small-leaved tuckeroo), the shrubs *Psychotria daphnoides* (smooth psychotria) and *Alyxia ruscifolia* (chain-fruit), the vines and lianas *Celastrus subspicatus* (large-leaved staff vine), *Solori involuta* (native derris) and *Maclura cochinchinensis* (Cock-spur), the grasses and sedges *Gahnia aspera* (Sword Sedge), *Cyperus gracilis* (slender flat-sedge) and *Ottochloa gracillima* (pademelon grass) (EPA 2016). Ferns such as *Blechnum neohollandicum syn. Doodia aspera* (rasp fern) (NSW TSSC 2011) and *Pellaea falcata* (sickle fern) also occur. Relatively shade tolerant grass species including *Oplismenus* spp. (basket grasses) are often present whilst relatively shade intolerant grasses may occur where sufficient sunlight reaches the ground naturally or following disturbance. Following disturbance, especially from fire, the understorey vine-forest floristic elements may occur together with grassy open forest flora or in a patch mosaic with areas of these flora interspersed with areas of drier vine-forest flora. Examples of grassy open forest taxa recorded as occurring in such areas in the understorey include juveniles of *Eucalyptus* spp. (eucalypts), *Acacia* spp. (wattles), *Allocasuarina torulosa* (forest she-oak), *Dodonaea viscosa* (sticky hop-bush), *Leucopogon ericoides* (heath-leaved beard-heath), *Leucopogon juniperinus* (prickly beard-heath), *Imperata cylindrica* (blady grass), *Aristida gracilipes* (three-awn spear-grass), *Poa labillardierei* (tussock), *Cymbopogon refractus* (barbed-wire grass) and *Glycine clandestine* (twining glycine).

Absence of any or all of the abovementioned understorey species should not be considered contra-indicative so long as the patch meets the Key Diagnostics (Section 2.2) as there is a diversity of species that occur in various parts of the range of the ecological community that are functionally equivalent to these. For the understorey especially it is essential that surveys are undertaken after sufficient time has elapsed post-disturbance as outlined in Section 2.2.5 to allow for regeneration. A more comprehensive list of understorey species likely to occur in the ecological community are in Appendix A - Species lists .

1.2.2.3 FAUNA

The ecological community supports fauna assemblages that are a mix of vine-forest/rainforest, affiliated and grassy open forest affiliated species. They include a wide range of fauna species utilising the above ground vegetation, the leaf litter, soil and subsurface. The ecological community's wide variety of habitats is important for fauna, providing food and shelter, as well as nesting, roosting, and hunting sites. This includes habitat for species migrating across the

[5] May be named *Eucalyptus biturbinata* in some jurisdictions.

[6] Species typically associated with dry vine-forests and related rainforest, thicket or scrub communities have been annotated with # in Appendix A - Species lists

landscape, particularly birds such as *Caligavis chrysops* (yellow-faced honeyeater), *Zosterops lateralis* (silvereye) and *Symposiachrus trivirgatus* (spectacled monarch). Fauna species play important roles in the ecological community, including pollination, seed dispersal and soil turnover.

The eucalypt-dominated canopy of the ecological community provides suitable habitat and forage for threatened species such as *Phascolarctos cinereus* (koala), *Petauroides volans* (greater glider [southern and central]), and *Petaurus australis* (yellow-bellied glider). Both grey box and grey gum are used as sap-feeding trees by yellow-bellied gliders (NPWS 2003, Eyre and Goldingday 2005). *Eucalyptus* species also provide floral resources used by a variety of birds such as honeyeaters and other fauna such as bats and insects. The hollows and crevices of mature trees of the ecological community, particularly the dominant eucalypts, provide important nesting and shelter sites for birds and arboreal mammals, including greater gliders and yellow-bellied gliders. The presence of *Araucaria cunninghamii* (hoop pine) in the canopy provides forage for cockatoos and parrots who break apart their cones for their seeds. Hoop pine also supports dense foliage that birds construct concealed nests amongst.

In the mid to upper layers of the understorey fleshy-fruit bearing tree, shrub and vine species provide resources for fruit eating bats, fruit doves and other frugivorous birds including *Ptilinopus magnificus* (wompoo fruit dove) and *Ptilinopus regina* (rose-crowned fruit dove) which are both threatened species in NSW. Fruit-eating bats and birds play a key role in the dispersal of these fruiting flora.

The dense understorey of long-unburned patches of the ecological community with its abundant leaf litter, organic matter-rich soils and extensive root-systems is important habitat for a diversity of fauna and flora, above and below ground. Together they play an important role in intercepting, storing and recycling carbon and nutrients. A broad range of invertebrates (and fungi) are involved in this recycling. This invertebrate and fungus-rich environment provides the shelter and forage favored by many rainforest understorey bird species such as *Orthonyx temminckii* (Australian logrunners), *Psophodes olivaceus* (eastern whip birds), *Sericornis* spp. (scrub wrens) and *Menura* spp. (lyrebirds). The ecological community includes the geographic crossover between Albert's and superb lyrebirds, likely indicative of historic rainforest expansion–contraction dynamics (R Kooyman 2022. pers comm Jan 25).

The understorey of the ecological community is also known habitat for, or provides suitable structure and resources for, smaller macropod species that occur within the geographic distribution of the ecological community. These include threatened species of wallabies and other small macropods, including species considered to be functionally important such as the long-nosed potoroo (Claridge et. al 1993, Claridge & May 1994, Claridge & Trappe 2004). The black-striped wallaby (*Notamacropus dorsalis*) is known from the ecological community and is listed as Endangered in NSW. This species favours habitats that provide grassy areas for feeding and shrubby/viny thickets suitable for retreat from predators and shelter (R Kooyman 2022. pers comm Jan 25). These habitat features of the ecological community are also suitable for *Notamacropus parma* (Parma wallaby) which is listed as Vulnerable in NSW. Like the black-striped wallaby, this species also favours eucalypt forest with a thick, shrubby understorey and nearby grassy areas. This type of patch mosaic of grassy and shrubby understorey areas in close proximity is a feature often seen within or along the periphery of the ecological community. In the past the Parma Wallaby occurred across a greater proportion of the range of the ecological community however its distribution has contracted southward and currently only occurs south from around the Drake/Malanganee areas in NSW, in the southern portion of the distribution of the ecological community (Maynes 1977, Maynes 2008).

The long-nosed potoroo (*Potorous tridactylus tridactylus*) is known from forest areas that include the ecological community and is listed as vulnerable both federally and in NSW (NSW OEH 2022). While there is no specific evidence of its functional importance due to a lack of relevant studies of the ecological community it is considered to play an important role in many ecosystems due to its habit of consuming fungi and distributing their spores, including hypogenous (underground fruiting) fungi, and mycorrhizal fungi (Claridge et al. 1993, Claridge & May 1994, Claridge & Trappe 2004). Through digging for food resources, including these fungi, the long-nosed potoroo and other digging mammals such as bettongs, bandicoots and some native rodents play a role in breaking up compacted soil and mixing organic material and fungal spores into its upper layers. The rufous bettong (*Aepyprymnus rufescens*) is another digging mammal known from forest areas that include the ecological community. It is among a limited number of Australian mammals that have been shown to be active consumers of the underground fruiting bodies of mycorrhizal fungi, with high frequency and abundance of spore found in their scats (Reddell et al. 1997). Rufous bettong scats are consumed and buried by several native dung beetles including one species (*Onthophagus peramelinus*) that is exclusively associated with populations of the rufous bettong (Wright 1997). There is some evidence that the decline of digging mammals in Australia has contributed to the deterioration of ecosystem function where it has occurred (Fleming et al. 2014) highlighting the possible importance of this faunal group and its associated dung beetles to the ecological community.

The ecological community also includes many invertebrate fauna species that have ecologically important roles such as pollination, predation, decomposition, herbivory as well as being food for a range of other fauna (e.g., mature and larval forms of moths and butterflies, flies, wasps, beetles, spiders and worms) but these may be less well documented than the vertebrate fauna.

A more comprehensive list of fauna species likely to occur in the ecological community, including threatened fauna, are in Appendix A - Species lists

1.2.3 Functionally important species within the ecological community

The eucalypt canopy species are a structural element that are important to the functioning of this ecological community. As well as providing structure, shade and plant material, mature trees are often hollow bearing, providing essential shelter for arboreal fauna. The development of critical habitat resources, such as tree hollows, varies with species and may take 100 years or more (Gibbons and Lindenmayer 2002).

Mesic elements are also functionally important and include the understorey species with rainforest affiliations. These contribute structural complexity and host-plant diversity that provide habitat for a range of fauna that are part of the ecological community.

1.2.4 Other relevant biology and ecology

1.2.4.1 FIRE ECOLOGY

The ecological community is composed of a diversity of flora with a variety of responses to differing fire regimes. This can lead to variation in structure and composition between or within patches. The nature of this variation is nuanced and dependent upon the interaction between fire and other factors such as season, drought, landscape position, disturbance history, weed invasion and other threatening processes.

Fire regimes that maintain an understorey typical of the ecological community (with a significant drier vine-forest component) are typically low intensity, low frequency and patchy. Such fire regimes ‘open up’ areas of the understorey, often on small scales, which are then ‘recolonised’ by vine-forest and/or open grassy forest species (including canopy eucalypts)

through resprouting or seeding. This often creates variation across the understorey which is favoured by certain characteristic fauna such as the endangered black striped wallaby (*Notomacropus dorsalis*) which moves between grassier areas (for foraging) and shrubby/viny areas (for shelter).

This mosaic of understorey flora will typically move to being dominated by vine-forest species if left long unburned. Long unburned sites tend to develop closed, structurally complex understoreys of drier vine-forest (rainforest) species with large eucalypts +/- hoop pine (and occasionally other rainforest species) above them in the canopy. These sites tend to be in more sheltered landscape positions for example gullies, lower slopes and easterly or southerly aspects.

After an intense fire the understorey may be simplified (NSW TSSC 2011) or temporarily absent. After a less intense fire, which may trickle slowly down-slope and be highly patchy spatially, the understorey may remain partially intact with some trees and shrubs being scorched or killed and others remaining unaffected.

During the post fire regeneration phase, recruitment and resprouting can take various trajectories. Where the fire has a large impact such that sufficient sunlight reaches the forest floor, seedlings or saplings of canopy eucalypts may be prominent, often in combination with grassy open forest flora whose recruitment and growth are also promoted by open conditions. These grassy open-forest elements may dominate temporarily, often in areas adjacent to or interspersed with areas dominated or co-dominated by vine-forest flora.

Where patchy, low-intensity burns have occurred within a largely vine-forest species dominated area, the smaller gaps created may be filled rapidly by these vine-forest species. These may establish from seed and/or resprout from surviving plants. After fire there is often evidence of a significant proportion of vine-forest species resprouting from the base of burned stems killed by fire. Resprout regeneration is an ecological strategy based on persistence and a range of rainforest species are known to resprout after fire (Fensham et al. 2003). High fire frequency can however lead to the decline or loss of such resprouting species. In addition, rainforest species not capable of resprouting (obligate seeders) are known to have been eliminated after as little as 2 closely spaced fires (Fensham et al. 2003). Thus, where frequent and intense fires occur, the understorey of this ecological community may lose its vine-forest components. Where such fires impact entire patches over long periods the patch may change in composition and structure to the point where the understorey is entirely open and grassy, and it no longer provides habitat for many characteristic fauna and flora or meets the description in (Section 1.2) or the key diagnostic characteristics (Section 2.2).

2 Identifying areas of the ecological community

Section 1.2 describes this ecological community and the area it inhabits. This section provides additional information to assist with the identification of the ecological community and important occurrences of it.

The Grey box-grey gum wet forest intergrades with other vegetation types and ecological communities (see section 2.2.6). Key diagnostic characteristics are used to identify an area of native vegetation as being the Grey box-grey gum wet forest, and define the features that distinguish it from other communities, noting that additional information to assist with identification is provided in the other sections of this document, particularly the description (section 1.2) and Appendix A - Species lists.

2.1 Key diagnostic characteristics

The key diagnostic characteristics are designed to allow identification of the ecological community irrespective of the season. Assemblages of species that do not meet the key diagnostics are not part of the nationally listed ecological community.

The ecological community is defined as the assemblage of species matching the description in Section 1.2 that meet the following key diagnostic characteristics:

- Occurs within the NSW north coast or southeast Queensland IBRA Bioregions[7]; within the Moreton Basin, Scenic Rim, Woodenbong, Cataract, Rocky River Gorge, Washpool, Dalmorton Clarence Sandstones or Chaelundi IBRA subregions;
- Occurs at elevations between 100m and 600m above sea level (ASL);
- It does not occur on broader alluvial landforms (including floodplains, alluvial flats, older floodplain terraces and periodically flooded depressions), but may occur on shallower alluvial soils on the margins of the floodplain and in the smaller narrow alluvial systems.
- Typically appears as a forest with a tree canopy that has a crown cover[8] of 20% or more[9];
- Has a tree canopy that contains *Eucalyptus mollucana* (grey box) and/or a grey gum (*E. propinqua* (small-fruited grey gum) and/or *E. punctata*[10] (grey gum));
- Has a tree canopy dominated[11] by one or a combination of *E. moluccana*, *E. propinqua*, *E. punctata*[10], *E. siderophloia* (Northern grey ironbark), or *Araucaria cunninghamii* (hoop pine); and
- Has an understorey[12] typically with drier vine-forest/rainforest flora[13] (often including vines and lianas). At some locations, the understorey vine-forest floristic elements occur together

(continued overleaf)

[7] Interim Biogeographical Regionalisation of Australia Version 7 (DoE 2012)

[8] Crown cover is measured as the % covered by the total area of the tree crowns, where the tree crowns are considered to be solid (as per the National Committee on Soil and Terrain (Hnatiuk et al. 2009)).

[9] Recent disturbance, such as fire, may remove the living canopy and cause a shift to a regenerative state. Under these circumstances, the loss is likely to be a temporary phenomenon, if natural regeneration is not disrupted. This temporary regenerative state (up to five years post-fire) is included as part of the ecological community when the other key diagnostic characteristics are met, even when crown cover is temporarily less than 20 percent. In these cases, there should be evidence that the canopy species will regenerate from seedlings, saplings, lignotubers or from epicormic regrowth.

[10] May be named *Eucalyptus biturbinata* in some jurisdictions.

[11] Canopy dominance is where one or a combination of these species are collectively the most abundant trees in the canopy — in terms of either crown cover (i.e. at least 50 percent of the canopy cover), or stem density (i.e. at least 50 percent of the trees). Include hybrids of these species in determining dominance (TSSC 2011).

[12] The understorey consists of all vegetation below the canopy, including young trees and the ground layer.

[13] Species typically associated with drier vine-forests and related rainforest, thicket or scrub communities have been annotated with # in Appendix A - Species lists, but other rainforest species not on this list may also be present within the ecological community.

with grassy open forest flora[14], or in a patch mosaic with areas of grassy open forest flora interspersed with or adjacent to areas of vine-forest flora[15].

2.2 Additional information to assist in identifying the ecological community

The following information should also be taken into consideration when applying the key diagnostic characteristics to assess if a site may include the ecological community.

2.2.1 Identifying a patch

A patch is a discrete and mostly continuous area of the ecological community, as defined by the key diagnostics, but can include small-scale variations, gaps and disturbances within this area. The smallest patch size that can be identified is 0.5 ha, as the key diagnostics cannot reliably be identified for smaller areas than this. Where a larger area has been mapped or classified as a different vegetation type, localised areas of the Grey box-grey gum wet forest equal to or greater than 0.5 ha may be present within this larger area.

2.2.2 Breaks in a patch

The definition of a patch of the ecological community allows for "breaks" up to 30 metres between areas that meet the key diagnostics. Such breaks may be the result of watercourses or drainage lines, tracks, paths, roads, gaps made by exposed areas of soil, or leaf litter, and areas of localised variation in vegetation that do not meet the key diagnostics. For example, a single patch could include two areas of the ecological community that meet the key diagnostics, but which are separated by a narrow strip of riparian vegetation lining a watercourse. Such breaks do not significantly alter the overall functionality of the ecological community and form a part of the patch. Watercourses or drainage lines, water bodies, gaps made by exposed areas of soil, or leaf litter, and areas of localised variation in vegetation should be included in the calculation of the size of the patch and be taken into account when determining the overall condition of the patch. Tracks, paths, roads or other man-made surfaces should be excluded from the calculation of patch size and condition.

Where there is a break in the ecological community of 30 metres or more (e.g., due to permanent artificial structures, wide roads or other barriers, water bodies or other types of vegetation) then the gap typically indicates that separate patches are present.

2.2.3 Variation within a patch

Patches of the ecological community may contain areas that vary in structural or biological characteristics. For example, one part of a patch may have an understorey consisting of entirely well-developed vine-forest (rainforest) species, whereas another recently burned part of the same patch may be dominated by regenerating eucalyptus and open grassy forest species in alone or in combination with resprouting and/or germinating vine-forest species (see

[14] Species typically associated with grassy open forests have been left un-annotated in Appendix A - Species lists, but other grassy open forest species not on this list may also be present within the ecological community.

[15] Areas where grassy open forest flora co-occur with drier vine-forest species in these ways are most often situated within areas that are recently or more frequently disturbed (particularly from fire). This often includes upper slope, ridge-top or otherwise more exposed sites that are surrounded by, or adjacent to areas that are more sheltered and have dense understories of drier vine-forest/rainforest flora. In some cases after large fires mixed areas may be extensive but evidence of regeneration of vine-forest flora is evident in patches or broadly given sufficient time post fire.

section 1.2). Variation in vegetation across a patch should not be considered to be evidence of multiple patches, so long as it meets the key diagnostics.

2.2.4 Revegetation and regrowth

Revegetated or otherwise restored sites or areas of regrowth are not excluded from the listed ecological community so long as the patch meets the key diagnostic characteristics.

Where ecological restoration is planned, the aim should be for recovery of as many key biodiversity and ecosystem attributes as practical for a particular site, so that the ecological community is on a trajectory to recovery and is self-sustaining. This should be based on identifying appropriate reference site(s) for the ecological community following the *National Standards for the Practice of Ecological Restoration in Australia* (Standards Reference Group SERA 2021) (also see Section 5.4.2).

2.2.5 Survey requirements

Patches of the ecological community can vary markedly in their shape, size, condition and features. Thorough and representative on-ground surveys are essential to accurately assess the extent and condition of a patch. The Australian Soil and Land Survey Field Handbook (National Committee on Soil and Terrain, 2009), New South Wales BioNet Vegetation Classification User Manual (NSW Office of Environment and Heritage 2017) and the Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland (Neldner et al. 2020) provide guidance.

The size, number and spatial distribution of plots or transects must be adequate to represent variation across the patch. Sampling should address likely variation in species composition and significant variation in the vegetation (including areas of different condition), landscape qualities and management history (where known) across the patch.

Recording the survey date/s and the search effort (identifying the number of person hours spent per plot/transect and across the entire patch; along with the surveyor's level of expertise and limitations at the time of survey) is useful for future reference. Include a map with adequate details to locate surveyed areas (such as an orthophoto of sufficient transparency not to obscure other information and geographic coordinates).

Whilst identifying the ecological community and its condition is possible at most times of the year, consideration must be given to the role that season, rainfall and disturbance history may play in identifying the ecological community and its condition. For example, after a fire the understorey layer of the Grey Box- Grey Gum Wet Forest may not be evident for a time. The vine-forest (rainforest) components of the understorey of the ecological community are mostly fire sensitive. While many rainforest species are capable of resprouting after fire (Fensham et al. 2003) their above ground parts may be destroyed and therefore not evident temporarily. Vine-forest (rainforest) obligate seeders not capable of resprouting may not recruit back into the site until seasonal conditions allow fruiting, dispersal and germination. During post-disturbance regeneration events, invasive species or open grassy forest species may dominate temporarily before declining in abundance.

Timing of surveys should allow for a reasonable interval after a disturbance (natural or human-induced) to allow for regeneration of species to become evident and be timed to enable diagnostic species to be identified. At a minimum, it is important to note climate conditions and what kind of disturbance may have happened within a patch, and when that disturbance occurred.

2.2.6 Mapping and vegetation classifications

There are a number of mapping and vegetation classification schemes used in New South Wales and Queensland. Although none directly map areas of the ecological community according to the key diagnostics, they can still provide useful information on the likely occurrence of the ecological community.

Table 1 Outlines current mapping units most likely to represent or contain the ecological community. See Appendix B - Relationship to other vegetation classification and mapping systems for a full list of largely equivalent mapping units and vegetation classifications including past/superseded classifications, and a summary of how the ecological community can be distinguished from other related and adjacent vegetation types.

Table 1: Mapping units most likely to represent or contain the ecological community

Code / Number	Name	Key Distinguishing Features	Source
Current mapping units most likely to represent or contain the ecological community			
PCT 3069 (NSW)	Far North Hinterland Grey Box-Grey Gum Wet Forest	This PCT is largely equivalent to the ecological community	DPIE 2021
Forest Ecosystem 62 (NSW)	Grey box-northern grey gum.	This ecosystem is largely equivalent to the ecological community	NPWS 1999a, 2001; Eco Logical 2005
QLD RE 12.9-10.3	*Eucalyptus moluccana* open forest on sedimentary rocks	Areas or patches of this may be the ecological community where they meet the key diagnostic criteria.	Qld Herbarium 2021
QLD RE 12.8.14a	*Eucalyptus moluccana* open forest +/- *E. tereticornis*, *Eucalyptus siderophloia* or *E. crebra*	Areas or patches of this RE may be the ecological community where they meet the key diagnostic criteria.	Qld Herbarium 2021
PCT 3233 (NSW)	Far North Hinterland Grey Gum Grassy Forest	This PCT occurs in close association with PCT 3069. Areas or patches of this PCT may be the ecological community where they meet the key diagnostic criteria.	DPIE 2021

2.2.7 Other relevant listed ecological communities

The New South Wales listed threatened ecological community "Grey Box-Grey Gum Wet Sclerophyll Forest in the NSW North Coast Bioregion" is largely equivalent to Grey-box-grey gum wet forest and is listed as endangered under the NSW Biodiversity Conservation Act 2016.

The Queensland regional ecosystem 12.9-10.3 (*Eucalyptus moluccana* open forest on sedimentary rocks) may be the ecological community in areas or patches that meet the key diagnostic criteria, and it is listed as 'of concern' under the Vegetation Management Act 1999 (QLD).

There are also other nationally listed threatened ecological communities that occur in, or close to, the same areas as the Grey box-grey gum wet forest. These include:

- Dunn's White Gum (*Eucalyptus dunnii*) Moist Forest in north-east New South Wales and south-east Queensland (currently under assessment) – also listed in NSW as the White Gum Moist Forest in the NSW North Coast Bioregion. This ecological community occupies a similar geographic range to the Grey box-grey gum wet forest, but its canopy is typified by the presence of *Eucalyptus dunnii* and has an understorey typified by predominance of subtropical rainforest affiliated species.

- Lowland rainforest of subtropical Australia (critically endangered) – also listed in NSW as the Lowland Rainforest on Floodplain in the NSW North Coast bioregion (NSW TSSC 2019). It differs from the ecological community by having a diverse closed canopy dominated by sub-tropical rainforest flora with eucalypts being absent or rare.
- Subtropical eucalypt forest on the floodplains of eastern Australia (under assessment) – largely equivalent to the *Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion* listed in NSW. This community may share similar species, but is restricted to alluvial flats, edges of waterways and floodplain margins.

2.3 Condition classes, categories and thresholds

Land use and disturbance history will influence the state and condition in which a patch of the ecological community is currently expressed. National listing focuses legal protection on patches of the ecological community that are the most functional and in comparatively good condition. These patches are identified through *minimum condition thresholds*.

Condition classes are also used to distinguish between patches of the ecological community of different qualities, to aid environmental management decisions.

In order to be protected as a matter of national environmental significance areas of the ecological community must meet both:

- the key diagnostic characteristics (section 2.1) AND
- at least the minimum condition thresholds (Table 2).

Table 2 outlines the different condition classes and categories that apply to the ecological community. The minimum condition thresholds are designed to identify those patches that retain sufficient conservation values to be considered a matter of national environmental significance, to which the referral, assessment, approval and compliance provisions of the EPBC Act apply. These include all patches in Classes A, B and C.

Patches that do not meet the minimum condition thresholds for at least Class C are excluded from protection under the EPBC Act. In many cases, the loss and degradation are irreversible because natural characteristics have been permanently removed. However, although not protected under the EPBC Act, many of these patches may still retain important natural values and may be protected through state and local laws or planning schemes.

In addition, patches that can be restored should not be excluded from recovery and other management actions. Suitable recovery and management actions may improve a patch's condition, such that it subsequently can be included as part of the ecological community fully protected under the EPBC Act. Management actions should be designed to restore patches to high quality condition where practical.

When assessing condition of a patch of the ecological community it is important to also consider the key diagnostics (section 2.1) and patch definition information (section 2.2).

The broadest area that meets the key diagnostic characteristics of the ecological community should be used in determining patch condition. Where condition is variable and the condition of the total area falls below the minimum thresholds, the largest area or areas within the overall area that do meet the minimum condition thresholds should be identified. This may result in multiple patches of the ecological community being identified within the overall area first considered.

Recent disturbance by fire is likely to result in the ecological community presenting in a temporarily altered state that may include severely reduced canopy cover, simplified vegetation structure, resprouting trees and shrubs that have been partially or completely top-killed. This condition is likely to be temporary and, if any surveys should be undertaken in line with guidance in section 2.2.5.

Table 2: Condition classes, categories and thresholds

<table>
<tr><th colspan="2">Patch size threshold →
Biotic thresholds ↓</th><th>Large Patch:
Patch size ≥ 2 ha</th><th>Small Contiguous[1] Patch
Patch ≥ 0.5 ha within area of native vegetation ≥ 5 ha</th><th>Small patch in non-native matrix
Patch ≥ 0.5 and < 2ha</th></tr>
<tr><td rowspan="2">High Condition Understorey
≥ 80% of its total understorey vegetation[2] cover[3] is comprised of native species</td><td>With ≥ 20 large trees[3] per ha</td><td colspan="3">Class A1
Patch with a high condition understorey and high density of large trees</td></tr>
<tr><td>With < 20 large trees[3] per ha</td><td colspan="2">Class A2
Large or contiguous patch with a high condition understorey</td><td>Class B1
Small patch with a high condition understorey</td></tr>
<tr><td>Good Condition Understorey
≥ 50% of its total understorey vegetation[2] cover[3] is comprised of native species</td><td>With ≥ 10 large trees[3] per ha</td><td colspan="2">Class B2
Large or contiguous patch with a good condition[5] understorey and good density of large trees</td><td>Class C1
Small patch with a good condition understorey and good density of large trees</td></tr>
<tr><td>Moderate Condition Understorey
≥ 20% of its total understorey vegetation[2] cover[3] is comprised of native species</td><td></td><td colspan="2">Class C2
Large or contiguous patch with a moderate condition understorey</td><td>Not protected</td></tr>
<tr><td colspan="5">Notes:
1 Contiguous means the patch is connected to, or in close proximity to (i.e., within 30 m of), another area of native vegetation (i.e., an area where the total perennial vegetation cover is dominated (50 percent or more) by native plant species).
2 Understorey vegetation is inclusive of all vegetation below the canopy layer including smaller trees, the ground layer, juveniles of the canopy species and fire/drought-affected canopy trees that are resprouting below the canopy branches.
3 Cover measurements should be based on representative areas within a patch of the ecological community. Cover is measured as projective foliage cover as defined in Hnatiuk et al. (2009), e.g. the percentage of the sample site occupied by the vertical projection of foliage.
4 Large trees include all native trees greater than 45 cm dbh [diameter at breast height]. This is used as a surrogate for tree hollows and other habitat values. This should be measured in a minimum 1ha plot where the patch size is ≥ 1 ha or calculated out from density in the entire patch where the patch is <1ha.</td></tr>
</table>

2.4 Habitat critical to the survival of the ecological community

The habitat or areas most critical to the survival of the ecological community are those patches that are in the best condition (i.e., Classes A and B in Table 2). These represent those parts of the ecological community that retain the highest diversity and most intact structure and ecological function and have the highest chance of persisting in the long-term.

However, areas that otherwise meet the minimum condition thresholds (i.e., Class C in Table 2) are also important for the functioning and survival of the ecological community. These areas are critical to the survival of the ecological community if they occur in locations or landscape positions that are particularly important for biodiversity or function and/or contain suites of species or habitat features that are important in a regional or local context (see Section 2.5). They also have the potential to recover, or be restored, to a higher condition.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat at this time. No significant occurrences of this ecological community are known to occur on Commonwealth land at this time.

2.5 Areas of high value - surrounding environment and landscape context

For natural resource management activities or actions that may have 'significant impacts' and require approval under the EPBC Act, it is important to consider the whole environment surrounding patches of the ecological community. The surrounding vegetation and other landscape considerations will influence how important any given patch is to the ecological community as a whole.

Patches that are larger and less disturbed are likely to provide greater biodiversity value. Patches that are spatially linked, whether ecologically or by proximity, are particularly important as wildlife habitat and to the viability of those patches of the ecological community into the future. However, this still does not necessarily consider the full landscape context. For example, in heavily cleared areas, some patches that meet the minimum condition thresholds occur in isolation. Such patches require protection and could benefit from revegetation or other restoration activities to link them with other patches. In other areas, patches that are interconnected to other native vegetation may not, in their current state, meet the minimum condition thresholds, but have high conservation value. Such patches could benefit from restoration works to improve their condition so that they meet the minimum condition thresholds.

The ecological community often occurs in association with other native vegetation types. Patches of the ecological community that remain connected with other native vegetation have a better chance of future survival and restoration success, because connected patches are buffered from disturbance by the surrounding native vegetation.

The following indicators of high-conservation value should be considered when assessing the impacts of proposed actions under the EPBC Act, or when determining priorities for protection, recovery, management and funding.

- Patches that meet or are closest to the best quality (Class A and B) condition for this ecological community. These may be based on on-site observations or known past management history.
- Patches with large area to boundary ratios – such patches are more resilient to edge effect disturbances such as weed invasion and human impacts.
- Patches within or near to a larger native vegetation remnant and that contribute to a mosaic of vegetation types present at a site. Areas of mosaic native vegetation provide a wider range of habitats that benefit flora and fauna diversity. Other patches are important as linkages among remnants, acting as 'stepping stones' of native remnants in the landscape. Connectivity includes actual or potential connectivity to restoration works (e.g., native plantings).
- Patches that occur in areas where the ecological community has been most heavily cleared and degraded, or that are at the natural edge of its range, particularly where there is genetic distinction, or absence of some threats. These may include unique variants of the ecological community, e.g., with a unique flora and/or fauna composition, or a patch that contains flora or fauna that have largely declined across the broader ecological community or region.

- Patches that show evidence of recruitment of key native plant species or the presence of a range of age cohorts (including through successful assisted regeneration or management of sites).
- Patches with good faunal habitat as indicated by diversity of landscape, diversity of plant species and vegetation structure, diversity of age class, presence of movement corridors, mature trees (particularly those with hollows), logs, large rocks, watercourses, etc.
- Patches utilised by nationally or state-listed threatened species.
- Patches with high species richness, as shown by the variety of native understorey plant species, or high number of native fauna species (vertebrates and/or invertebrates).
- Patches with relatively low levels of weeds and feral animals or areas where these can be managed efficiently.

Additionally, areas such as buffer zones around patches (see information on buffer zones in Section 5.4.1.3), particularly adjoining native vegetation, and areas that meet the description of the ecological community but not the condition thresholds, can also be important to the survival of the ecological community. They should still be taken into consideration as part of the surrounding environment and landscape context.

3 Cultural and community significance

3.1 Indigenous values and uses of the ecological community

The ecological community occurs within Country (the traditional lands) of the Gumbaingirr, Bundjalung, Githabu, Yugambeh, Yuggera and Barunggam people. We acknowledge their culture and continuing link to the ecological community and the Country it inhabits. These peoples used the area encompassing the Grey box-grey gum wet forest for ceremonial and economic purposes for thousands of years.

The significance of the ecological community, particular species, spiritual, customary and other cultural values are diverse and varied for the Indigenous Australians that live on and care for Country. This section describes some examples of this significance but is not intended to be comprehensive or applicable to, or speak for, all Indigenous Australians. Such knowledge may be only held by Indigenous groups and individuals who are the custodians of this knowledge and have the rights to decide how it is shared and used.

Many fauna species of the ecological community have spiritual significance, such as totem and Dreaming relevance. More commonly occurring animals with cultural significance include Echidna and Goanna (Mathew 1910; English 2002; Wesson 2009; Smith 2011; Arrawarra Culture Project 2021; Maynard 2014) Important food and medicine plants include, Lilly Pilli, Red Ash (or soap tree), vine tubers and ferns (Arrawarra Culture Project 2021; Australian Museum Consulting 2015).

Eucalypt species that occur in the ecological community have been used as a source of materials essential for economic and ceremonial life in the broader region (Fensham 2021). Eucalypts have provided firewood, honey (from native bee-hives), medicines, dyes, paint, and sweet sap for consumption. They also have been used for materials for constructing canoes, tools, weapons, shelter, and storage vessels. Appendix C – Indigenous language names associated with the ecological community provides more details about Eucalypt species known from the ecological community and their traditional names and uses.

3.2 Community values associated with the ecological community

The Northern Rivers region of NSW and adjoining Scenic Rim in Queensland are known for their scenic beauty and biological diversity. The ecological community is a tall forest with a dark green, diverse understorey supporting charismatic flora and fauna. It thus contributes to the scenic quality and diversity of parts of those areas. A series of self-guided tourist drives known as "The Rainforest Way" were created so that tourists could enjoy the natural landscapes and vegetation of these places. They are associated with the Gondwana Rainforests of Australia World Heritage properties in the region and "Australia's Green Cauldron" which is listed as one of Australia's iconic landscapes under the National Landscapes Program. A number of the routes of "The Rainforest Way" pass through or adjacent to areas occupied by the Grey box-grey gum wet forest and help support the tourism economy for many towns and businesses in the region.

4 Threats

Grey box-grey gum wet forest was primarily impacted by historic land clearing and the selective harvesting of the canopy species and associated impacts. The remaining remnants continue to be under threat from ongoing degradation caused by weed invasions, pests, inappropriate grazing. altered fire regimes and climate change.

4.1 Threat table

Table 3 outlines the key threats facing the ecological community, which represent the *main factors that cause it to be eligible for listing* as required by section 266B (2) (a) (ii) of the EPBC Act. This information supports the assessment against the criteria at section 6. Although presented as a list, in reality these threats often interact, rather than act independently.

Table 3: Summary of threats facing the ecological community

Threat	Threat Status*	Threat Impacts
Clearing and fragmentation legacies	*Timing: ongoing* *Severity: extreme* *Scope: majority*	The area encompassing and surrounding the ecological community has been extensively cleared, resulting in a high loss of biodiversity and increased fragmentation (COAG Standing Council on Environment and Water 2012). Since 1750 Grey Box - Grey Gum Wet Forest has been subject to a severe reduction in geographic distribution due to clearing. It primarily occurs on relatively well-drained, moderately fertile soils on lower slopes and foothills in a relatively well-watered part of Australia. This distribution made, and continues to make, the ecological community vulnerable to clearing for agriculture (NSW Scientific Committee 2009). The naturally patchy distribution of the Grey box-grey gum wet forest and fragmentation resulting from historic land-clearing makes it susceptible to gradual attrition from various threats, including through continued small-scale clearing associated with land and infrastructure development and management activities (DECC 2008a).

Fire regimes that cause declines in biodiversity	*Timing: ongoing* *Severity: extreme* *Scope: majority*	Inappropriate and changing fire regimes may threaten the ecological community through a variety of direct and indirect processes including through interaction with other threats (DAWE 2021; Keith et al. in press). These processes pose a threat to the ecological community in various ways including limiting regeneration of the vine-forest components of the understorey, fauna mortality or doing damage to mature trees leading to their decline (DAWE 2021). Other interactions with fire include predator-prey interactions (e.g. facilitating easier access for feral predators to native fauna) and abiotic interactions, such as combined drought and fire, which may have compounding effects on rates of plant mortality and regenerative capacity (DAWE, 2021). Fire is also known to facilitate invasion of the significant environmental weed lantana in similar ecological communities (Gentle and Duggin 1998). Disturbance of and the decline of the canopy, which may be caused by inappropriate fire regimes, has also been implicated in the development of bell miner associated dieback (DECC 2008a) Changes to fire regimes are recognised to be occurring globally and are linked to human induced climate change (Bowman et al., 2020; Kirchmeier-Young et al., 2019, Canadell et al. 2021) and imposed upon this background is a variety of fire regimes implemented by land managers. Inappropriate fire regimes imposed by land managers are a major threat to the ecological community. Understorey burning (e.g., to encourage grass for cattle) is a frequently used management practice in forested lands of northern NSW and southeast Qld, while broad-acre aerial ignitions are increasingly applied in fire management operations. Frequent fires have been shown to modify the structure and composition of forests in the region in a way that poses a threat to the structure and biodiversity of Grey box-grey gum wet forest. Tasker (2002) found that in northern NSW un-grazed/unburnt patches of *Eucalyptus* forest supported many more fern, climber, and small tree species than their more frequently burnt counterparts. Many species in these groups were found exclusively or almost exclusively in unburnt patches, and many of them had vine-forest (rainforest) affiliations. This study shows how frequent burning in northern NSW is detrimental to understorey rainforest species where they occur in eucalypt forests such as this ecological community. Whilst fire is essential for the regeneration of the canopy eucalypts, inappropriate and changing fire regimes, including severe, frequent and/or high intensity fires are mostly a threat to the ecological community because of impacts on the vine-forest (rainforest) elements of the understorey. Fire size is also an important factor, as burns that cover larger areas can reduce areas of dense understorey that provide important shelter for fauna species such as the endangered black striped wallaby and seed sources for regeneration of the understorey mesic elements. Mega-fires, such as those experienced in the 2019-2020 fire season, while fire severity is heterogeneous within their boundaries, can burn a significant proportion of the ecological community and the surrounding vegetation in a single event (an estimated 15 percent of the ecological community was burnt in the 2019-20 bushfires) (DAWE 2020). Large fires like these have been linked to climate change (Canadell et al. 2021) and have the potential to interact with and compound the detrimental impacts from inappropriate burns and fire regimes that occur on smaller spatial scales. Fire frequency, intensity and size are expected to increase under climate change as temperatures rise, rainfall variability increases and droughts become more severe (Lucas et al. 2007; Andrade et al. 2019; Nolan et al. 2020, Canadell et al. 2021). The interaction of these trends with

Threat	Threat Status*	Threat Impacts
		inappropriate fire regimes implemented by land managers and other threats is a significant threat to the ecological community. Further information about fire as a threat to biota is given in DAWE (2021).
Invasive Plant Species	*Timing: ongoing* *Severity: extreme* *Scope: majority*	Clearing, grazing, frequent burning and other disturbances have facilitated establishment of invasive flora in Grey Box - Grey Gum Wet Forest. These include exotic trees, shrubs, perennial grasses, vines and other life-forms. The most significant of these is the scrambling shrub *Lantana camara* (lantana). Lantana is regarded as one of the ten most invasive plants in the world and a Weed of National Significance in Australia (Department of Natural Resources, Mines and Energy 2004). Lantana and other invasive flora are known to prevent regeneration of native species after disturbances through mechanisms such as shading, smothering, allelopathy, changes to fire dynamics and altered nutrient cycles (Department of Natural Resources, Mines and Energy 2004). Lantana and other weeds such as invasive vines can also smother established vegetation. The ecological community often has an understorey made up of shrubs and smaller trees. Due to their smaller stature, they are particularly vulnerable to smothering by Lantana and invasive vines. In addition, the relatively fertile and moderately well-watered soils supporting the ecological community tend to support very dense stands of invasive species where they establish. The presence of dense weeds suppresses the regeneration of all layers of Grey box-grey gum wet forest and therefore is a significant threat. Lantana infestations have been known to facilitate fire incursions in vine-forest (Fensham et al. 1994). The mechanism by which lantana facilitates such incursions is by introducing more fuel and a more continuous fuel load (Berry et al. 2011). The prevalence of lantana in the ecological community therefore increases the risk of fire to the understorey of the ecological community over significant areas, heightening the risk of loss of the fire sensitive vine-forest elements of the understorey and therefore the community itself. In addition, a study by Duggin and Gentle (1998) shows that fires can facilitate lantana invasion. Taken together, these studies, showing the ability of lantana to promote fire and the ability of fire to promote lantana invasion supports the Fire-Lantana Cycle Hypothesis by Hiremath and Sundaram (2005). This suggests that positive lantana-fire feedback loops may be operating within the ecological community, contributing to ongoing degradation. This is an example of how more than one threat can interact to drive degradation in the ecological community (DAWE 2021; Keith et al. in press).

Threat	Threat Status*	Threat Impacts
Timber Harvesting	*Timing: ongoing* *Severity: major* *Scope: minority*	The canopy of the Grey box-grey gum wet forest supports a number of commercially valuable timber species. A significant proportion (68%) of the remaining stands in NSW are outside the conservation estate and have been subject to timber harvesting in the past leading to structural changes including a loss of hollow bearing trees (NSW Scientific Committee 2009). Timber harvesting in the ecological community has also led to disturbances such as road and track construction and significant disturbance of the understorey by heavy machinery. Disturbances like these have contributed to weed invasion of the understorey (NSW Scientific Committee 2009). Within NSW State Forests the risk of degradation or loss from timber harvesting in the ecological community remains active where it is misidentified or poorly mapped. Outside of State Forests and the conservation estate it faces the threat of ongoing attrition through timber harvesting due to lack of community awareness. Private Native Forestry in New South Wales poses a significant threat to the ecological community as it extends often on to private land and the self-assessment processes of this commercial activity in NSW sometimes fail to identify threatened ecological communities correctly (J Morrison 2022, Pers Comm Feb 2).
Invasive animals	*Timing*: ongoing *Severity*: minor *Scope*: majority	Invasive animals are known to have a number of impacts on threatened species and ecological communities in the region where Grey box-grey gum wet forest occurs. These include the direct effects of herbivory, predation, habitat degradation and competition, as well as trampling, wallowing and other forms of disturbance. *Bufo marinus* (Cane Toad) is known to cause poisoning of native wildlife through ingestion (DECCW 2010). Threats from invasive fauna thus include both degradation of vegetation and soil and watercourse structure as well as direct impacts on populations of species that make up the ecological community. Feral pigs are now established in several areas within the distribution of the Grey box-grey gum wet forest and have been increasing in distribution and density (QLD Government 2004, NSW Government 2005). Feral pigs can cause severe habitat degradation to the ecological community and can also act as a vector for weeds and exotic agricultural diseases. Feral goats, deer and rabbits occur within the distribution of the ecological community (NSW Government 2018). They are known to alter the structure and composition of understorey through trampling, browsing and grazing and compete with native animals for food and habitat resources. Predation, disease transmission and spread of invasive plant species by dogs, foxes, cats, and other non-native predators are also known threats within the distribution of the ecological community. Competition and mortality of native wildlife from interactions with cane toads, feral honeybees, over-abundant noisy miners and other aggressive birds and insects are known threats across the distribution of the ecological community.

Threat	Threat Status*	Threat Impacts
Livestock and Livestock Management	*Timing: ongoing* *Severity: major* *Scope: minority*	The presence of livestock in the ecological community leads to habitat loss resulting from impacts including grazing/browsing, trampling, soil compaction and erosion (Lindenmayer & Fischer 2006; Steinfeld et al. 2006; Tasker & Bradstock 2006). Where livestock have access to remnants of the ecological community these impacts can result in reduced or eliminated regeneration and thinning or destruction of the understorey. These impacts make weed invasion and fire incursion more likely. Management activity associated with livestock grazing can also exacerbate this degradation through native vegetation clearing, inappropriate burning regimes and weed dispersal (DECCW 2010). A feature of the ecological community at maturity is a structurally complex understorey of vine-forest (rainforest) species. Tasker and Bradstock (2006) found that grazing practices had the greatest impact on the complexity of understorey vegetation of all factors measured. Grazed sites had significantly lower vegetation complexity, reduced or absent shrub layers and different dominant species. These sites were more open, simplified, and grassy compared with un-grazed sites. They concluded that management for cattle grazing in eucalypt forests and associated frequent fire-regimes can have major impacts on the structure and composition of forests at a regional level.
Pathogens	*Timing*: ongoing *Severity*: minor *Scope*: unknown	The ecological community includes a diversity of frogs that are at high risk from Chytridiomycosis caused by chytrid fungus (*Batrachochytrium dendrobatidis*) (DoEE 2016a). There are 2 species of threatened parrots (Coxen's fig parrot and Swift parrot) and a number of other parrots, cockatoos (including the threatened Glossy Black Cockatoo) and lorikeets which have ranges and habitat preferences that include the ecological community. These all may be affected by Psittacine beak and feather disease (Psittacine Circoviral Disease) (DoEE 2016b). The ecological community includes species of plants in the family Myrtaceae, which are known have the potential to be impacted by myrtle rust (*Austropuccinia psidii*). Whilst the typical canopy species of the ecological community aren't particularly susceptible to this pathogen there are species that are known from the understorey that are. Both scrub turpentine (*Rhodamnia rubescens*) and native guava (*Rhodomyrtus psidioides*) have been listed as critically endangered in Queensland, New South Wales and federally primarily due to impacts from myrtle rust. Pegg et al. (2014) rates native guava (*Rhodomyrtus psidioides*) as extremely susceptible to myrtle rust and scrub turpentine (*Rhodamnia rubescens*) as highly to extremely susceptible. Rose myrtle (*Archirhodomyrtus beckleri)* is considered to be in serious decline from the impacts of myrtle rust but has yet to be listed in any jurisdiction (Pegg et. al 2017). Other myrtaceae species known from the ecological community such as *Gossia* spp. and *Backhousia myrtifolia* (cinnamon myrtle) may be affected to a lesser degree by this pathogen.

Threat	Threat Status*	Threat Impacts
Climate Change	*Timing*: ongoing *Severity*: major *Scope*: whole	There are uncertainties about the ways in which climate change will impact the ecological community. Projections of future changes in climate for Northern NSW and Southern QLD include higher temperatures, more intense but likely reduced annual average rainfall, increased temperature extremes and higher evaporative demand (Hennessy 2011). These changes are likely to lead to greater intensity and frequency of fires, more severe droughts, reduced river runoff and water availability, regional flooding and increased erosion. The impacts of these changes are likely to play out through interactions with other threatening processes (Auld & Keith 2009; Dunlop & Brown 2008). Perhaps most significantly for the ecological community, climate change is intensifying drought events (Dai 2012; Mitchell et al. 2016), heat waves and fire weather (Lucas et al. 2007; Canadell et al. 2021). This has the potential to degrade, or impact the regeneration of, the fire sensitive vine-forest elements of the understorey. It may also result in the mortality of species that make up the ecological community. Some functionally important fauna of the ecological community, such as Flying Foxes can suffer heat stress, with reported deaths when temperatures exceed 40°C (Welbergen, 2008). Latitudinal and altitudinal shift in the distribution of this ecological community is a plausible response to climate change, but the area to shift into may not be available or suitable, because of agricultural development, soil types or competition with other vegetation communities (Paice & Chambers 2016).
Bell Miner Associated Dieback (BMAD)	*Timing: future* *Severity: unknown* *Scope: unknown*	Bell miner associated dieback (BMAD) is a potential threat to the ecological community. BMAD is primarily associated with changes to forest structure from disturbance. These changes have led to psyllid and bell miner populations increasing and flow on negative impacts to the ecological community such as exclusion of other native fauna species and dieback of canopy *Eucalyptus* species. Whilst there are no quantitative studies of BMAD within the ecological community, it has been observed in stands of Grey box-grey gum wet forest in Mt Lindsay and Donaldson State Forests in NSW, with dieback impacts largely affecting grey gum rather than grey box (J Morrison 2022, pers comm Feb 2). In addition, BMAD is very common in some areas surrounding known occurrences of the ecological community and many of the risk factors associated with BMAD, particularly canopy disturbance, are common within the ecological community (DECC 2008a).
*__***Timing***__ – the threat occurs in the **past** (and unlikely to return), is **ongoing** (present/continuing), is likely to occur/return in the **future,** or timing is **unknown** __***Severity***__ – the threat causes or has the potential to cause impacts that are **extreme** (leading to loss or transformation of affected patches/occurrences), **major** (leading to degradation of affected patches/occurrences), **minor** (impacting some components of affected patches/occurrences), **negligible** or **unknown** __***Scope***__ – the threat is affecting the **whole** (>90%), a **majority** (>50%), a **minority** (<50%), a **negligible** amount, or **unknown** amount of the ecological community		

4.1.1 Key threatening processes

The EPBC Act provides for the identification and listing of key threatening processes. A process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community.

The following are EPBC-listed threatening processes, current at the date of writing, that may be relevant to the ecological community or specific plants and animals that comprise it:

- Land clearance
- Novel biota and their impact on biodiversity

- Competition and land degradation by rabbits
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs
- Competition and land degradation by unmanaged goats
- Predation by European red fox
- Predation by feral cats
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (Bufo marinus)
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases

Any approved threat abatement plans or advice associated with these items provides information to help landowners manage these threats and reduce their impacts to biodiversity. These can be found at http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl.

5 Conservation of the ecological community

5.1 Primary conservation objective

To prevent the extinction of the Grey Box -Grey Gum Wet Forest in the near future and promote recovery of its biodiversity and function through protecting it from significant impacts as a Matter of National Environmental Significance under national environmental law, and by guiding management and recovery, consistent with the recommended priority conservation and research actions set out in this advice.

5.2 Existing protection and management plans

5.2.1 *Existing protection as other matters of national environmental significance*

Approximately 1200ha (20%) of the estimated area of ecological community is within the Gondwana Rainforests of Australia World Heritage Area; formerly known as the Central Eastern Rainforest Reserves (Australia).

5.2.2 Existing protection in reserves

It is estimated that around 4030ha (68%) of the remaining ecological community occurs outside the conservation estate. Approximately 1750ha (29%) of its remaining area is within National Parks, with small areas (approximately 150ha or 3%) found within state conservation areas nature refuges or nature reserves. Most threats to the ecological community operate regardless of land tenure.

5.2.3 Existing legislative protection

The largely equivalent *Grey Box—Grey Gum Wet Sclerophyll Forest in the NSW North Coast Bioregion* is listed as an Endangered Ecological Community under the NSW *Biodiversity Conservation Act 2016*

5.2.4 Existing management plans

The following list may not be comprehensive. It is intended to help guide where some other information relevant to the management of the ecological community and broader landscape may be found.

- *Northern Rivers Regional Biodiversity Management Plan, National Recovery Plan for the Northern Rivers Region*. Department of Environment, Climate Change and Water NSW 2010
- *Fire Frequency Guidelines and the Vegetation of the Northern Rivers Region Draft 2*. Dr Penny Watson Project Ecologist January 2006

5.3 Principles and standards for conservation

To undertake priority actions to meet the conservation objective, the overarching principle is to maintain existing areas of the ecological community that are relatively intact and of high quality. There are good, practical reasons to do so. It is typically more cost-effective to retain an intact remnant than to allow degradation and then attempt to restore it or another area. The more disturbed and modified a patch of the ecological community, the greater the recovery effort that is required. Also, intact remnants are likely to retain a fuller suite of native plant and animal species, and ecological functions. Certain species, including fauna species, may not be easy to recover in practice, if lost from a site.

This principle is highlighted in the *National Standards for the Practice of Ecological Restoration in Australia* (Standards Reference Group SERA, 2021):

> ***"Ecological restoration is not a substitute for sustainably managing and protecting ecosystems in the first instance.***
>
> *The promise of restoration cannot be invoked as a justification for destroying or damaging existing ecosystems because functional natural ecosystems are not transportable or easily rebuilt once damaged and the success of ecological restoration cannot be assured."*
>
> *Standards Reference Group SERA (2021) – Appendix 2.*

The principle discourages 'offsets' where intact remnants are removed with an undertaking to set aside and/or restore other, lesser quality, sites. The destruction of intact sites represents a net loss of the functional ecological community because there is no guarantee all the species and ecological functions of the intact site can be replicated elsewhere.

Where restoration is to be undertaken, it should be planned and implemented with reference to the *National Standards for the Practice of Ecological Restoration in Australia*. These Standards guide how ecological restoration actions should be undertaken and are available online from the Standards Reference Group SERA (2021). They outline the principles that convey the main ecological, biological, technical, social and ethical underpinnings of ecological restoration practice.

5.4 Priority conservation and research actions

Priority actions are recommended for the abatement of threats and supporting recovery of the ecological community. They are designed to provide guidance for:

- planning, management and restoration of the ecological community by landholders, Traditional custodians, NRM and community groups and other land managers;

- conditions of approval for relevant controlled actions under national environment law (the EPBC Act); and
- prioritising activities in applications for Australian Government funding programs.

Detailed advice on actions may be available in specific plans, such as management plans for weeds, fire or certain parks or regions. The most relevant at the time this conservation advice was developed are listed in section 5.2.4.

This conservation advice identifies priority conservation actions under the following key approaches:

- PROTECT the ecological community to prevent further losses;
- RESTORE the ecological community by active abatement of threats, appropriate management, restoration and other conservation initiatives;
- COMMUNICATE, ENGAGE WITH AND SUPPORT people to increase understanding of the value and function of the ecological community and encourage their efforts in its protection and recovery; and
- RESEARCH AND MONITORING to improve our understanding of the ecological community and the best methods to aid its management and recovery.

These approaches overlap in practice; and form part of an iterative approach to management that includes research, planning, management, monitoring and review.

The actions below do not necessarily encompass all actions in detail that may benefit the ecological community. They highlight general but key actions required to at least maintain survival of the ecological community at the time of preparing this Conservation Advice.

5.4.1 PROTECT the ecological community

This key approach includes priorities intended to protect the ecological community by preventing further losses of occurrences.

- Protecting the ecological community should be ensured during the early stages of zoning and development planning decisions, including strategic planning documents at state, regional and local levels.
- Liaise with local councils and State authorities to ensure that cumulative impacts on the ecological community are reduced as part of broader strategic planning or large projects (e.g., fire management, road works, developments).
- Undertake activities to mitigate future climate change and therefore reduce the impacts of climate stress on this ecological community.

5.4.1.1 CONSERVE REMAINING PATCHES

There should be no further clearance and deliberate damage to patches of this ecological community that meet the minimum condition thresholds because it has a limited extent and has been greatly reduced in its extent and ecological integrity.

- Protect and conserve remaining areas of the ecological community.
- Cease/prohibit timber harvesting within the ecological community.
- Retain other native vegetation remnants, near patches of the ecological community, where they are important for connectivity, diversity of habitat and act as buffer zones between the ecological community and threats or development zones.

- Protect patches identified as of regional importance in formal conservation reserves. Consider other remnants for less formal conservation tenures, preferably ones that aim for protection over the long-term. This includes investigating formal conservation arrangements, management agreements and covenants to protect patches on private land. This is particularly important for larger patches or areas that link to other patches of native vegetation.
- Where regeneration is occurring, implement measures that will support the regeneration to maturity (e.g., provide fencing to minimise damage risk).
- Protect mature and over-mature trees and stags, particularly those with hollows. Large and old trees typically have numerous hollows or fissures that provide shelter and support a diversity of animals.

5.4.1.2 MANAGE ACTIONS TO MINIMISE IMPACTS

Apply the mitigation hierarchy to avoid, then mitigate, then offset potential impacts on the ecological community from development or other actions. The priority is to avoid further clearance and fragmentation of remnants with offsetting as the last resort.

- Plan projects to avoid the need to offset, by avoiding significant impacts to the ecological community.
- In circumstances where impacts cannot be totally avoided, then they should be minimised by:
    - retaining and avoiding damage to high quality patches, which should be managed to retain their benchmark state; and
    - protecting important habitat features, such as large mature trees or stags with hollows as these take many decades to develop and cannot be quickly replaced.
- Where impacts are unavoidable, offsets should be used as a last resort to compensate for the adverse impacts of the action deemed unavoidable. The outcomes of offsetting activities are generally highly uncertain. Any proposals considering offsets for this ecological community should aim to:
    - minimise the need to offset the ecological community by designing development around the ecological community and applying buffers;
    - retain moderate and higher quality patches of the ecological community, rather than offset them (particularly with lower quality offset sites);
    - manage and protect offset areas in perpetuity in areas dedicated for conservation purposes - avoid risks that reduce may their size, condition and ecological function in the future;
    - select offset sites as close as possible to the impact site, to allow for local and regional variation in the ecological community;
    - increase the area and improve ecological function of existing patches, for example by enhancing landscape connectivity, habitat diversity and condition;
    - focus on the restoration of lower quality patches of the ecological community to achieve high quality condition (see Table 2);
    - extend protection to otherwise unprotected sites (e.g., sites that are currently too small or degraded to meet the minimum condition thresholds, but can

reasonably be restored to a better, more intact condition that does meet the thresholds);

- maintain a register of any offsets for the ecological community; and
- monitor offset areas and the outcomes they deliver over the long-term, to manage them adaptively and improve understanding of the best ways to manage offsets to delivery biodiversity benefits.

- Minimise the risk of indirect impacts to the ecological community from actions outside but near to patches of the ecological community, for example avoid building fire-sensitive infrastructure in or immediately adjacent to patches of the community that will encourage fire-hazard reduction activities.
- Prior to removal of any trees or use of heavy machinery that may also damage the understorey, ensure comprehensive flora and fauna surveys have identified threatened or locally important species on site and their potential shelter and nesting sites (for example hollows, burrows, rocks and tree crevices, as well as visible nests). Damage to these should be avoided altogether, but if approved for removal, care should be taken to appropriately relocate or otherwise protect fauna, and avoid undertaking the works during important times, such as during breeding seasons.

5.4.1.3 APPLY BUFFER ZONES

- Protect and apply appropriate buffers, particularly of other native vegetation, around patches of the ecological community to minimise off-site impacts. A buffer zone is a contiguous area adjacent to a patch that is important for protecting the integrity of the ecological community. As the risk of indirect damage to an ecological community is usually greater where actions occur close to a patch, the purpose of the buffer zone is to minimise this risk by guiding land managers to be aware that the ecological community is nearby and take extra care. For instance, the buffer zone will help protect the root zone of edge trees and other components of the ecological community from spray drift (fertiliser, pesticide or herbicide sprayed in adjacent land), weed invasion, polluted water runoff and other damage. The best buffer zones are typically comprised of other native vegetation. Fire breaks and other built asset protection zones do not typically provide a suitable buffer and should be additional to a vegetated buffer.
- The recommended minimum buffer zone is 50 m from the outer edge of the patch as this distance accounts for likely influences upon the root zone. A larger buffer zone (e.g., 100 m) should be applied, where practical, to protect patches that are of very high conservation value. Judgement should be exercised to determine an appropriate buffer distance, depending on circumstances and how a patch may be detrimentally impacted.

5.4.1.4 PREVENT THE INTRODUCTION AND SPREAD OF EXOTIC SPECIES

- Implement strong border biosecurity and avoid importing or accidentally introducing invasive species and pathogens that may have a serious adverse impact on this ecological community.
- Prevent planting of known or potentially invasive species in gardens, developments and landscaping near the ecological community.
- Prevent dumping of garden waste into bushland, especially in or near patches of the ecological community.

- Avoid the sale and planting of known invasive species in areas where the ecological community occurs. Review the planting schedule for new developments and landscaping to ensure that potential weeds or other inappropriate plants (e.g., native plants likely to contaminate the local gene pool) are not included.
- Control runoff during nearby construction activities to prevent movement of weeds and pathogens into the ecological community.
- When conducting activities in or around the ecological community, practice good biosecurity hygiene to avoid spreading weeds or pathogens (see DoE, 2015).
- Minimise unnecessary soil disturbance that may facilitate weed establishment.
- If new invasive species or pathogen incursions do occur, detect and control them early, as small infestations are more likely to be eradicated.
- Limit or prevent access of grazing animals to patches of the ecological community (e.g., construct fences) where practicable. Provide advice and support to landholders to assist with this.
- Limit or prevent access of vehicles to patches of the ecological community.
- Prevent further incursions of feral animals into the ecological community and, where possible, contain pets in nearby residential areas.

5.4.2 RESTORE and MANAGE the ecological community

This key approach includes priorities to restore and maintain the remaining occurrences of the ecological community by active abatement of threats, appropriate management, restoration and other conservation initiatives.

- Liaise with landholders, NRM and community groups, Traditional Owners/Custodians and governments to support, undertake and promote programs that ameliorate threats such as grazing, invasive plants and animals and human disturbance.
- Identify and prioritise other specific threats and undertake appropriate on-ground site management strategies where required.

5.4.2.1 MANAGE WEEDS, PESTS AND DISEASES

Implement effective integrated control and management techniques for weeds, pests and diseases affecting the ecological community and manage sites to prevent the introduction of new, or further spread of, invasive species.

- Identify potential new weed incursions early and manage for local eradication, where possible.
- Prioritise weeds and patches for which management is most urgent.
- Plan and budget for both initial weed management and for follow up treatment for as long as this is needed.
- Target control of key weeds that threaten the ecological community using appropriate methods that avoid impacts to non-target species.
- Encourage appropriate use of local native plant species in developments in the region through local government and industry initiatives and best practice strategies.

- Ensure chemicals, or other mechanisms used to manage weeds, do not have significant adverse, off-target impacts on the ecological community or adjacent native vegetation or waterbodies.
- Implement controls to prevent or reduce infection by fungal pathogens, especially myrtle rust (*Austropuccinia psidii*).
- Control introduced pest animals through coordinated landscape-scale control programs, with a particular focus on feral pigs.
- Implement best practice measures to control, prevent and restore Bell Miner associated dieback. Follow recommendations in Silver & Carnegie (2017).

5.4.2.2 MANAGE TRAMPLING, BROWSING AND GRAZING

- Any livestock grazing which may be occurring in the ecological community should cease and fencing may be required for exclusion of stock.
- Low level grazing, firewood cutting and other uses which may be acceptable in dry forests are not appropriate in this ecological community.

5.4.2.3 MANAGE ACTIVITIES AND ACCESS

- Avoid disturbance from visitors to sites containing the ecological community. Stay on established walking tracks when visiting national parks, nature reserves and state forests.
- Cease/prohibit and monitor wood collection, such as for firewood or fencing, that leads to the loss and damage of trees, stags, logs or disturbs the natural litter layer.
- Cease/prohibit and monitor destructive activities such as off-road trail bike or four-wheel-driving
- Cease/prohibit and monitor wildflower, invertebrate and other fauna collection
- Cease/prohibit and monitor rubbish dumping.
- Cease/prohibit access by domestic pets, by containing them in nearby residential areas or keeping them on leashes.

5.4.2.4 MANAGE FIRE REGIMES

Fires (including planned burns) must be managed to: maintain the integrity of the ecological community and avoid disruption of the life cycles of the component species; support rather than degrade the habitat; avoid invasion and facilitate control of exotic species; avoid impacts from suppression and mop-up operations, and; avoid increased impacts of other threats such as drought, prolonged heavy grazing or predation by feral predators. Isolated faunal populations and threatened plants are particularly vulnerable to local extinction following intense fires combined with other threats.

- Implement appropriate fire management regimes for the ecological community and for the landscapes surrounding the ecological community. Take into account Indigenous knowledge and scientific research.
- There is uncertainty about appropriate fire regimes for the ecological community. Planned burns should generally be avoided unless there is strong evidence to support the need for one. It is likely that longer intervals (>50 years) will be required for the regeneration of the vine-forest (rainforest) elements of the ecological community,

especially between high intensity fires. Any fire management should take into account the latest research and the impacts of a changing climate.

- Where hazard reduction burns or prescribed fires are undertaken in areas near to the ecological community, ensure that the potential for the fire to escape is appropriately risk assessed and management responses are in place to protect the ecological community.
- Use a landscape-scale approach and available local knowledge on fire histories to identify sites that would benefit from reinstating appropriate fire frequency to prevent further declines of patches affected by either too low, or too high, fire frequency.
    - For areas of the ecological community affected by too high fire frequency, identify options for reducing the frequency of fires and protecting important features, such as habitat trees.
    - Fire management strategies at each location should take into account patch size, habitat features (e.g., protect hollow-bearing trees and large logs), vegetation structure and the surrounding landscape (including property protection) to minimise damage, maintain refuges for fauna (during and after fire) and increase habitat variability
- Fires (including planned burns nearby) must be managed to: maintain the integrity of the ecological community and avoid disruption of the life cycles of the component species; support rather than degrade the habitat; avoid invasion of exotic species; and avoid increased detrimental impacts of other threats such as drought, grazing, weeds, or predation by feral predators. Isolated faunal populations, the vine-forest (rainforest) understorey, and threatened plants are particularly vulnerable to local extinction following intense fires combined with other threats.
    - Ensure that an invasive species risk assessment and management program is planned and budgeted for ahead of proposed burning.
    - Use available ecological information to avoid detrimental fire impacts on key and susceptible species in the ecological community. For instance, do not undertake planned burns in areas adjacent to the ecological community when key, threatened or functionally important flora and fauna (that may be adversely impacted) are flowering, nesting or otherwise reproducing.
    - Consider weather conditions. Do not burn adjacent to the ecological community when soil moisture is low, or dry conditions are predicted for the coming season because flora and fauna will already be stressed, recovery will be too slow, and erosion may occur; or weeds may become established while vegetation cover is reduced.
    - Monitor the outcomes of fire and the consequences of other threats. Manage these within an appropriate timescale (e.g., immediately: put in place erosion control measures; limit access by feral predators and grazers; control weeds as they first appear with follow up treatments as necessary, until native vegetation has regenerated); consider shelter and food needs of native fauna. Ensure monitoring results are taken into account when planning and implementing future fire regimes.

5.4.2.5 UNDERTAKE RESTORATION

- Undertake restoration, including facilitating regeneration and revegetation, of poorer and medium quality patches to restore them to high quality, including restoration of patches that don't currently meet the minimum condition thresholds for protection to a condition that does (see Table 2).
    - Restoration to improve the condition of degraded patches should aspire to the 5 Star Standard of the SERA Standards. Land managers should aim for the highest and best recovery of the ecological community to maximise biodiversity and ecological function based on appropriate metrics for each site (see Condition Thresholds at Table 2 and SERA (2021) for guidance on implementing appropriate standards). This is particularly the case for sites that are being restored or reconstructed from highly altered states (see also Section 2.2.4).
    - Work with landholders to restore and reconnect patches of the ecological community and other adjacent or nearby native vegetation (including buffer areas)
    - Maintain stags, logs, large rocks, rock piles and mature and trees with hollows as they provide important habitat for fauna.
    - If necessary, supplement, (but do not replace) habitat as part of restoration projects by placing hollow logs, large rocks or other habitat features (such as artificial hollows or various sized nest boxes) in or near to, the ecological community. This may be particularly important after disturbance such as a severe fire event.
    - Use local native species in restoration/revegetation projects for the ecological community and restore understorey vegetation to a structure and diversity appropriate to the site.
    - In general, use locally collected seeds, where available, to revegetate native plant species. However, choosing sources of seed closer to the margins of their range may increase resilience to climate change. Take into account key plant species' growing seasons to successfully achieve seed set.
    - Ensure commitment to follow up after planting, such as the care of newly planted vegetation by watering, mulching, weeding and use/removal of tree guards.
    - Consider the landscape context and other relevant species and communities when planning restoration works. For example, ensure adjacent ecological communities and threatened and migratory species are not adversely impacted by tree planting or other restoration activities for the ecological community.
    - Close unnecessary roads and tracks, and rehabilitate them back to their original vegetation, and otherwise control access to restored patches.
    - Explore the potential for carbon mitigation investment activities to also restore this ecological community through reforestation of farmland. This should be in line with appropriate reforestation methodologies such as those developed under the *Carbon Credits (Carbon Farming Initiative) Act 2011*. As part of any such initiatives, investigate the potential for biodiversity credits.

5.4.3 COMMUNICATE, engage with and support

This key approach includes priorities to promote the ecological community to build awareness and encourage people and groups to contribute to its recovery. This includes communicating, engaging with and supporting the public and key stakeholders to increase their understanding of the value and function of the ecological community and to encourage and assist their efforts in its protection and recovery. Key groups to communicate with include landholders, land managers, land use planners, researchers, community members and Indigenous communities.

5.4.3.1 RAISE AWARENESS

- Communicate with landholders/managers, relevant agencies and the public to emphasise the value of the ecological community, the key threats, its significance, and appropriate management. Encourage landholders to talk with local NRM organisations, Indigenous Australians, and other knowledgeable groups.
- Undertake effective community engagement and education to highlight the importance of minimising disturbance (e.g., during recreational activities) and of minimising pollution and littering (e.g., via signage).
- Highlight a species such as the black-striped wallaby (*Notamacropus dorsalis*) as a flagship species to use for community awareness about the ecological community.
- With permission, include culturally appropriate information on traditional knowledge and values in education and awareness programs, publications and signage.
- Inform landholders about incentives, such as conservation agreements, stewardship projects, funding and government NRM programs etc. that may apply to help manage landscape-level threats and look after sites on private lands.

5.4.3.2 PROVIDE INFORMATION

- Develop education programs, information products and signage to help the public recognise the presence and importance of the ecological community, and their responsibilities under state and local regulations and the EPBC Act.
- Improve understanding of Traditional Ecological Knowledge and where agreed by the knowledge-holders, identify and support culturally appropriate mechanisms to share and maintain this knowledge to protect and restore the ecological community.
- Install signage to discourage damaging activities such as the removal of dead timber, dumping garden waste and other rubbish, creating informal paths and tracks, and the use of off-road vehicles in patches of the ecological community.
- Install significant vegetation markers along roads to designate areas of the ecological community to protect and prevent inappropriate roadside maintenance from occurring.
- Promote knowledge about local weeds and what garden plants to avoid planting. Recommend local native species for revegetation and landscaping or safe alternative garden plants.

5.4.3.3 COORDINATE EFFORTS

- Encourage local participation in restoration and 'landcare' efforts through local conservation groups, creating 'friends of' groups, field days and planting projects, etc.
- Liaise with local fire management authorities and agencies and engage their support in fire management of the ecological community. Ensure land managers are given

information about how to manage fire risks to conserve this and other threatened ecological communities and species.

- Develop coordinated incentive projects to encourage conservation and stewardship of the ecological community on private land, and link with other programs and activities, especially those managed by regional Natural Resource Management groups.
- Support opportunities for Traditional owners/custodians or other members of the Indigenous community to manage the ecological community.
- Promote awareness and protection of the ecological community with relevant agencies and industries. For example, with:
    - state and local government planning authorities, to ensure that planning takes the protection of remnants into account; infrastructure or development works involving substrate or vegetation disturbance in the surrounding areas do not adversely impact the ecological community; maintenance activities (e.g., roads and roadsides) avoid the introduction or spread of weeds; with due regard to principles for long-term conservation;
    - land owners and developers, to minimise threats associated with land conversion and development;
    - Natural Resource Management organisations, conservation organisations and groups volunteering time for restoration and ecological management.

5.4.4 RESEARCH and monitoring

This key approach includes priorities for research into the ecological community, and monitoring, to improve understanding of the ecological community and the best methods to aid its recovery through restoration and protection. Relevant and well-targeted research and other information gathering activities are important in informing the protection and management of the ecological community. For example, understanding the size- and age-class distributions of all components of the vegetation community and the dynamics of emergent versus canopy species relative to sub-canopy species will provide essential insights into the ecology of these assemblages.

5.4.4.1 SURVEY AND MAPPING

- Collate, update and validate existing vegetation mapping information and associated data for this ecological community and identify gaps in knowledge.
- Comprehensively map the extent and condition of the ecological community across its range:
    - support field survey and interpretation of other data such as aerial photographs and satellite images to more accurately document current extent, condition, threats, function, presence and use by regionally significant or threatened species.
    - support and enhance existing programs to model the pre-1750 extent across the entire range of the ecological community to inform restoration;
    - gain a better understanding of variation across the ecological community and identify the most intact, high conservation value remnants;

- identify and map at high accuracy and spatial resolution the fire history of the ecological community and surrounding fire-dependent and/or fire sensitive vegetation;
- undertake new surveys and collate existing information on populations of fauna characteristic of the ecological community across its range.

5.4.4.2 OPTIONS FOR MANAGEMENT

- Research ecosystem dynamics and life history processes of component flora and fauna to define appropriate fire regimes for their long-term persistence.
- Research to improve understanding of effectiveness of alternative management and restoration options for prevention, amelioration and restoration of Bell Miner Associated Dieback (BMAD) impacts.
- Improve understanding of seed bank dynamics and regeneration ecology of component species.
- Improve understanding of habitat requirements of resident and transient fauna.
- Research into appropriate and integrated methods to manage pests and weeds that affect the ecological community.
- Assess the vulnerability of the ecological community to climate change and investigate viable adaptation measures and ways to increase resilience through other threat abatement and management actions.
- Conduct research leading to the development of effective landscape-scale restoration techniques for the ecological community. Investigate the interaction between disturbance types, such as fire and invasion by weeds and feral animals, to determine how an integrated approach to threat management can be implemented.
- Investigate the most cost-effective options for restoring landscape function, including re-vegetation or assisted regeneration of priority areas, potentially buffering, connecting and protecting existing remnants.

5.4.4.3 MONITORING

- It is important that any monitoring is planned before management commences and considers what data are required to address research questions. Monitoring must also be resourced for management activities, especially for those using a novel approach, and applied during and following the management action.
    - Monitor for signs of decline, in terms of known problems e.g., Bell Miner associated dieback.
    - Monitor changes in the condition, composition, structure and function of the ecological community, including response to climate change and all types of management actions and use this information to increase understanding of the ecological community and inform recommendations for future management.
    - Monitor the responses of the ecological community to fire to inform fire management regimes.

6 Listing assessment

This assessment outlines the *grounds on which the community is eligible to be listed* as required by section 266B (2) (a) (i) of the EPBC Act.

The Threatened Species Scientific Committee finalised this assessment on 9 March 2022.

6.1 Assessment process

6.1.1 Reason for assessment

This assessment follows prioritisation of a nomination from the Threatened Species Scientific Committee in response to the impacts of the 2019-2020 bushfires.

6.1.2 Public consultation

Notice of the proposed listing and consultation documents were made available for public comment for 35 business days between 14 December 2021 and 7 February 2022. Any comments received that were relevant to the assessment of the ecological community were considered by the Committee as part of the assessment process.

6.2 Eligibility for listing

An ecological community is eligible for listing under section 182 of the EPBC Act if it meets the prescribed criteria outlined in section 7.02 of the EPBC Regulations. This assessment uses the criteria set out in section 7.02 the EPBC Regulations and the TSSC Guidelines for nominating and assessing the eligibility for listing of threatened ecological communities (TSSC 2017), as in force at the time of the assessment.

The TSSC Guidelines (TSSC 2017) outline indicative timeframes to be used when interpreting the prescribed criteria, in relation to the generation length of any long-lived or key species believed to play a major role in sustaining the community. For the purposes of this assessment the relevant species used to determine this timeframe is the mature eucalypt canopy trees (see section 1.2.3). While the mean age of mature trees in some examples of this community is likely to exceed hundreds of years, the generation length of the resprouter-type eucalypt species that comprise the canopy species of this community is likely to be around 70 years (Fensham et al. 2020). This estimate may be longer for species that have longer time to reproduction, e.g. some fire-sensitive mesic elements of the community (see section 1.2.4.1).

6.2.1 Criterion 1 – decline in geographic distribution

Eligible under Criterion 1 for listing as **Vulnerable**

	Category		
	Critically Endangered	**Endangered**	**Vulnerable**
Its decline in geographic distribution is:	very severe	severe	substantial
decline relative to the longer-term/1750 timeframe	*≥90%*	*≥70%*	*≥50%*
decline relative to the past 50 years	*≥80%*	*≥50%*	*≥30%*

Source: TSSC 2017

Evidence:

Estimates from NSW indicate that the ecological community had undergone a substantial (69%) decline from its pre-European extent by 1999 (NPWS 1999a). It likely has declined further since this time.

In QLD the Regional Ecosystem (RE) most likely to contain patches of the ecological community (RE 12.9-10.3) has undergone a decline of 55% in the border regions adjacent to the NSW occurrences (Scenic Rim and Moreton Basin IBRA subregions). The second Regional Ecosystem most likely to contain patches of the ecological community (RE 12.8.14a) has undergone a 21% decline over the longer term in these subregions. However only a small proportion of the original extent of the ecological community is likely to have occurred in Queensland and these REs also include many areas that would not be included in the ecological community.

Given these estimates, the geographic distribution of the ecological community has declined by 50-70%, indicating a vulnerable status.

This represents a **substantial** decline in geographic distribution. The Committee considers that the ecological community meets the relevant elements of Criterion 1 to make it eligible for listing as **Vulnerable**.

This decline in geographic distribution since 1750 also represents a likely Vulnerable status under Criterion A3 of the IUCN Red List of Ecosystems (Bland et al. 2017).

6.2.2 Criterion 2 – limited geographic distribution coupled with demonstrable threat

Eligible under Criterion 2 for listing as **Endangered**

Its geographic distribution is:		very restricted	restricted	limited
Extent of occurrence (EOO)		*< 100 km2 = <10,000 ha*	*<1,000 km2 = <100,000 ha*	*<10,000 km2 = <1,000,000 ha*
Area of occupancy (AOO)		*< 10 km2 = <1,000 ha*	*<100 km2 = <10,000 ha*	*<1,000 km2 = <100,000 ha*
Average patch size		*< 0.1 km2 = <10 ha*	*< 1 km2 = <100 ha*	-
AND the nature of its distribution makes it likely that the action of a threatening process could cause it to be lost in:				
the immediate future	*10 years or 3 generations (Up to a maximum of 60 years)*	**Critically endangered**	**Endangered**	**Vulnerable**
the near future	*20 years or 5 generations (Up to a maximum of 100 years)*	**Endangered**	**Endangered**	**Vulnerable**
the medium-term future	*50 years or 10 generations (Up to a maximum of 100 years)*	**Vulnerable**	**Vulnerable**	**Vulnerable**

Source: TSSC 2017

Evidence:

The geographic distribution for the ecological community has been calculated from the state vegetation map units that most closely match the description of the ecological community (FE62 in Northern Rivers CMA VIS_ID 524 in New South Wales (NPWS 1999a, 2001; Eco Logical 2005,) and the Queensland REs 12.9-10.3 and 12.8.14a (Qld Herbarium 2021)), where they occur within the appropriate IBRA subregions, between 100-600m ASL.

The estimated extent of occurrence (EoO) of the Grey box-grey gum wet forest is 1,149,900ha (11,499km^2), which is not indicative of limited distribution.

It's estimated total area of occupancy (AoO) is 5,950ha (59 km^2) which is indicative of a **restricted** distribution.

Risk of loss due to cumulative small-scale losses and inappropriate management

Approximately 4035ha (68%) of the ecological community occurs outside of the conservation estate on various tenures. These tenures include freehold, leasehold, state forest, infrastructure reserves and stock routes. This increases its vulnerability to the cumulative impacts of numerous significant threats such as inappropriate fire regimes, grazing impacts, clearing and the cumulative losses of patches. As of 2009 the ecological community was still considered to

face a continued threat from small-scale clearing, especially on fertile sites suitable for agriculture. (NSW Scientific Committee 2009).

Risk of loss resulting from fragmentation impacts and the alteration of surrounding habitat

The alteration of the landscape surrounding the ecological community compounds the effects of clearing and fragmentation. Approximately 66% of land surrounding patches of the ecological community is either non-native vegetation or native vegetation actively managed for production of timber or cattle.

Non-native vegetation makes up 16% of the land bordering patches of the ecological community, including areas of active human land-use. A further 50% of the adjoining vegetation is native vegetation that is managed for production forestry or grazing. Impacts from proximity to such land uses can include invasion by exotic flora and fauna, incursion by domestic animals including livestock, extractive activities such as firewood harvesting, exposure to intentional or unintentional burning, small-scale clearing and "tidying" of bushland near infrastructure including for fuel reduction purposes, dumping of refuse and chemicals and other disturbances, erosion, and sedimentation. All of these can lead to decline in the integrity of the vegetation and habitat values of patches of the ecological community. This exposure to modified areas, where it occurs, makes patches of the ecological community susceptible to these threats as well as edge effects including exposure to drying winds and increased sunlight penetration.

Risk of loss resulting from timber harvesting

The ecological community faces the risk of loss from timber harvesting as its canopy species are valued timber species. Approximately 25% of the ecological community in NSW borders native vegetation managed for forestry. Within state forests it is at risk of loss or degradation where it is misidentified or mis-mapped. Outside of state forests it faces potential losses and degradation through timber harvesting activities including from private native forestry operations which occur throughout its distribution on various scales. Accidental or deliberate mis-identification of the ecological community by logging contractors working for private native forestry operations poses a significant threat in parts of its range. Lack of community awareness combined with its patchy distribution could also lead to ongoing attrition through opportunistic small-scale timber harvesting on private land.

Risk of loss resulting from altered fire regimes

Climate change is likely to lead to an increase in the frequency and intensity of fires in Australia (BOM 2021; Andrade et al., 2019; Lucas et al. 2007; Nolan et al. 2020). Such changes to fire regimes would likely lead to continued risk of a further decline in the geographic distribution of the ecological community through the loss of drier vine-forest (rainforest) areas and elements in its understorey to the point where patches of the community no longer meet the description in section 1.2 or the key diagnostics in section 2.12.1.

The ecological community typically has a fire-sensitive understorey that relies on long intervals between fire to persist. Therefore, recurring burns with short intervals could lead to the severe degradation or loss of the ecological community. Wet sclerophyll communities have been shown to respond to extreme fire weather with dramatically increased fire intensity relative to more moderate fire weather, unlike pure stands of rainforest which are only slightly to moderately sensitive to these differences (Clarke et al. 2014). This suggests the ecological community's vine-

forest (rainforest) understorey is more susceptible to extreme fire than a pure stand of these rainforest species under the same conditions.

Fire is also known to facilitate lantana invasion in vine-forest (rainforest)-open forest ecotones (Duggin & Gentle 1998). In this study it was shown that the increase in light availability, and to a lesser extent nutrient availability, from the disturbance of the shrub and canopy layers by fire led to an increase in lantana germination, survival and growth. Therefore, escalating fire impacts from climate change are likely to further facilitate and maintain lantana infestation in the ecological community. This is likely to lead to further losses of the ecological community through suppression of regeneration and succession.

In addition, lantana infestations have been known to facilitate fire incursions in dry rainforest (Fensham et al. 1994) -The mechanism by which lantana facilitates such incursions is by introducing more fuel and a more continuous fuel load (Berry et al. 2011). The prevalence of lantana in the ecological community therefore increases the risk of fire to the understorey of the ecological community over significant areas, heightening the risk of loss of the fire sensitive dry rainforest elements of the understorey and therefore the community itself. Taken together, these studies, showing the ability of lantana to promote fire and the ability of fire to promote lantana invasion supports the Fire-Lantana Cycle Hypothesis by Hiremath and Sundaram (2005). This suggests that positive lantana-fire feedback loops may be operating within the ecological community, contributing to its further degradation.

Lucas et al. 2007 project that in Australia by the year 2050 extreme fire weather days will have increased by +100–300 %. The high end of the projections suggest 'Very extreme' fire weather days may have a four to five-fold increase in frequency at many sites across south eastern Australia. This modelling suggests that fire seasons will commence earlier and end slightly later, whilst being in general more intense throughout.

Analysis by Canadell et al. (2021) shows that forests in Australia were subject to an annual average increase of 350% in burned area when comparing 1988-2001 with 2002-2018, and this increased to 800% when the Black Summer bushfires of 2019 were included. Ten out of the eleven years with at least 5000 km^2 burned have occurred since 2001. This analysis shows that over the last 32 years (1988–2018), burned area in Australian forests exhibited an exponential increase related to both the number of days with Forest Fire Danger Index (FFDI) ≥ 25 and FFDI ≥ 50, equating to a to 21% increase in burned area for every additional day of FFDI ≥ 25, and about 3 to 5 times increase in burned area for every additional day of FFDI ≥ 50. Their analysis also shows that the number of years since last fire (YSLF) also declined over the past four decades with the decadal mean (±SD) of 70.6 years in the 1980's declining to 39.8 years in the 2010's. They concluded that a continuation of this trend, particularly in locations with sensitive species (such as characteristic vine-forest understorey species for this ecological community), could lead to significant ecological changes. This combination of increasing burned area with declining fire intervals is likely to be detrimental to the ecological community through the loss of fire sensitive vine-forest (rainforest) elements in the understorey and canopy.

A number of threatened animals known from the ecological community are considered to be under threat from increasing fire frequency including the koala, long nosed potoroo, parma wallaby, rufous bettong and spotted-tailed quoll (DECCW 2010). Some of these are also considered to be functionally important. For example, the long nosed potoroo and rufous bettong are known to both play roles in dispersing fungal spores including from mycorrhizal fungi and in bioturbation of (turning over) soil and organic matter (Claridge et. al 1993; Claridge & May 1994; Claridge & Trappe 2004; Reddell et al. 1997). The cumulative loss of such fauna with important functional roles in the ecological community from increasing fire frequency

poses a risk to ecosystem function. Especially in combination with other degradation from altered fire regimes, and other threatening processes underway, such that patches of the ecological community may be lost (no longer meet the description in 1.2).

Given a significant percentage (approximately 15%) of the ecological community burned in the 2019-2020 fires (DAWE 2020), and that the frequency and severity of extreme fire weather is projected to increase over the coming decades (Lucas et al. 2007, Canadell et al. 2021) it is reasonable to expect that fire impacts on the ecological community will increase in the near term. Fire impacts are likely to occur over an increasing proportion of its geographic distribution and occur at increased frequency given the multi-decadal trends observed in area burned and years since last fire that are linked to climate change (Canadell et al. 2021). These trends will likely negatively impact the fire sensitive vine-forest elements of the ecological community such that where fire is too frequent, they will be unable to regenerate, resulting progressive losses of patches.

Conclusion

Together, these threatening processes have the potential to cause the loss of the ecological community within 100 years (five generations of the functional canopy species)**.**

This represents a **restricted** geographic distribution, and the nature of this distribution makes it likely that the action of a threatening process could cause it to be lost in the **near future**. The Committee considers that the ecological community has met the relevant elements of Criterion 2 to make it eligible for listing as **Endangered**.

6.2.3 Criterion 3 – decline of functionally important species

Insufficient data to determine eligibility under Criterion 3

	Category		
	Critically Endangered	**Endangered**	**Vulnerable**
For a population of a native species that is likely to play a major role in the community, there is a:	very severe decline	severe decline	substantial decline
Estimated decline over the last 10 years or three generations, whichever is longer	*80%*	*50%*	*20%*
to the extent that restoration of the community is not likely to be possible in:	the immediate future	the near future	the medium-term future
Timeframe	*10 years or 3 generations (up to a maximum of 60 years)*	*20 years or 5 generations (up to a maximum of 100 years)*	*50 years or 10 generations (up to a maximum of 100 years)*

Source: TSSC 2017

Evidence:

The relationship between all the various species of this ecological community is important to maintain its ecological function, but specific data related to the decline of individual key species or their functional importance within this ecological community are not available.

The Committee considers that there is insufficient information to determine the eligibility of the ecological community for listing in any category under Criterion 3.

6.2.4 Criterion 4 – reduction in community integrity

Eligible under Criterion 4 for listing as **Endangered**

	Category		
	Critically Endangered	**Endangered**	**Vulnerable**
The reduction in its integrity across most of its geographic distribution is:	very severe	severe	substantial
as indicated by degradation of the community or its habitat, or disruption of important community processes, that is:	very severe	severe	substantial
such that restoration is unlikely (even with positive human intervention) within	*the immediate future (10 years or 3 generations up to a maximum of 60 years)*	*the near future (20 years or 5 generations up to a maximum of 100 years)*	*the medium-term future (50 years or 10 generations up to a maximum of 100 years)*

Source: TSSC 2017

Evidence:

The Grey box-grey gum wet forest has undergone severe changes in structure and function as a result of the threats outlined in Section 4. The ecological community has experienced a reduction in integrity across most of its extent primarily because of:

- Timber harvesting and the loss of mature trees;
- Cattle grazing and associated forest management, including burning;
- Fire impacts;
- Weed invasion; and
- Loss of native fauna.

Reduction in integrity due to timber harvesting and loss of mature trees

The loss of hollow bearing trees along with other structural changes across such a large proportion of the range of the ecological community through timber harvesting and partial clearing have resulted in a significant disruption of ecological processes (NSW Scientific Committee 2009).

A significant proportion of the remaining stands in NSW are within public lands and have been subject to timber harvesting in the past leading to structural changes including a loss of hollow bearing trees (NSW Scientific Committee 2009). Based on 2001 mapping (NPWS 2001) and plot data (DECC YETI 2007) that 56.25 % of the stands in NSW had a low structural integrity exhibiting moderately high to very high levels of disturbance. A further 37.5 % of stands exhibited moderate disturbance levels and levels of structural integrity. Leaving just 6.25% of stands undisturbed or with low levels of disturbance. The stands were ranked on disturbance based on the criteria for identifying candidate old growth forest adopted by (NPWS1999b) and expert opinion.

The canopy of the ecological community in NSW are almost always dominated by younger trees with very few mature or senescent stag trees in areas surveyed (DECC 2008a). The loss of hollow bearing trees along with other structural changes across such a large proportion of the range of the ecological community through timber harvesting and partial clearing are indicative of a significant disruption of ecological processes within the community (NSW Scientific Committee 2009). Old, hollow and crevice bearing trees are essential nesting and shelter resources for a variety of arboreal mammals and birds. Hollow nesting mammals and birds

perform important ecological functions such as pollination and apex predation. Such a significant loss of these old trees is likely to have degraded or disrupted these processes across most of its geographic range.

Reduction in integrity through cattle grazing and associated forest management, including burning

Historically in north-east NSW cattle grazing has occurred across large areas of freehold and leasehold eucalypt forest including within and adjoining the ecological community (DECC 2008a). Frequent burning of the understorey has been carried out for forest management related to grazing. There is evidence that this frequent burning has resulted in changes to the structure, composition and diversity of a range of eucalypt forest communities in northern NSW, including Grey Box - Grey Gum Wet Forest (York 1999, 2000; Andrew et al. 2000; Henderson and Keith 2002; Harris et al. 2003; York and Tarnawski 2004; Tasker and Bradstock 2006).

A feature of the ecological community is an understorey with vine-forest (rainforest) species with varying levels of dominance and structural complexity. Tasker and Bradstock (2006) found that grazing practices had the greatest impact on the complexity of understorey vegetation of all factors measured. Grazed sites had significantly lower vegetation complexity, reduced or absent shrub layers and different dominant species. These sites were more open, simplified, and grassy compared with un-grazed sites. They concluded that management for cattle grazing in eucalypt forests and associated frequent fire-regimes can have major impacts on the structure and composition of forests at a regional level. Given the nature of, and significant scale of these kinds of impacts across the region and the sensitivity of the ecological community to degradation from such changes, it is considered likely that the ecological community has undergone a significant decline in integrity due to grazing and associated management practices.

Reduction in integrity due to fire impacts

The 2019-2020 Black-Summer Bushfires had impacts on areas known to support patches of the ecological community. Analysis of vegetation mapping intersected with the Australian Google Earth Engine Burnt Area Map (DAWE 2020) show that approximately 15% of the estimated area of the ecological community was within the extent of these fires. Whilst not all these areas burned at high intensity, research shows that even moderate to low intensity fires can enhance the persistence and spread of lantana thickets (Gentle & Duggin 1997) which is another major threat to the ecological community.

Canadell et al. (2021) show that over the last four decades that there has been a trend of increasing area burned and decreasing number of years since last fire in the forests of south eastern Australia this has likely resulted in loss of integrity of some patches of the ecological community.

Reduction in integrity due to invasive flora

Lantana camara (lantana) is one of the most common weeds where the ecological community occurs (DECC 2007; DECC 2008b, DECC 2008c). Lantana has been recorded in 95% of vegetation sites surveyed of Grey Box - Grey Gum Wet Sclerophyll Forest (DECC 2008a). Lantana infestation is known to prevent regeneration of native species through mechanisms such as shading, smothering (Lamb 1991) and allelopathy (Gentle & Duggin 1997) and lead to declines in native flora diversity, especially where it occurs at high densities (Gooden et al. 2009). The relatively fertile and moderately well-watered soils supporting the ecological community typically support dense stands of invasive weeds when they establish. The presence of dense weeds can suppress the regeneration of all layers of Grey box-grey gum wet forest. The documented prevalence of lantana within the ecological community and its impacts on

ecological succession and understorey development and native flora diversity indicates a very severe reduction in community integrity across most of its geographic distribution.

Reduction in integrity due to loss of native fauna

Faunal components of the ecological community, such as digging mammals and arboreal mammals, birds and insects are important for nutrient cycling, dispersal and/or burial of seeds and fungal spores, water infiltration, and pollination. The loss of these animals negatively impacts the functioning of the ecological community and reduces its ability to recover from the adverse impacts of other threats.

Most threatened and near threatened Australian land mammal species are continuing to decline (Woinarski et al. 2015), including those of the ecological community. The Grey-headed flying-fox, for example, suffered recent large declines due to heat stress and fire (NSW OEH 2019). As a key pollinator of the ecological community (SCEE 2017), its decline is likely to impair the regeneration of key vegetation species. Most recently, the State of NSW reported that 64% of mammals are now considered to have suffered long-term reductions in their habitat range (State of NSW & NSW EPA 2021).

Inappropriate fire regimes, grazing by stock and invasive herbivores and invasion by weeds, have resulted in the loss of groundcover and understorey structure and flora species. The loss of the understorey negatively impacts ground-dwelling fauna that play key roles in the ecological community. Fallen timber is also important as habitat for ground-dwelling fauna (as well as for carbon turnover) and has been selectively removed for firewood. All these threats reduce the habitat value and exacerbate the direct loss of fauna from the ecological community.

Insects are functionally critical to the ecological community, in a wide variety of roles. Marsh et al. (2021) found that 44 percent (more than 14,000) of the invertebrate species, for which they were able to compile data, were likely to have lost habitat during Australia's 2019-20 bushfires, including in the Grey box-grey gum wet forest. This further compromises the ecological community through cascade effects through the food chain, including detriment impacts on many birds, reptiles, and amphibians that feed on insects (Sanchez Bayo & Wyckhuys 2019).

Conclusion

The combination of these threat impacts has impacted the structure, species assemblage and ecological function across the range of the ecological community.

This represents a **severe** reduction in integrity across most of its geographic distribution, as indicated by a **severe** degradation of the community or its habitat or disruption of important community processes. The Committee considers that the ecological community has met the relevant elements of Criterion 4 to make it eligible for listing as **Endangered**.

6.2.5 Criterion 5 – rate of continuing detrimental change

Insufficient data to determine eligibility under Criterion 5

	Category		
	Critically Endangered	**Endangered**	**Vulnerable**
Its rate of continuing detrimental change is: as indicated by:	very severe	severe	substantial
(a) rate of continuing decline in its geographic distribution, or a population of a native species that is believed to play a major role in the community, that is: OR	very severe	severe	serious
(b) intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	very severe	severe	serious
an observed, estimated, inferred or suspected detrimental change over the immediate past, or projected for the immediate future (10 years or 3 generations), of at least:	*80%*	*50%*	*30%*

Source: TSSC 2017

Evidence:

Although continuing detrimental change is occurring within this ecological community, data on the rate of this change is not available to support specific analysis against Criterion 5 and its indicative thresholds.

The Committee considers that there is insufficient information to determine the eligibility of the ecological community for listing in any category under Criterion 5.

6.2.6 Criterion 6 – quantitative analysis showing probability of extinction

Insufficient data to determine eligibility under Criterion 6

	Category		
	Critically Endangered	**Endangered**	**Vulnerable**
A quantitative analysis shows that its probability of extinction, or extreme degradation over all of its geographic distribution, is:	at least 50% in the immediate future	at least 20% in the near future	at least 10% in the medium-term future
Timeframes	*10 years or 3 generations (Up to a maximum of 60 years)*	*20 years or 5 generations (Up to a maximum of 100 years)*	*50 years or 10 generations (Up to a maximum of 100 years)*

Source: TSSC 2017

Evidence:

Quantitative analysis of the probability of extinction or extreme degradation over all its geographic distribution has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the ecological community for listing in any category under this criterion.

6.3 Listing and Recovery Plan Recommendations

6.3.1 TSSC recommendations

The Threatened Species Scientific Committee recommends:

(i) that the list referred to in section 181 of the EPBC Act be amended by **including** the Grey box-grey gum wet forest of subtropical eastern Australia in the list in the **Endangered** category.

AND

(ii) that there not be a recovery plan for this ecological community at this time.

This recommendation is in accordance with the provisions of the EPBC Act and the Committee's conservation planning principles as follows:

- There are no significant complexities in conservation planning. The threats facing the ecological community are well-understood and the priority actions needed relate primarily to ongoing appropriate management of individual occurrences.
- There are no known occurrences on Commonwealth land.
- An approved conservation advice would be an effective, efficient and responsive document to guide the implementation of priority management actions, mitigate against key threats and support the recovery for this ecological community at the national level.
- Having regard to the above factors, a national recovery plan is not recommended as it would not provide a significant conservation planning benefit in addition to this Conservation Advice and other existing mechanisms.

Appendix A - Species lists

This Appendix lists the assemblage of native species that characterises the ecological community throughout its range at the time of listing, particularly characteristic and frequently occurring vascular plants at Scientific names annotated with # in Table 4 are species typically associated with dry vine-forests and related rainforest, thicket or scrub communities. Other rainforest species not on this list may also be present within the ecological community.

Table 4 and macroscopic animals at Table . The ecological community also includes fungi, cryptogamic plants and other species; however, these are relatively poorly documented.

The species listed may be abundant, rare, or not necessarily be present in any given patch of the ecological community, and other native species not listed here may be present. The total list of species that may be found in the ecological community is considerably larger than the species listed here.

Species presence and relative abundance varies naturally across the range of the ecological community based on factors such as historical biogeography, soil properties (e.g., moisture, chemical composition, texture, depth and drainage), topography, hydrology and climate. They also change over time, for example, in response to disturbance (by logging, fire, or grazing), or to the climate and weather (e.g., seasons, floods, drought and extreme heat or cold). The species recorded at a particular site can also be affected by sampling scale, season, effort and expertise. In general, the number of species recorded is likely to increase with the size of the site.

Scientific names used in this Appendix are nationally accepted names as per the Atlas of Living Australia, as at the time of writing.

A1 Flora

Scientific names annotated with # in Table 4 are species typically associated with dry vine-forests and related rainforest, thicket or scrub communities. Other rainforest species not on this list may also be present within the ecological community.

Table 4: Characteristic, frequently occurring or threatened flora

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Tree and shrub species				
Abutilon oxycarpum	flannel weed			
Acacia fimbriata	Brisbane wattle			
Acacia irrorata	green wattle			
Acacia leiocalyx subsp. *leiocalyx*	early black wattle			
Acacia maidenii	Maiden's wattle			
Acalypha nemorum	hairy acalypha			
Acronychia oblongifolia #	common acronychia			
Actephila mooreana #	actephila			

[16] Conservation status under the Environment Protection and Biodiversity Conservation Act 1999 at the time this document was prepared. See notes at end of table for further details.
[17] Conservation status under the NSW Biodiversity Conservation Act 2016 at the time this document was prepared. See notes at end of table for further details.
[18] Conservation status under the Qld Nature Conservation Act 2014 at the time this document was prepared. Blank = Least Concern or not listed. See notes at end of table for further details.

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Alchornea ilicifolia #	holly-wood			
Alectryon subcinereus #	wild quince			
Alectryon subdentatus f. *subdentatus #*	hard alectryon			
Alectryon tomentosus #	hairy alectryon			
Alphitonia excelsa	soap-tree			
Alyxia ruscifolia #	chain fruit			
Angophora subvelutina	rough-barked apple			
Aphananthe philippinensis #	rough-leaved elm			
Araucaria cunninghamii #	hoop pine			
Archirhodomyrtus beckleri #	rose myrtle			
Arytera divaricata #	coogera			
Astrotricha latifolia	flannel leaf/white star-hair			
Backhousia myrtifolia #	cinnamon myrtle			
Breynia oblongifolia	breynia			
Bridelia exaltata #	scrub ironbark			
Bursaria spinosa	bursaria			
Capparis arborea #	native caper			
Carronia multisepala #	carronia/pink-underwing moth vine			
Casearia multinervosa #	casearia			
Claoxylon australe #	brittlewood			
Corchorus cunninghamii #	native jute	E	E	E
Cordyline petiolaris #	broad-leaved palm-lily			
Cordyline rubra #	red-fruited palm-lily			
Cordyline stricta #	narrow-leaved palm-lily			
Corymbia intermedia	pink bloodwood			
Corymbia citriodora	spotted gum			
Croton acronychioides #	thick-leaved croton			
Croton insularis #	silver croton			
Croton verreauxii #	native cascarilla			
Cryptocarya floydii	Floyd's gorge laurel			NT
Cupaniopsis newmanii #	long-leaved tuckeroo			NT
Cupaniopsis parvifolia #	small-leaved tuckeroo			
Cupaniopsis tomentella	boonah tuckeroo	V		V
Denhamia bilocularis #	orange bark			
Denhamia pittosporoides subsp. *pittosporoides #*	veiny denhamia			
Denhamia silvestris #	narrow- leaved orange bark			
Diospyros australis #	yellow persimmon			
Diospyros pentamera #	grey ebony			
Dodonaea viscosa	sticky hop-bush			
Drypetes deplanchei #	yellow tulip			
Elaeodendron australe #	red olive-berry			
Endiandra virens #	white apple			
Eucalyptus acmenoides	white mahogany			
Eucalyptus biturbinata syn. *E. punctata*	grey gum			
Eucalyptus carnea	broad-leaved white mahogany			
Eucalyptus crebra	narrow-leaved grey ironbark			
Eucalyptus microcorys	tallow-wood			
Eucalyptus moluccana	grey box			
Eucalyptus propinqua	small-fruited grey gum			
Eucalyptus punctata syn. *E. biturbinata*	grey gum			
Eucalyptus rummeryi	steel Box			

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Eucalyptus siderophloia	grey ironbark			
Eucalyptus tereticornis	river red gum			
Eupomatia bennettii #	small bolwarra			
Euroschinus falcata #	ribbonwood			
Excoecaria dallachyana #	blind your eye			
Geijera salicifolia var. *latifolia #*	broad-leaved scrub wilga			
Geijera salicifolia var. *salicifolia #*	scrub wilga			
Gossia acmenoides #	ironwood			
Gossia bidwillii #	python tree			
Guilfoylia monostylis #	guilfoylia			
Guioa semiglauca #	guoia			
Harnieria hygrophiloides	white karambal		E	
Hibiscus heterophyllus #	native rosella			
Hymenosporum flavum #	native frangipani			
Indigofera australis	native indigo			
Jagera pseudorhus #	jagera/foam bark			
Leucopogon ericoides	heath-leaved beard heath			
Leucopogon juniperinus	prickly beard heath			
Lophostemon confertus	brush-box			
Mallotus claoxyloides #	green kamahla			
Mallotus philippensis #	red kamahla			
Melaleuca salicina syn. *Callistemon salignus #*	willow bottlebrush			
Melicope micrococca #	doughwood			
Muellerina myrtifolia	myrtle-leaved mistletoe		E	NT
Myoporum betcheanum	mountain boobialla			
Myoporum montanum	boobialla			
Myrsine richmondensis	Richmond Range muttonwood	E	E	
Myrsine variabilis #	muttonwood			
Notelaea longifolia #	long-leaved mock-olive			
Olearia stellulata	starry daisy-bush			
Owenia cepiodora	onion cedar	V	V	V
Persicaria elatior	tall knot-weed	V	V	V
Phaleria chermsideana #	scrub daphne			
Pimelea ligustrina	tall rice-flower			
Pimelea neo-anglica	new england pimelea			
Pittosporum lancifolium #	narrow-leaved orange-thorn			
Pittosporum multiflorum #	orange-thorn			
Pittosporum revolutum #	hairy pittosporum			
Pittosporum undulatum #	native mock-orange			
Polyscias elegans #	celerywood			
Psychotria daphnoides #	smooth psychotria			
Psychotria simmondsiana #	creeping psychotria			
Psydrax odorata #	shiny-leaved canthium			
Rhodamnia rubescens #	scrub turpentine	CE	CE	CE
Rhodomyrtus psidioides #	native guava	CE	CE	CE
Rubus rosifolius #	native strawberry			
Sarcomelicope simplicifolia subsp. *simplicifolia #*	yellow aspen			
Sida platycalyx	sida			
Solanum hapalum	furry nightshade			
Solanum limitare	border-ranges nightshade		E	
Solanum stelligerum	devil's needles			
Sophora fraseri	brush sophora	V	V	V
Tabernaemontana pandacaqui	banana bush			

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Trema tomentosa var. *aspera*	poison-peach			
Wikstroemia indica #	bootlace bark			
Wilkiea hugeliana #	veiny wilkiea			
Fern species				
Adiantum aethiopicum #	maidenhair fern			
Adiantum formosum	tall maidenhair fern			
Adiantum hispidulum	rough maidenhair fern			
Arachniodes aristata	prickly shield fern			
Asplenium australasicum	crow's nest fern			
Asplenium polyodon	mare's tail fern			
Blechnum neohollandicum syn. *Doodia aspera*	rasp fern			
Davallia solida var. *pyxidata*	hare's-foot fern			
Dictymia brownii #	strap fern			
Lastreopsis acuminata	shiny shield-fern			
Lastreopsis decomposita	trim shield fern			
Pellaea falcata #	sickle fern			
Pellaea paradoxa #	heart fern			
Platycerium bifurcatum #	elkhorn			
Platycerium superbum #	staghorn			
Pteris tremula	jungle brake			
Pyrrosia confluens var. *confluens*	robber fern			
Pyrrosia rupestris	robber fern/rock felt fern			
Graminoid species				
Aristida gracilipes	slender spear-grass			
Austrostipa ramosissima	stout bamboo grass			
Carex breviculmis	short-stemmed sedge			
Carex hubbardii	Hubbard's sedge			
Cymbopogon refractus	barbed-wire grass			
Cyperus enervis	a sedge			
Cyperus gracilis #	slender flat-sedge			
Cyperus polystachyos	bunchy sedge			
Dianella caerulea #	blue flax-lily			
Entolasia stricta	entolasia			
Gahnia aspera #	sword sedge			
Gahnia melanocarpa	black-fruited saw-sedge			
Imperata cylindrica	blady grass			
Lepidosperma laterale	variable sword sedge			
Lomandra filiformis	wattle matt-rush			
Lomandra longifolia	long-leaved matt-rush			
Lomandra multiflora subsp. *multiflora*	many-flowered matt-rush			
Lomandra spicata #	rainforest lomandra			
Microlaena stipoides	weeping grass			
Oplismenus aemulus #	basket grass			
Oplismenus imbecillis #	purple basket grass			
Ottochloa gracillima #	pademelon grass			
Panicum pygmaeum #	pygmy panic			
Paspalidium distans	shot grass			
Poa labillardierei var. *labillardierei*	tussock			
Schoenus apogon	common bog-rush			
Scleria mackaviensis	tufted scleria sedge			
Sorghum leiocladum	native sorghum			
Themeda triandra	kangaroo grass			

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Herbs and Forbs				
Aneilema biflorum #	aneilema			
Brunoniella australis	blue trumpet			
Dysphania carinata syn. *Chenopodium carinatum*	green crumbweed			
Commelina cyanea	native commelina			
Desmodium rhytidophyllum	hairy tick-trefoil			
Dianella brevipedunculata	divaricate flax-lily			
Dichondra repens #	kidney weed			
Einadia hastata	ruby saltbush			
Gymnostachys anceps #	settlers flax			
Pigea stellariodes syn. *Hybanthus stellarioides*	spade-flower			
Lobelia purpurascens	white-root			
Nyssanthes diffusa #	barbed-wire shrub			
Oxalis chnoodes	native wood-sorrel			
Peperomia leptostachya#	native peperomia			
Peperomia tetraphylla #	four-leaved peperomia			
Phyllanthus similis	small phyllanthus			
Plectranthus parviflorus syn. *Coleus australis*	native Coleus/little spur-flower			
Pseuderanthemum variabile	love flower			
Sigesbeckia orientalis subsp. *orientalis*	Indian weed			
Solanum prinophyllum	prickly nightshade			
Swainsona galegifolia	smooth darling pea			
Thesium australe	austral toad-flax	V	V	V
Tripladenia cunninghamii	tripladenia			
Cyanthillium cinereum	iron weed			
Veronica plebeia	trailing speedwell			
Viola hederacea	native violet			
Vines and Lianas				
Aphanopetalum resinosum #	gum vine			
Austrosteenisia blackii var. *blackii #*	blood vine			
Callerya megasperma #	native wisteria			
Capparis sarmentosa #	scrambling caper			
Cayratia clematidea #	bushy water vine			
Celastrus subspicatus #	large-leaved staff vine			
Cissus antarctica #	kangaroo vine			
Cissus hypoglauca #	five leaved water vine			
Clematicissus opaca #	pepper vine			
Clematis fawcettii #	stream clematis	V	V	V
Clematis glycinoides #	headache vine			
Cynanchum elegans syn. *Vincetoxicum elegans #*	domin/white-flowered wax plant	E	E	
Desmodium varians	slender tick trefoil			
Dioscorea transversa #	common yam vine			
Embelia australiana #	embelia			
Eustrephus latifolius #	orange vine			
Geitnoplesium cymosum #	climbing lily			
Glycine clandestina	glycine			
Gynochthoes jasminoides #	shiny leaved morinda			

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Jasminum simplicifolium subsp. *australiense* syn. *Jasminum volubile #*	stiff jasmine			
Legnephora moorei #	round leafed vine			
Leichardtia coronate syn. *Marsdenia coronata*	slender milk-vine			V
Leichardtia flavescens syn. *Marsdenia flavescens #*	hairy milk-vine			
Leichardtia llyodii syn. *Marsdenia llyodii #*	slender marsdenia			
Leichardtia longiloba syn. *Marsdenia longiloba #*	slender marsdenia	V	E	V
Leichardtia rostrata syn. *Marsdenia rostrata #*	native milk vine			
Maclura cochinchinensis #	cock's spur			
Muehlenbeckia gracillima #	climbing lignum			
Pandorea baileyana #	Bailey's wonga vine			
Pandorea jasminoides #	bower of beauty			
Pandorea pandorana #	wonga vine			
Parsonsia lanceolata #	northern silk-pod			
Parsonsia longipetiolata #	green-leaved silk-pod			
Parsonsia rotata #	veinless silk-pod			
Parsonsia straminea	monkey-rope vine			
Parsonsia velutina #	hairy silkpod			
Passiflora herbertiana subsp. *herbertiana #*	native passionfruit			
Petermannia cirrosa #	petermannia			
Rhynchosia acuminatissima #	rycho		V	
Ripogonum album #	white supplejack			
Ripogonum brevifolium #	small-leaved supplejack			
Rubus moluccanus #	molucca raspberry			
Sarcopetalum harveyanum #	big-leaf vine			
Secamone elliptica #	corky milk vine			
Smilax australis #	austral sarsaparilla			
Solori involuta syn. *Derris involuta #*	native derris			
Stephania japonica var. *discolor #*	snake vine			
Tetrastigma nitens #	native grape			
Tinospora smilacina #	snake vine		E	
Tinospora tinosporoides syn. *Fawcettia tinosporoides #*	arrow-head vine		V	V
Tragia novae-hollandiae #	stinging vine			
Trophis scandens subsp. *Scandens #*	burny vine			
Vincetoxicum grandiflorum #	small-leaved tylophora			
Vincetoxicum paniculata #	thin leaved tylophora			
Uvaria leichhardtii #	acid drop vine			
Orchids				
Bulbophyllum globuliforme #		V	V	NT
Bulbophyllum weinthalii subsp. *weinthalii*				V
Cymbidium madidum #	giant boat-lip orchid			
Cymbidium suave #	snake orchid			
Dendrobium aemulum #	box orchid/ironbark feather orchid			
Dockrillia fairfaxii syn. *Dendrobium fairfaxii #*	rat's tail orchid			

Scientific name	Common name/s	EPBC status[16]	NSW status[17]	Qld status[18]
Dendrobium gracilicaule #	blotched cane orchid			
Dendrobium kingianum #	lily-of-the-valley orchid/pink rock-orchid			
Dockrillia schoenina syn. *Dendrobium schoeninum #*	pencil orchid			
Dendrobium speciosum #	king orchid			
Dendrobium speciosum subsp. *hillii syn. Dendrobium taberi #*	pale king orchid			
Dockrillia teretifolia syn. *Dendrobium teretifolium #*	bridal veil orchid			
Plectorrhiza tridentata #	tangle orchid			
Rhinnerrhiza divitiflora	raspy root orchid			
Sarcochilus hillii #	myrtle bells			
Sarcochilus weinthalii#	blotched sarcochilus	V	V	E
Notes – EPBC Status refers to a species conservation status under the Environmental Protection Biodiversity Conservation Act 1999, NSW status refers to a species conservation status under the NSW Biodiversity Conservation Act 2016, Qld Status refers to a species conservation status under the Qld Nature Conservation Act 2014, at the time this document was prepared**. CE=critically endangered, E=Endangered, V=Vulnerable, Blank=not listed or in Qld either not listed or listed as Least Concern**				

Sources: EPA 2016; DPIE 2021; L Weber 2021, Pers Comm Aug 15, Feb 21; NSW TSSC 2011; OEH 2012; Appendix 8; ID Guide GBGGWSF NSW OEH.

A2 Fauna

Table 5: Fauna recorded in the ecological community

Scientific name	Common name/s	EPBC status[19]	NSW Status[20]	Qld Status[21]
Mammals and monotremes				
Aepyprymnus rufescens	rufous bettong		V	
Cercartetus nanus	eastern pygmy-possum		V	
Chalinolobus dwyeri	large-eared pied bat	V	V	V
Chalinolobus nigrogriseus	hoary wattled bat		V	
Dasyurus maculatus	spotted-tailed quoll	E	V	E
Falsistrellus tasmaniensis	eastern false pipistrelle		V	
Notaacropus dorsalis	black-striped wallaby		E	
Notamacropus parma	parma wallaby		V	
Micronomus norfolkensis	eastern coastal free-tailed bat		V	
Miniopteris orianae oceanensis	large bentwing-bat		V	
Miniopterus australis	little bentwing-bat		V	
Myotis macropus	southern myotis		V	

[19] Conservation status under the Environment Protection and Biodiversity Conservation Act 1999 at the time this document was prepared. See notes at end of table for further details.

[20] Conservation status under the NSW Biodiversity Conservation Act 2016 at the time this document was prepared. See notes at end of table for further details.

[21] Conservation status under the Qld Nature Conservation Act 2014 at the time this document was prepared. Blank = Least Concern or not listed. See notes at end of table for further details.

Scientific name	Common name/s	EPBC status[19]	NSW Status[20]	Qld Status[21]
Nyctimene robinsoni	eastern tube-nosed bat		V	
Nyctophilus bifax	eastern long-eared bat		V	
Ozimops lumsdenae	northern free-tailed bat		V	
Petauroides volans	greater glider	V		V
Petaurus australis	yellow-bellied glider		V	
Petaurus norfolcensis	squirrel glider		V	
Petrogale penicillata	brush-tailed rock-wallaby	V	E	V
Phascogale tapoatafa	brush-tailed phascogale		V	
Phascolarctos cinereus	koala	E (population)	V	V
Phoniscus papuensis	golden-tipped bat		V	
Planigale maculata	common planigale		V	
Potorous tridactylus	long-nosed potoroo	V	V	V
Pseudomys oralis	Hastings River mouse	E	E	E
Pteropus poliocephalus	grey-headed flying-fox	V	V	
Scoteanax rueppellii	greater broad-nosed bat		V	
Syconycteris australis	common blossom-bat		V	
Thylogale stigmatica	red-legged pademelon		V	
Thylogale thetis	red-necked pademelon			
Birds				
Amaurornis moluccana	pale-vented bush-hen	marine	V	
Artamus cyanopterus	dusky woodswallow		V	
Atrichornis rufescens	rufous scrub-bird	E	V	V
Burhinus grallarius	bush stone-curlew		E	V
Calyptorhynchus banksii banksii	red-tailed black-cockatoo (coastal) subspecies)		CE	
Calyptorhynchus lathamii	glossy black cockatoo		V	V
Climacteris picumnus victoriae	brown treecreeper (eastern subspecies)		V	
Coracina lineata	barred cuckoo-shrike		V	
Pyrrholaemus sagittata	speckled warbler		V	
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	E	CE	E
Daphoenositta chrysoptera	varied sittella		V	
Dasyornis brachypterus	eastern bristlebird		E	E
Ephippiorhynchus asiaticus	black-necked stork		E	
Erythrotriorchis radiatus	red goshawk	V	CE	E
Paryipsitta pusilla	little lorikeet		V	

Scientific name	Common name/s	EPBC status[19]	NSW Status[20]	Qld Status[21]
Grantiella picta	painted honeyeater	V	V	V
Hieraaetus morphnoides	little eagle		V	
Hirundapus caudacutus	white-throated needletail	V, marine, migratory		V
Ixobrychus flavicollis	black bittern		V	
Lathamus discolor	swift parrot	CE, marine	E	E
Lophoictinia isura	square-tailed kite		V	
Melanodryas cucullata	hooded robin (south-eastern form)		V	
Menura alberti	Albert's lyrebird		V	NT
Menura novaehollandiae	superb lyrebird			
Ninox connivens	barking owl		V	
Ninox strenua	powerful owl		V	V
Pachycephala olivacea	olive Whistler		V	
Petroica phoenicea	flame robin	marine	V	
Podargus ocellatus	marbled frogmouth		V	
Ptilinopus magnificus	wompoo fruit dove		V	
Ptilinopus regina	rose crowned fruit dove		V	
Ptilinopus superbus	superb fruit-dove	marine	V	
Turnix melanogaster	black-breasted button-quail	V	CE	V
Tyto novaehollandiae	masked owl		V	
Tyto tenebricosa	sooty owl		V	
Amphibians				
Assa darlingtoni	pouched frog		V	
Litoria brevipalmata	green-thighed frog		V	
Litoria piperata	peppered tree frog	V	CE	
Litoria subglandulosa	glandular frog		V	V
Mixophyes balbus	stuttering barred frog	V	E	
Mixophyes fleayi	Fleay's barred frog	E	E	E
Mixophyes iteratus	giant barred frog	V	E	V
Philoria kundagungan	mountain frog	E	E	E
Philoria loveridgei	masked mountain frog		E	
Philoria pughi	Pugh’s frog		E	
Philoria richmondensis	Richmond Range sphagnum frog	E	E	
Philoria sphagnicolus	sphagnum frog		V	
Reptiles				

Scientific name	Common name/s	EPBC status[19]	NSW Status[20]	Qld Status[21]
Coeranoscincus reticulatus	three-toed snake-tooth skink	V	V	
Hoplocephalus bitorquatus	pale-headed snake		V	
Hoplocephalus stephensii	stephen's banded snake		V	
Invertebrates				
Nurus atlas	atlas rainforest ground-beetle		E	
Nurus brevis	shorter rainforest ground-beetle		E	
Ornithoptera richmondia	richmond birdwing butterfly			V
Phyllodes imperialis smithersi	southern pink underwing moth	E	E	E

Notes – EPBC Status refers to a species conservation status under the Environmental Protection Biodiversity Conservation Act (EPBC Act), NSW status refers to a species conservation status under the NSW Biodiversity Conservation Act 2016, Qld Status refers to a species conservation status under the Qld Nature Conservation Act 2014, at the time this document was prepared. **CE=critically endangered, E=Endangered, V=Vulnerable, Blank=not listed or in Qld listed as Least Concern**

Sources: NSW TSSC 2011; Atlas of Living Australia 2021; NSW Government 2019

Appendix B - Relationship to other vegetation classification and mapping systems

Ecological communities are complex to classify. States and Territories apply their own systems to classify vegetation communities. Reference to vegetation and mapping units as equivalent to the ecological community, at the time of listing, should be taken as indicative rather than definitive. A unit that is generally equivalent may include elements that do not meet the key diagnostics and minimum condition thresholds. Conversely, areas mapped or described as other units may sometimes meet the key diagnostics for the ecological community. Judgement of whether the ecological community is present at a particular site should focus on how the site meets the description (section1.2), the key diagnostic characteristics (section 2.1) and minimum condition thresholds (section 2.3).

State vegetation mapping units are not the ecological community being listed. However, for many sites (but not all) certain vegetation map units will correspond sufficiently to provide indicative mapping for the national ecological community, where the description matches.

Table 5 outlines the common mapping units that most closely align with the description of the ecological community. Table 6 outlines similar mapping units that occur in close proximity but are unlikely to represent the ecological community.

On-ground assessment is vital to finally determine if any patch is part of the ecological community.

Table 5: State mapping units or vegetation classifications that in are most likely to be the ecological community, in whole or in part.

Code / Number	Name	Classification System	Notes
FE62	*Grey Box-Northern Grey Gum*	***Vegetation Map for the Northern Rivers CMA VIS_ID 524*** *(Eco Logical 2005)*	This map unit is considered equivalent to the NSW TEC the ecological community is based on. It is an integration of the forest ecosystem model and API coverage (NPWS 1999a, 2001) undertaken for the Comprehensive Regional Assessment.
PCT 3069 (NSW)	*Far North Hinterland Grey Box- Grey Gum Wet Forest*	***NSW PCT Classification*** *(DPIE 2021)*	This PCT is considered to be the closest matching PCT to the ecological community and largely equivalent.
PCT 3233 (NSW)	*Far North Hinterland Grey Gum Grassy Forest*	***NSW PCT Classification*** *(DPIE 2021)*	This PCT occurs in close association with PCT 3069. Areas or patches of this PCT may be the ecological community where they meet the key diagnostic criteria.

Code / Number	Name	Classification System	Notes
RE 12.9-10.3 (Qld)	*Eucalyptus moluccana* open forest on sedimentary rocks	***Regional Ecosystem Classification QLD*** *(Queensland Herbarium 2021)*	Areas or patches of this RE may be the ecological community where they meet the key diagnostic criteria.
RE 12.8.14a (Qld)	*Eucalyptus moluccana* open forest +/- *E. tereticornis, E. siderophloia* or *E. crebra.*	***Regional Ecosystem Classification QLD*** *(Queensland Herbarium 2021)*	Areas or patches of this RE may be the ecological community where they meet the key diagnostic criteria.
RE 12.8.8a (Qld)	*Eucalyptus siderophloia, E. microcorys, Corymbia intermedia +/- E. propinqua, E. carnea* open forest on Cainozoic igneous rocks.	***Regional Ecosystem Classification QLD*** *(Queensland Herbarium 2021)*	Areas or patches of this RE may be the ecological community where they meet the key diagnostic criteria.
1000-1665	*Grey Gum - Grey Box - Hoop Pine shrubby open forest on hinterland hills of the Richmond and Clarence catchments*	***Vegetation Classification for the Northern Rivers Catchment Management Area of New South Wales*** *NSW Office of Environment and Heritage 2012*	
171	*Grey Box - Small-fruited Grey Gum shrubby forest of the far north of the North Coast*	***Review of Biometric Vegetation Type Names and Species Information in the PVP Developer*** *– EcoLogical 2007 NSW Office of Environment and Heritage 2012*	
81	*Grey Box - Northern Grey Gum*	***Forest Types in New South Wales*** *Forestry Commission of N.S.W. Baur 1965*	
PCT 857	*Grey Box - Small Fruited Grey Gum shrubby forest of the far north of NSW North Coast Bioregion*	***PVP Developer - NSW Catchment Management Authority*** *Equivalent to Forest Ecosystem 81 above*	

Table 6: Key features distinguishing Grey box-grey gum wet forest from other vegetation types/mapping units that may be adjacent to or occur near the ecological community.

Code / Number	Name	Key Distinguishing Features
PCT 3070 (NSW) *PCT 3003 (NSW)*	Far North Hinterland Kamala-Coogera Dry Rainforest Border Ranges Black Booyong Subtropical Rainforest	• Has a closed canopy with Eucalypts absent or in very low densities in canopy or as emergents. • Has a diverse canopy of broad-leaved fire-sensitive rainforest flora.

Code / Number	Name	Key Distinguishing Features
PCT 3251 (NSW) PCT 3456 (NSW) PCT 3465 (NSW) PCT 3466 (NSW) PCT 3422 (NSW)	Northern Gorges Diverse Grassy Forest Clarence Gorges Grey Gum-Ironbark Grassy Forest Northern Gorges Red Gum Grassy Forest Northern Gorges Red Gum-Stringybark Forest Clarence Sandstone Rises Spotted Gum Grassy Forest	• Has a sparse mid-stratum that almost always includes one or more *Allocasuarina* spp. +/- one or more *Acacia* species • Has a dense to mid-dense grassy ground layer including shade intolerant grasses, forbs and twiners such as Themeda *triandra, Vernonia cinerea* and *Desmodium* spp.
PCT 3420 (NSW)	Clarence Lowland Ironbark-Spotted Gum Grassy Forest	• Has a sparse mid-stratum of small trees including *Alphitonia excelsa* and almost always, Acacia spp., commonly including *Acacia concurens* • Has a mid-dense ground layer typically including shade intolerant grasses, forbs, twiners and vines. *Imperata cylindrica* is almost always present with Lobelia purpurascens*, Eustrephus latifolius, Vernonia cinerea, Themeda triandra* and *Entolasia stricta* very frequent. • Occurs below 80 metres ASL
PCT 3329 (NSW) PCT 3312 (NSW)	Northern Hinterland Valleys Red Gum Grassy Forest Acacia Creek Grassy Forest	• The canopy almost always includes red gums (*Eucalyptus tereticornis* or *Eucalyptus amplifolia*). • The mid-stratum very frequently includes acacias of which *Acacia implexa* or *Acacia melanoxylon* are most frequent, • The mid-dense to dense ground layer is mainly comprised of shade intolerant grasses, soft-leaved forbs, twiners +/- hardy ferns,
PCT 3322 (NSW)	Far North Ranges Red Gum Grassy Forest	• The canopy very frequently includes *Eucalyptus tereticornis, Corymbia intermedia* and *Eucalyptus microcorys*, commonly associated with *Acacia melanoxylon* and *Angophora subvelutina*. • The shrub layer is sparse with scattered individuals of *Breynia oblongifolia* being very frequent. • The dense ground layer is typically comprised of shade intolerant grasses, twiners, forbs, ferns and vines.
PCT 3323 (NSW)	Far North Lowland Basalt Grassy Forest	• *Corymbia intermedia* is very frequent in the canopy, commonly in association with *Eucalyptus tereticornis*. • Has a sparse small tree and shrub layer • The mid-dense ground layer is typically composed of grasses, twiners, forbs, ferns and vines, almost always including *Imperata cylindrica*, *Geitonoplesium cymosum*, *Oplismenus aemulus* and *Lobelia purpurascens*
QLD RE 12.3.7	Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp. fringing woodland	• Occurs on alluvium on fringing levees and banks of rivers and drainage lines of alluvial plains. • Canopy dominated by *Eucalyptus tereticornis* and *Casuarina cunninghamiana* • Note: other forests on alluvial floodplains (landzone 3) are typically excluded from the ecological community

Code / Number	Name	Key Distinguishing Features
QLD RE 12.9-10.15	Semi-evergreen vine thicket with Brachychiton rupestris on sedimentary rocks	• *Eucalyptus* species are typically absent or rare in the canopy
QLD RE's 12.8.17 12.9-10.19 12.9-10.2 12.9-10.7	Eucalyptus melanophloia +/- E. crebra, E. tereticornis, Corymbia tessellaris woodland on Cainozoic igneous rocks Eucalyptus fibrosa subsp. fibrosa woodland on sedimentary rocks Corymbia citriodora subsp. variegata +/- Eucalyptus crebra open forest on sedimentary rocks Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp. and E. melanophloia woodland on sedimentary rocks	• *Eucalyptus* species differ from the characteristic species of the ecological community • Understorey typically open and grassy and lacks significant cover of drier vine-forest species
QLD RE *12.11.2*	*Eucalyptus saligna* or *E. grandis*, *E. microcorys*, *Lophostemon confertus* tall open forest on metamorphics +/- interbedded volcanics	• The **wet sclerophyll** canopy is a tall open forest dominated by *Eucalyptus saligna* or *E. grandis,* alongside *Lophostemon confertus*. If *E. dunnii* is present, it's usually in low abundance and is never dominant. • Occurs on Palaeozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics (not basalt derived).
12.8.11	Eucalyptus dunnii tall open forest on Cainozoic igneous rocks	• Has a tree canopy with Eucalyptus dunnii either as a dominant or co-dominant with E. saligna, E. grandis, E. microcorys and/or Lophostemon confertus.

Sources: ***NSW PCT Classification*** *(DPIE 2021);* ***Regional Ecosystem Classification QLD*** *(Queensland Herbarium 2021)*

Appendix C – Indigenous language names associated with the ecological community

This brief glossary of terms refers to a selection of biota known from Grey box-grey gum wet forest in languages deriving from various Indigenous language groups across the contemporary distribution of the ecological community. This glossary is not exhaustive and does not attempt to reflect the extant diversity or richness of relevant Language terms; however, it aims to acknowledge some of the terms by which these flora and fauna of the ecological community were expressed in Indigenous Languages. This information does not cover all language, dialect and cultural groups from the country where the Grey box-grey gum wet forest occurs.

Table 7: Indigenous language names for a selection of biota known from the Grey box grey gum wet forest

Scientific name	Common name	Name (Language Group)
Calyptorhynchus spp.	Yellow-tailed black-cockatoo; and Glossy black cockatoo	Baleirei (Yugambeh)
Petauroides spp., *Petaurus* spp., *+- Acrobates* spp.	Gliders	Balling (Birpai)
Themeda triandra	Kangaroo grass	Banbun (Bundjalung)
Order: LEPIDOPTERA	Butterflies/Moths	Bandjalahm (Bundjalung)
Dasyurus maculatus	Spotted-tailed quoll	Bandjim/ Banydjim (Bundjalung)
Phascolarctos cinereus	Koala	Bandurbah/ Dndjur/ Burbi (Bundjalung)
Aepyprymnus rufescens	Rufous bettong	Barol (Yugambeh)
Imperata cylindrica	Blady grass	Barul (Yugambeh)Baruhl (Bundjalung, Gold Coast Tweed dialect)
Orders: CHIROPTERA & MEGACHIROPTERA	Bats	Girra'man (Kabi Kabi); Bilin (Yugambeh)
Angophora subvelutina	Rough-barked apple	Bubu, buyi-buyi, bulbu (Bundjalung)
Passiflora herbertiana subsp. herbertiana #	Native passionfruit	Bungguhm (Wild Passionfruit, generic - Bundjalung)
Acacia spp.	Wattles	Buygun (Bundjalung)
Tetrastigma nitens	Native grape	Cangervan (Grape - Birpai)
Alpinia caerulea	Native ginger	Dargahn (Bundjalung, Upper Clarence dialect)
Eucalyptus spp., *Corymbia* spp.	Gum trees	Dayrabay (Bundjalung); Balugam (Bundjalung, unknown dialect)
Corymbia variegata	Spotted gum	Dayrabay (Gum Tree generic - Bundjalung); Dayrabay (Gum Tree generic - Bundjalung); Balugam (Gum Tree generic - Bundjalung, unknown dialect); Barbum (Grey or Spotted Gum - Bundjalung)
Eucalyptus siderophloia	Grey iron bark	Dayrabay (Gum Tree, generic - Bundjalung); Dayrabay (Gum Tree generic - Bundjalung); Balugam (Gum Tree generic - Bundjalung, unknown dialect); Bigar (Grey Ironbark - Bundjalung, Gold Coast Tweed dialect)

Turnix melanogaster	Black-breasted button-quail	Dulung (Quail, generic - Yugambeh)
Platycerium superbum	Staghorn	Dumbin (Bundjalung)
Phascolarctos cinereus	Koala	Dumbirrbi (Yugara); Borobi (Yugambeh)
Indigofera australis	Native indigo	Duwabili (D'harawal)
Clematis glycinoides	Headache vine	Guwalyari (D'harawal)
Menura alberti	Albert's lyrebird	Kalbun (Yugambeh)Galbuny (Bundjalung, Upper Clarence dialect); Galwuny/ Galbuny (Bundjalung, Gold Coast Tweed dialect)
Ninox spp. and *Tyto* spp.	Owls	Karang (Yugambeh)
Thylogale stigmatica	Red-legged pademelon	Kumang (Pademelon, generic - Yugarapul); Bahndum (Bandjalung, Upper Clarence dialect); Biyam (Pademelon - Bundjalung, Gold Coast Tweed dialect)
Hieraaetus morphnoides	Little eagle	Mibunn (Yugambeh)
Acmena smithii Syn: Syzygium smithii	Lilly pilly	Midjuburi (Cadigal)
Family: POACEAE	Grasses	Budjuy (Bundjalung, Low Richmond dialect); Ban (Succulent grass, generic – Waka Waka); Bar-rail (Bladey grass – Waka Waka)
Lophostemon confertus	Brush-box	Tabilpurra (Yugurapul); Gurayir (Bundjalung)
Allocasuarina torulosa	Forest oak	Werrie (Githabul)
Dichondra repens	Dichondra	Yilibili (D'harawal)

Source: Branch 1887; Watson 1943; Jolly 1994; Allen & Lane 2013

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Version history table

Document type	Title	Date [dd mm yyyy]
Consultation draft	Draft Conservation Advice for the Grey box (*Eucalyptus moluccana*) – Grey Gum (*Eucalyptus propinqua*) Wet Forest of Subtropical Eastern Australia	10 12 2021
Approved conservation advice	Approved Conservation Advice for Grey box-grey gum wet forest of subtropical eastern Australia	11 08 2022