

Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list the Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions as a CRITICALLY ENDANGERED ECOLOGICAL COMMUNITY in Part 1 of Schedule 2 of the Act, and to remove the Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions from Part 2 of Schedule 2. Listing of ecological communities is provided for in Part 4 of the Act.

Summary of Conservation Assessment

Werriwa Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions is eligible for listing as Critically endangered under Clauses 4.9 (a), 4.11 (a) and 4.12 (a) because the community has: i) undergone a very large reduction in geographic distribution; ii) experienced a very large degree of environmental degradation; and iii) experienced a very large disruption of biotic processes and interactions.

This determination contains the following information:

- Parts 1 & 2:** Section 1.6 of the Act defines an ecological community as “an assemblage of species occupying a particular area”. These features of Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions are described in Parts 1 and 2 of this Determination, respectively.
- Part 3:** Part 3 of this Determination describes the eligibility for listing of this ecological community in Part 1 of Schedule 2 of the Act according to criteria prescribed by the *Biodiversity Conservation Regulation 2017*.
- Part 4:** Part 4 of this Determination provides additional information intended to aid recognition of this community in the field.

Part 1. Assemblage of species

- 1.1 Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions (hereafter referred to as the Werriwa Tablelands Cool Temperate Grassy Woodland) is characterised by the assemblage of species listed below.

<i>Acaena ovina</i>	<i>Aristida ramosa</i>
<i>Asperula conferta</i>	<i>Austrostipa bigeniculata</i>
<i>Bothriochloa macra</i>	<i>Calocephalus citreus</i>
<i>Carex inversa</i>	<i>Chrysocephalum apiculatum</i>
<i>Convolvulus erubescens</i>	<i>Desmodium varians</i>
<i>Dichelachne micrantha</i>	<i>Elymus scaber</i>

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<i>Eryngium ovinum</i>	<i>Eucalyptus pauciflora</i>
<i>Eucalyptus rubida</i> subsp. <i>rubida</i>	<i>Gonocarpus tetragynus</i>
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	<i>Haloragis heterophylla</i>
<i>Goodenia pinnatifida</i>	<i>Hypericum gramineum</i>
<i>Hydrocotyle laxiflora</i>	<i>Leptorhynchos squamatus</i>
<i>Juncus filicaulis</i>	<i>Microlaena stipoides</i> var. <i>stipoides</i>
<i>Lomandra filiformis</i>	<i>Panicum effusum</i>
<i>Oxalis perennans</i>	<i>Poa sieberiana</i>
<i>Plantago varia</i>	<i>Rytidosperma</i> spp.
<i>Schoenus apogon</i>	<i>Solenogyne dominii</i>
<i>Themeda triandra</i>	<i>Tricoryne elatior</i>
<i>Triptilodiscus pygmaeus</i>	<i>Vittadinia muelleri</i>

- 1.2 The total species list of the community across all occurrences is likely to be considerably larger than that given above. Due to variation across the range of the community, not all of the above species are present at every site and many sites may also contain species not listed above.

Characteristic species may be abundant or rare and comprise only a subset of the complete list of species recorded in known examples of the community. Some characteristic species show a high fidelity (are relatively restricted) to the community, but may also occur in other communities, while others are more typically found in a range of communities.

The number and identity of species recorded at a site is a function of sampling scale and effort. In general, the number of species recorded is likely to increase with the size of the site and there is a greater possibility of recording species that are rare in the landscape.

Species presence and relative abundance (dominance) will vary from site to site as a function of environmental factors such as soil properties (chemical composition, texture, depth, drainage), topography, climate and through time as a function of disturbance (e.g. fire, logging, grazing) and weather (e.g. flooding, drought, extreme heat or cold).

At any one time, above ground individuals of some species may be absent but the species may be represented below ground in the soil seed bank or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers.

The species listed above are vascular plants, however the community also includes micro-organisms, fungi and cryptogamic plants as well as vertebrate and invertebrate fauna. These components of the community are less well documented.

Part 2. Particular area occupied by the ecological community

- 2.2 The assemblage of species listed in Part 1.1 above which characterises the Werriwa Tablelands Cool Temperate Grassy Woodland occurs within the South Eastern Highlands and South East Corner Bioregions. These bioregions are defined by SEWPaC (2012) Interim Biogeographic Regionalisation for Australia, Version 7. Department of Sustainability, Environment, Water, Population and Communities.

<http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/maps.html>

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- 2.3 It is the intent of the NSW Threatened Species Scientific Committee that all occurrences of the ecological community (both recorded and as yet unrecorded, and independent of their condition) that occur within these bioregions be covered by this Determination.

Part 3. Eligibility for listing

3.1 Reasons for determining eligibility for listing

3.1.1 Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions is part of the broadly circumscribed Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions which was listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995*. Since that listing, new data have become available and the NSW Threatened Species Scientific Committee has undertaken a review of the conservation status of the ecological community to inform the current listing status under the Act.

3.1.2 Werriwa Tablelands Cool Temperate Grassy Woodland is one of several related plant communities (*sensu* Keith 2004) which collectively comprised Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland. Although these related communities share many structural and compositional attributes, more recent analyses have demonstrated they occur in different environments, comprise distinct assemblages of species and differ in the extent to which they are affected by the threats listed in Sections 3.1.4–3.1.11. As a consequence, the NSW Threatened Species Scientific Committee has determined that it is not appropriate to include all of these related communities under a single ecological community.

3.1.3 Werriwa Tablelands Cool Temperate Grassy Woodland includes Frost Hollow Grassy Woodland (GWp22) of Tozer *et al.* (2010) where it occurs north of the Monaro Tableland, Snow Gum Mid-high Grassy Woodland of the South Eastern Highlands Bioregion (u78) of Armstrong *et al.* (2013), Tablelands and Slopes Herb/Grassland/ Woodland (vg153) of Gellie (2005) and those parts of Tableland Herb/Grassland (vg152) of Gellie (2005) that comprise secondary grasslands. It is the intention of the NSW Threatened Species Scientific Committee that secondary grasslands derived from any of the communities described above are covered by this Determination. Parts of other vegetation types described by Gellie (2005) may correspond to Werriwa Tablelands Cool Temperate Grassy Woodland but only where they overlap in definition with Frost Hollow Grassy Woodland (GWp22) or Snow Gum Mid-high Grassy Woodland of the South Eastern Highlands Bioregion (u78).

3.1.4 Werriwa Tablelands Cool Temperate Grassy Woodland has undergone a very large reduction in distribution. Published estimates of the extent of this reduction relevant to this Determination include: i) a 98% reduction of the extent of Tablelands and Slopes Herb/Grassland/ Woodland (vg153 of Gellie (2005)) and an 86% reduction of the extent of Tableland Herb/Grassland (vg152 of Gellie (2005)) and ii) an 80–95% reduction in the extent of Frost Hollow Grassy Woodland (GWp22 of Tozer *et al.* (2010)). These estimates of a very large reduction in distribution are corroborated by Armstrong *et al.* (2013) in their assessment of Snow Gum Mid-high Grassy Woodland of the South Eastern Highlands Bioregion (u78), which overlaps with the communities listed in i) and ii). Based on an analysis of maps associated with these sources, together with maps depicting more recent vegetation clearing

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(Danaher 2011) and, taking into account changes in the circumscription of the units described above in light of the more recent plot data, the NSW Threatened Species Scientific Committee concludes that between 4–10% of the pre-1750 distribution of Werriwa Tablelands Cool Temperate Grassy Woodland remains.

- 3.1.5 The distribution of Werriwa Tablelands Cool Temperate Grassy Woodland is highly restricted. The extent of occurrence of Werriwa Tablelands Cool Temperate Grassy Woodland is 6,285 km² based on a minimum convex polygon enclosing known occurrences of the community as interpreted in Sections 4.2–4.10 and using the method of assessment recommended by IUCN (Bland *et al.* 2017). The estimated area of occupancy (AOO) is five 10 x 10 km grid cells, the scale recommended for assessing AOO by IUCN and applying a minimum occupancy threshold of 1% (Bland *et al.* 2017).
- 3.1.6 Remnants of Werriwa Tablelands Cool Temperate Grassy Woodland are poorly represented in the formal reserve network and unreserved remnants are subject to the threat of vegetation clearing. Only 57 ha of the distribution of Werriwa Tablelands Cool Temperate Grassy Woodland are known to occur in reserves (Tallaganda State Conservation Area (SCA), Thalba SCA and Deua National Park), and a further 29 ha occur on land covered by two conservation agreements between private landholders and the NSW government. Remnants are typically small, fragmented and are thus susceptible to attrition through clearing for routine land management practices. 'Clearing of native vegetation' is listed as a Key Threatening Process under the Act.
- 3.1.7 Remnants of Werriwa Tablelands Cool Temperate Grassy Woodland are predominantly located on pastoral properties and occur in a region that has been subject to grazing by domestic stock since the 1820s (Costin 1954). Impacts associated with grazing include a decline in species diversity due to the preferential consumption of palatable species, the reduction of shrub and ground cover leading to erosion of topsoil, compaction and nutrient enrichment of the soil, invasion by exotic plant species and reduction in overstorey cover as a consequence of damage to mature trees and a lack of recruitment (Yates *et al.* 2000, Eddy 2002, McIntyre *et al.* 2002, Prober *et al.* 2005, Lunt *et al.* 2007). These impacts may be further exacerbated by the application of chemical fertilizers, the removal of large trees, tilling of the soil and the sowing of exotic pasture and crop species to increase stocking rates (Keith 2004).
- 3.1.8 Remnants of Werriwa Tablelands Cool Temperate Grassy Woodland are subject to invasion by exotic perennial plant species, including *Eragrostis curvula* (African Lovegrass), *Hypericum perforatum* (St. Johns Wort), *Nassella neesiana* (Chilean Needlegrass), *Phalaris aquatica* (Phalaris), *Dactylis glomerata* (Cocksfoot), *Festuca* spp. (Fescue) and *Nassella trichotoma* (Serrated Tussock). 'Invasion of native plant communities by exotic perennial grasses' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as a Key Threatening Processes under the Act.
- 3.1.9 Remnants of Werriwa Tablelands Cool Temperate Grassy Woodland are subject to on-going grazing pressure from wild introduced herbivores such as the European Rabbit (*Oryctolagus cuniculus*) and Brown Hare (*Lepus capensis*). This, in combination with grazing by native marsupials and domestic stock, has resulted in higher rates of biomass consumption than

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occurred prior to European settlement. 'Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus* (L.)' is listed as a Key Threatening Process under the Act.

3.1.10 Werriwa Tablelands Cool Temperate Grassy Woodland may be adversely affected by human-induced climate change, including the potential to exacerbate other threats such as weed invasion and fire. The community is likely to be adversely affected by higher temperatures, particularly warmer winter minima and fewer frosts, as it often occupies 'frost hollow' situations at high elevations, and much of its current distribution could be replaced by other communities. Changes to fire regimes predicted under climate change scenarios could lead to changes in the understorey composition and the shrub layer may also become more prominent. 'Anthropogenic Climate Change' and 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' are listed as Key Threatening Processes under the Act.

3.1.11 The threats to Werriwa Tablelands Cool Temperate Grassy Woodland listed above are ongoing and likely to cause continuing declines in geographic distribution and environmental quality.

3.2 Criteria for listing

Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions is eligible to be listed as a Critically Endangered Ecological Community in accordance with Part 4 of the Act as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing an extremely high risk of extinction in Australia in the immediate future, as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Clause 4.9 – Reduction in geographic distribution of ecological community
(Equivalent to IUCN criterion A)

Assessment Outcome: Critically endangered under Clause 4.9 (a).

The ecological community has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of its component species:			
	(a)	for critically endangered ecological communities	a very large reduction in geographic distribution
	(b)	for endangered ecological communities	a large reduction in geographic distribution
	(c)	for vulnerable ecological communities	a moderate reduction in geographic distribution

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Clause 4.10 - Restricted geographic distribution of ecological community
(Equivalent to IUCN criterion B)

Assessment Outcome: Endangered under Clause 4.10 (b), (d) (i, ii, iii), e.

The ecological community's geographic distribution is:			
	(a)	for critically endangered ecological communities	very highly restricted.
	(b)	for endangered ecological communities	highly restricted.
	(c)	for vulnerable ecological communities	moderately restricted.
and at least 1 of the following conditions apply:			
	(d)	there is a projected or continuing decline in any of the following:	
	(i)	a measure of spatial extent appropriate to the ecological community,	
	(ii)	a measure of environmental quality appropriate to characteristic biota of the ecological community,	
	(iii)	a measure of disruption to biotic interactions appropriate to characteristic biota of the ecological community,	
	(e)	There are threatening processes that are likely to cause continuing decline in either geographic distribution, environmental quality or biotic interactions within the near future,	
	(f)	The ecological community exists at:	
	(i)	for critically endangered ecological communities	an extremely low number of locations.
	(ii)	for endangered ecological communities	a very low number of locations.
	(iii)	for vulnerable ecological communities	a low number of locations.

Clause 4.11 – Environmental degradation of ecological community
(Equivalent to IUCN criterion Clause C)

Assessment Outcome: Critically endangered under Clause 4.11 (a).

The ecological community has undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:			
	(a)	for critically endangered ecological communities	a very large degree of environmental degradation.
	(b)	for endangered ecological communities	a large disruption of biotic processes or interactions.
	(c)	for vulnerable ecological communities	a moderate degree of environmental degradation.

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Clause 4.12 – Disruption of biotic processes or interactions in ecological community (Equivalent to IUCN criterion D)

Assessment Outcome: Critically endangered under Clause 4.12 (a).

The ecological community has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of its component species:			
	(a)	for critically endangered ecological communities	a very large disruption of biotic processes or interactions
	(b)	for endangered ecological communities	a large disruption of biotic processes or interactions
	(c)	for vulnerable ecological communities	a moderately large disruption of biotic processes or interactions

Clause 4.13 - Quantitative analysis of probability of collapse of ecological community (Equivalent to IUCN criterion E)

Assessment Outcome: Data deficient under Clause 4.12 (a).

The probability of collapse of the ecological community is estimated to be:			
	(a)	for critically endangered species	extremely high
	(b)	for endangered ecological communities	a large disruption of biotic processes or interactions
	(c)	for vulnerable species	high

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Part 4. Additional information about the ecological community

The following information is additional to that required to meet the definition of an ecological community under the Act, but is provided to assist in the recognition of the Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions (hereafter referred to as the Werriwa Tablelands Cool Temperate Grassy Woodland) in the field. Given natural variability, along with disturbance history, Werriwa Tablelands Cool Temperate Grassy Woodland may sometimes occur outside the typical range of variation in the features described below.

4.1 Werriwa Tablelands Cool Temperate Grassy Woodland (WTCTGW) ranges in structure from woodland to low open woodland (*sensu* Specht 1970). It is characterised by a sparse to very sparse tree stratum dominated by *Eucalyptus pauciflora* either in monospecific stands or with *E. rubida* subsp. *rubida* as a co-dominant. A number of other tree species have been recorded within the community, although infrequently and always as canopy subdominants. These include: *E. viminalis*, *E. bridgesiana*, *E. dives* and *E. melliodora*. Tree height and cover vary as a function of moisture availability, drainage and past land management. The tree stratum becomes shorter and sparser with declining moisture

availability or increasing levels of soil waterlogging. Trees may be absent as a consequence of tree removal under pastoral management and grazing by domestic stock. A continuous herbaceous ground stratum is usually present, although this may vary in composition and cover as a function of grazing pressure from wild herbivores (native and introduced) and domestic stock. The ground stratum contains a range of species including *Themeda triandra*, *Gonocarpus tetragynus*, *Microlaena stipoides*, *Hypericum gramineum*, *Poa sieberiana*, *Asperula conferta*, *Lomandra filiformis*, *Elymus scaber*, *Hydrocotyle laxiflora*, *Leptorhynchus squamatus*, *Haloragis heterophylla*, *Oxalis perrenans*, *Schoenus apogon*, *Tricoryne elatior*, *Plantago varia*, *Acaena ovina*, *Carex inversa*, *Panicum effusum*, *Calocephalus citreus* and *Chrysocephalum apiculatum*. Species of sub-shrubs such as *Pimelea curviflora*, *Astroloma humifusum* and *Hibbertia obtusifolia* may be interspersed with herb species at some sites (Armstrong *et al.* 2013). Sites regenerating following tree-removal or the cessation of stock grazing may support a shorter stratum of *Eucalyptus* species of variable density (Tozer *et al.* 2010).

- 4.2 The majority of records of WTCTGW occur in the Southern Tablelands of New South Wales (NSW) on the eastern fall of the Great Dividing Range between Golspie in the north and Majors Creek in the south. The extent of its distribution largely coincides with the extent of the Werriwa Tablelands Physiographic Region (Pain *et al.* 2011), although the most northern records lie in the Bathurst Tablelands Region and the southern-most records lie in the Tinderry-Gourock Ranges Region. The community has been recorded as far to the east as Marulan and its eastern boundary corresponds approximately to the 750 mm average annual rainfall isohyet. The most northern record lies just to the north of the Great Dividing Range in the catchment of the Abercrombie River. Areas where the Community was most extensively distributed include the upper Wollondilly River catchment in the vicinity of Crookwell, Taralga and Laggan and astride the Great Dividing Range in the closed drainage basins of Lake George and the Breadalbane Plains. The most westerly records are located on the low hills surrounding the Ginninderra, Molonglo, Tuggeranong and Limestone Plains of the Australian Capital Territory (ACT). These western examples are discontinuous with the distribution of the Community in the east as a consequence of a rain-shadow associated with the valleys of the Queanbeyan and Molonglo Rivers and Jerrabomberra and Woolshed Creeks. The ACT records are not included in the calculations of extent, occupancy and reduction.
- 4.3 Werriwa Tablelands Cool Temperate Grassy Woodland occurs on broad valley floors and gentle slopes and low rises of the moderately undulating Southern Tablelands of NSW. It has been commonly recorded on a wide variety of substrates including basalt, fine-grained sedimentary rocks, granite, acid volcanics and alluvium but rarely on steeper ridgelines on the tablelands (Keith 2004, Tozer *et al.* 2010). Records of Werriwa Tablelands Cool Temperate Grassy Woodland fall within a relatively narrow range of elevation (600–900 m a.s.l.), average annual maximum temperature (26–28°C) and average annual rainfall (600–800 mm). These factors are among the primary determinants of both the energy-water relations underpinning the primary production of the Community and the physiological tolerances of its constituent members. The community may occur outside the ranges stated above where other factors such as wind, topographic exposure and soil texture counteract the effects of lower or higher rainfall or temperatures, thus creating micro-climatic niches of appropriate water supply and temperature for the members of the assemblage. The Community is likely to have been most extensive in areas where annual rainfall is in the upper half of the range. Such areas occur along the Great Dividing Range and at the

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northern and southern limits of its distribution where rainfall at the upper end of the range coincides with maximum temperatures at the lower end of the range. Werriwa Tablelands Cool Temperate Grassy Woodland was likely to be less extensively distributed in areas where annual rainfall is in the lower half of the range, such the Wollondilly River valley in the vicinity of Goulburn, the region between Windellama and Bungonia and in the low hills of the northern ACT (Baines *et al.* 2013).

- 4.4 Werriwa Tablelands Cool Temperate Grassy Woodland is part of a continuum of related vegetation communities occurring on the broad valleys and gently undulating rises of the Southern Tablelands of NSW. These communities have been formally defined and described by quantitative analyses of plot data by Keith and Bedward (1999), Gellie (2005), Tozer *et al.* (2010) and Armstrong *et al.* (2013). Relationships among the units described by these authors were established for this Determination by a revised analysis including additional recently acquired plot data. The circumscription of the WTCTGW community here (its distribution and diagnostic taxa) reflects this more substantial information base as well as a rationalisation of the existing units to reduce duplication and overlap. WTCTGW constitutes a single vegetation community type which corresponds broadly with i) Gellie's (2005) Tablelands and Slopes Herb/Grassland/Woodland (VG153) and the distribution of Tableland Herb/Grassland (VG152) outside of the Monaro region, which together comprise the drier components of the Community, ii) Armstrong *et al.*'s (2013) Snow Gum grassy mid-high woodland of the South Eastern Highlands Bioregion (u78) which comprises the moister components of the Community, and iii) parts of Tozer *et al.*'s (2010) Frost Hollow Grassy Woodland (GWp22). Note that GWp22 also included vegetation outside the scope of this Determination occurring in cooler and more elevated parts of the Monaro Tableland, and corresponding with Keith and Bedward's (1999) Monaro Basalt Grass Woodland (MU23B).
- 4.5 Werriwa Tablelands Cool Temperate Grassy Woodland intergrades with other vegetation communities depending on temperature and moisture availability. In warmer areas WTCTGW grades into two communities which comprise part of the Endangered Ecological Community White Box Yellow Box Blakely's Red Gum Woodland. These are described as Tableland Grassy Box-Gum Woodland (GWp24 of Tozer *et al.* (2010) equivalent to p24 of Armstrong *et al.* (2013)) and Blakely's Red Gum – Yellow Box ± White Box tall grassy woodland (u19) of Armstrong *et al.* (2013). Where the distributions of these communities overlap, WTCTGW occurs on soils of heavier texture (Costin 1954, Keith 2004) and where the incidence of frost is higher.

Werriwa Tablelands Cool Temperate Grassy Woodland is replaced by Armstrong *et al.*'s (2013) Yellow Box – Apple Box tall grassy woodland (u178) as average annual rainfall falls below 650 mm, and by Monaro Tablelands Cool Temperate Grassy Woodland in areas where temperature maxima are cooler by around 2–3°C. Monaro Tablelands Cool Temperate Grassy Woodland is listed as a Critically Endangered Ecological Community under the *NSW Biodiversity Conservation Act*.

Werriwa Tablelands Cool Temperate Grassy Woodland grades into Tozer *et al.*'s (2010) Tableland Granite Grassy Woodland (GWp420) with increasing rainfall to the north of its distribution. Where rainfall exceeds 800 mm, WTCTGW grades into either Tozer *et al.*'s (2010) Tableland Swamp Flats Grassy Woodland (GWp520) or Armstrong *et al.*'s (2013) Black Sallee grass-herb woodland in drainage depressions and moist valley flats (u118), in the latter case where average maximum temperatures fall below 25°C.

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Werriwa Tablelands Cool Temperate Grassy Woodland rarely occurs in areas receiving less than 600 mm of annual rainfall or where the soil experiences periods of waterlogging. In such areas within its altitude and temperature range, the Community is replaced by either temperate montane grasslands or montane peatlands or swamps. 'Natural Temperate Grassland of the Southern Tablelands (NSW and ACT)' is listed as a Threatened Ecological Community under the Commonwealth EPBC Act 1999. 'Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and South East Corner and Australian Alps' is listed as an Endangered Ecological Community under the Act.

- 4.6 In areas where their distributions overlap, Werriwa Tablelands Cool Temperate Grassy Woodland can be distinguished from White Box Yellow Box Blakely's Red Gum Woodland by the dominant canopy species. Werriwa Tablelands Cool Temperate Grassy Woodland is dominated by *Eucalyptus pauciflora* (with or without *E. rubida* subsp. *rubida*) while White Box Yellow Box Blakely's Red Gum Woodland is dominated by *E. melliodora*, *E. bridgesiana*, *E. rubida* subsp. *rubida* and *E. blakelyi*. Other plant species which have been recorded more frequently in plot samples of White Box Yellow Box Blakely's Red Gum Woodland include, in decreasing order of diagnostic power*, *Austrostipa scabra*, *Aristida ramosa*, *Rumex brownii*, *Cheilanthes sieberi* subsp. *sieberi*, *Geranium solanderi*, *Arthropodium minus* and *Einadia nutans*. Species recorded more frequently in WTCTGW include, in decreasing order of diagnostic power*, *Themeda triandra*, *Chrysocephalum apiculatum*, *Haloragis heterophylla*, *Schoenus apogon*, *Calocephalus citreus*, *Bossiaea prostrata*, *Plantago varia* and *Scleranthus biflorus*.

[*species listed in sections 4.6 – 4.9 generally occur in more than one of the related communities. Diagnostic power is a measure of the extent to which the records of a species are concentrated in the target community.]

- 4.7 Werriwa Tablelands Cool Temperate Grassy Woodland is replaced by Yellow Box – Apple Box tall grassy woodland (u178) (Armstrong *et al.* 2013) where rainfall falls below 650 mm in the rain-shadow valleys of the Murrumbidgee, Queanbeyan and Molonglo Rivers, and associated major drainage features. Yellow Box – Apple Box tall grassy woodland is most readily distinguished by its dominant tree species (*E. melliodora*, *E. bridgesiana* and *E. blakelyi*) as well as a suite of species that have been recorded more frequently than in Werriwa Tablelands Cool Temperate Grassy Woodland. These include, in decreasing order of diagnostic power*, *Austrostipa scabra*, *Acaena ovina*, *Convolvulus erubescens*, *Crassula sieberiana*, *Solenogyne dominii*, *Bothriochloa macra*, *Wahlenbergia communis*, *Melichrus urceolatus*, *Bulbine bulbosa*, *Sebaea ovata*, *Aristida ramosa*, *Daucus glochidiatus*, *Euchiton sphaericus*, *Pultenaea procumbens*, *Hydrocotyle laxiflora*, *Geranium solanderi*, *Cheilanthes sieberi* subsp. *sieberi* and *Hibbertia obtusifolia*. Species that have been recorded more frequently in Werriwa Tablelands Cool Temperate Grassy Woodland include, in decreasing order of diagnostic power*, *Calocephalus citreus*, *Rytidosperma laeve*, *Microlaena stipoides*, *Scleranthus biflorus*, *Solenogyne gunnii*, *Poa labillardieri* and *Rytidosperma pilosum*.
- 4.8 Intergradation between Werriwa Tablelands Cool Temperate Grassy Woodland and Monaro Tableland Cool Temperate Grassy Woodland is largely precluded by a minimal overlap between their respective temperature and rainfall envelopes. Monaro Tableland Cool Temperate Grassy Woodland shares both *Eucalyptus pauciflora* and *E. rubida* subsp. *rubida*

as dominant species but may have in addition *E. stellulata* and *E. viminalis* as co-dominants. It is further distinguished from Werriwa Tablelands Cool Temperate Grassy Woodland by the more frequent occurrence of, in decreasing order of diagnostic power*, *Euchiton japonicum*, *Solenogyne gunnii*, *Poa labillardieri*, *Acaena echinata*, *Scleranthus biflorus*, *Asperula scoparia*, *Plantago varia*, *Veronica gracilis*, *Wahlenbergia planiflora*, *Mirbelia oxylobioides*, *Desmodium varians*, *Ajuga australis*, *Carex breviculmis*, *Rytidosperma pilosum*, *Arthropodium milleflorum*, *Dichelachne inaequiglumis*, *Geranium solanderi*, *Rubus parvifolius*, *Oreomyrrhis eriopoda*, *Hydrocotyle laxiflora*, *Epilobium billardierianum*, *Viola betonicifolia*, *Acaena novae-zelandiae*, *Bossiaea buxifolia*, *Luzula densiflora*, *Hovea linearis*, *Glycine clandestina* and *Acacia dealbata*. Species occurring more frequently in Werriwa Tablelands Cool Temperate Grassy Woodland include, in decreasing order of diagnostic power*, *Chrysocephalum apiculatum*, *Goodenia pinnatifida*, *Schoenus apogon*, *Solenogyne dominii*, *Wurmbea dioica* subsp. *dioica*, *Aristida ramosa*, *Acaena ovina*, *Lomandra filiformis* subsp. *filiformis*, *Goodenia hederacea* and *Melichrus urceolatus*.

- 4.9 Werriwa Tablelands Cool Temperate Grassy Woodland intergrades with Tableland Granite Grassy Woodland (GWp420) (Tozer *et al.* 2010) in the northern part of its range. Both communities occupy similar ranges in terms of average maximum temperature and rainfall, but in both cases temperature and rainfall are negatively correlated, and samples of Tableland Granite Grassy Woodland are estimated to receive an average of 50 mm more rainfall per annum than those of WTCTGW across the temperature range. In Tableland Granite Grassy Woodland, *Eucalyptus pauciflora* is co-dominant with *E. viminalis*, *E. melliodora*, *E. bridgesiana* and *E. dalrympleana*. A range of other species are also more frequently recorded including, in decreasing order of diagnostic power*, *Austrostipa rudis*, *Plantago debilis*, *Desmodium varians*, *Cheilanthes sieberi* subsp. *sieberi*, *Bursaria spinosa*, *Lomandra longifolia*, *Cynoglossum australe*, *Geranium solanderi*, *Echinopogon ovatus*, *Acacia implexa*, *Glycine clandestina*, *Asplenium flabellifolium*, *Dianella revoluta*, *Rubus parvifolius*, *Lomandra multiflora* subsp. *multiflora*, *Cynoglossum suaveolens*, *Acaena novae-zelandiae*, *Acacia melanoxyton* and *Acacia dealbata*. Species recorded more frequently in Werriwa Tablelands Cool Temperate Grassy Woodland include, in decreasing order of diagnostic power*, *Chrysocephalum apiculatum*, *Haloragis heterophylla*, *Schoenus apogon*, *Leptorhynchus squamatus*, *Calocephalus citreus*, *Goodenia pinnatifida*, *Juncus filicaulis*, *Dichopogon fimbriatus*, *Carex inversa*, *Elymus scaber*, *Plantago varia* and *Dichelachne micrantha*.
- 4.10 Werriwa Tablelands Cool Temperate Grassy Woodland comprises part of Keith's (2004) Tableland Clay Grassy Woodlands, Southern Tableland Grassy Woodlands and Subalpine Woodlands Classes, although it occurs at substantially lower elevations than other Subalpine Woodlands. The attribution of WTCTGW to this latter class reflects a relatively high incidence of frost relative to other grassy-woodland communities of the Southern Tablelands, which is associated with the slightly higher elevations and closed drainage basins in which it occurs on the crest of the Great Dividing Range. WTCTGW and related communities grade into Southern Tablelands Wet Sclerophyll Forests (Keith 2005) with increasing rainfall. Communities such as Southern Tableland Flats Forest (GWp220 of Tozer *et al.* 2010) comprise part of this transition to wetter forests at higher elevations along the Great Dividing Range.

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4.11 Werriwa Tablelands Cool Temperate Grassy Woodland may contain the following threatened animal and plant species listed under the NSW *Biodiversity Conservation Act 2016* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*:

Species	Common name	BC Act*	EPBC Act†
Plants			
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	Endangered	
<i>Calotis glandulosa</i>	Mauve Burr-daisy	Vulnerable	Vulnerable
<i>Commersonia prostrata</i>	Dwarf Kerrawang	Endangered	Endangered
<i>Diuris aequalis</i>	Buttercup Doubletail	Endangered	Vulnerable
<i>Diuris ochroma</i>	Pale Golden Moths	Endangered	Vulnerable
<i>Diuris pedunculata</i>	Small Snake Orchid	Endangered	Endangered
<i>Dodonaea procumbens</i>	Trailing Hop-bush	Vulnerable	Vulnerable
<i>Eucalyptus aggregata</i>	Black Gum	Vulnerable	Vulnerable
<i>Eucalyptus parvula</i>	Small-leaved Gum	Vulnerable	Vulnerable
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	Endangered	Endangered
<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	Endangered	Endangered
<i>Rutidosia leptorrhynchoides</i>	Button Wrinklewort	Endangered	Endangered
<i>Swainsona sericea</i>	Silky Swainson-pea, Silky Pea	Vulnerable	
<i>Thesium australe</i>	Austral Toadflax,	Vulnerable	Vulnerable
Animals			
<i>Artamus cyanopterus</i>	<i>Artamus cyanopterus</i>	Vulnerable	
<i>Callocephalon fimbriatum</i>	Gang Gang Cockatoo	Vulnerable	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	Vulnerable	
<i>Melanodryas cucullata cucullata</i>	Hooded Robin	Vulnerable	
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	Vulnerable	
<i>Stagonopleura guttata</i>	Diamond Firetail	Vulnerable	
<i>Ninox strenua</i>	Powerful Owl	Vulnerable	
<i>Tyto novaehollandiae</i>	Masked Owl	Vulnerable	
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Vulnerable	
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	Vulnerable	
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Vulnerable	Endangered
<i>Petroica boodang</i>	Scarlet Robin	Vulnerable	
<i>Petroica phoenicea</i>	Flame Robin	Vulnerable	
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Vulnerable	
<i>Cercartetus nanus</i>	Eastern Pygmy Possum	Vulnerable	
<i>Petaurus australis</i>	Yellow-bellied Glider	Vulnerable	
<i>Phascolarctos cinereus</i>	Koala	Vulnerable	Vulnerable
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	Vulnerable	Vulnerable
<i>Suta flagellum</i>	Little Whip Snake	Vulnerable	
<i>Paralucia spinifera</i>	Purple Copper Butterfly	Endangered	Vulnerable

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*Biodiversity Conservation Act 2016

+ Environment Protection and Biodiversity Conservation Act 1999

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