

**INQUIRY INTO LOCAL LAND SERVICES AMENDMENT  
(CRITICALLY ENDANGERED ECOLOGICAL  
COMMUNITIES) REGULATION 2019 AND LOCAL LAND  
SERVICES AMENDMENT (ALLOWABLE ACTIVITIES)  
REGULATION 2019**

**Organisation:** NSW Threatened Species Scientific Committee  
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SERVICES AMENDMENT (CRITICALLY  
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AND LOCAL LAND SERVICES  
AMENDMENT (ALLOWABLE  
ACTIVITIES) REGULATION 2019**

**Submission by the  
New South Wales  
Threatened Species Scientific  
Committee**

**Abbreviations**

MTCTGW - Monaro Tableland Cool Temperate Grassy Woodland  
WTCTGW - Werriwa Tablelands Cool Temperate Grassy Woodland  
IUCN - International Union for the Conservation of Nature  
TSSC - Threatened Species Scientific Committee  
BC Act - NSW Biodiversity Conservation Act 2016  
LLS - Local Land Services  
SAIL - Serious and Irreversible Impact

## Summary

- i. An International Union for the Conservation of Nature (IUCN) risk assessment of the conservation status of Monaro Tableland Cool Temperate Grassy Woodland and Werriwa Tablelands Cool Temperate Grassy Woodland has determined that both meet the criteria to be listed as Critically Endangered and may, within the bounds of uncertainty, be on the verge of collapse (equivalent to extinction of species). IUCN assessments are globally recognised as best practice for assessing extinction risk (Bland *et al.* 2017).
- ii. The Local Land Services (LLS) Amendment (Critically Endangered Ecological Communities) Regulation 2019 specifically provides for further clearing of these communities which, if undertaken, would constitute a serious and irreversible impact as defined under the Biodiversity Conservation Act (2016) (OEH 2017).
- iii. Prior to the amendment, clearing of Critically Endangered Communities appears to have been entirely subject to approval of the Native Vegetation Panel which is bound to refuse any clearing likely to have serious and irreversible impacts on biodiversity values.
- iv. Amendments to the Land Management (Native Vegetation) code (2018) have placed LLS Officers in a position of authority to determine whether any vegetation constitutes part of a Critically Endangered Community based on its condition. If, in the opinion of LLS, the vegetation does not form a functioning ecological community that is likely to be viable over the long term then that vegetation no longer meets the definition of a Critically Endangered Community under the LLS Act.
- v. Under the LLS Act as amended, the definition of a Critically Endangered Ecological Community is in conflict with the definition under the BC Act (under which no condition requirements apply) and contradicts the advice of the NSW Threatened Species Scientific Committee (TSSC) who are engaged by the Minister to provide independent, evidence-based assessments of NSW biodiversity.
- vi. As a consequence of the amendment, applications for clearing of Critically Endangered Ecological Communities as defined under the BC Act will not be considered by the Native Vegetation Panel as was originally intended under the LLS Act.
- vii. In undertaking its conservation assessments, the NSW TSSC has determined that there are insufficient data available to determine the long-term viability of remnants of Monaro Tableland Cool Temperate Grassy Woodland and Werriwa Tablelands Cool Temperate Grassy Woodland (as described in the determinations under Criterion E). The basis on which LLS Officers will determine whether vegetation forms a

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functioning ecological community that is likely to be viable over the long term is not available for scientific scrutiny.

- viii. The NSW TSSC notes that The Audit Office of NSW (2019) has reported: *“The clearing of native vegetation on rural land is not effectively regulated and managed [in NSW] because the processes in place to support the regulatory framework are weak. There is no evidence-based assurance that clearing of native vegetation is being carried out in accordance with approvals. Responses to incidents of unlawful clearing are slow, with few tangible outcomes. Enforcement action is rarely taken against landholders who unlawfully clear native vegetation. There are processes in place for approving land clearing but there is limited follow-up to ensure approvals are complied with.”*
- ix. The NSW TSSC notes that clearing continues to be a major threat in NSW because, under the current regulatory framework, recent data show a tripling of agricultural clearing of Grassy Woodlands since the current legislation was enacted (DPIE 2019).
- x. The NSW TSSC concludes that there is a very high risk that the LLS Amendment (Critically Endangered Ecological Communities) Regulation 2019 and associated amendments to the Land Management (Native Vegetation) code (2018) will lead to further clearing of Monaro Tableland Cool Temperate Grassy Woodland and Werriwa Tablelands Cool Temperate Grassy Woodland which have already been reduced in extent by over 90% since 1750.

## 1. NSW Threatened Species Scientific Committee (TSSC)

- The NSW TSSC is an independent NSW Government Agency established under Division 3, Part 4 of the Biodiversity Conservation (BC) Act (2016) with responsibility for determining which species and ecological communities are to be listed as threatened under the Act and their relevant threat categories (i.e. Vulnerable, Endangered or Critically Endangered).
- Threat assessments made by the TSSC are made on the basis of scientific evidence and with reference to internationally agreed criteria published by the International Union for the Conservation of Nature (IUCN).
- The BC Act requires that the Committee comprises 11 scientists with collective expertise encompassing the fields of vertebrate and invertebrate ecology, plant biology, terrestrial ecology, plant community ecology, limnology, aquatic biology, genetics and population dynamics.

## 2. Status of the Ecological Communities

### 2.1 Context of the recent listings

In response to submissions received from the public, the NSW TSSC undertook a revision of the conservation status of Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland, previously listed as Endangered under the *Threatened Species Conservation Act* (1995). The Committee determined, based on the available scientific evidence, that the listed entity was inclusive of too wide a range of vegetation types and distributed over too great an area than could be justified in terms of both conservation risk and for the purposes of its characterisation as an assemblage of species. As such, the listing was revoked and replaced with determinations for two more tightly-constrained ecological communities: Monaro Tableland Cool Temperate Grassy Woodland (MTCTGW) and Werriwa Tablelands Cool Temperate Grassy Woodland (WTCTGW). The practical implications of the revision were two-fold: 1) vegetation communities occurring in the regions surrounding Mudgee, Bathurst, Orange, Moss Vale, Tumut and Yass were explicitly excluded from the listing; and 2) those parts of the original listing corresponding to MTCTGW and WTCTGW were listed at the level of Critically Endangered as mandated by the evidence presented to the Committee.

### 2.1 IUCN conservation assessment

The NSW TSSC has made determinations under the Biodiversity Conservation Act (2016) that Monaro Tableland Cool Temperate Grassy Woodland (MTCTGW) and Werriwa Tablelands Cool Temperate Grassy Woodland (WTCTGW) are eligible to be listed as Critically Endangered based on historical reduction in geographic extent (IUCN criterion A, sub-criterion A3: reduction in geographic distribution exceeds 90% of the pre-1750 distribution) (Final determinations for these communities are

attached). The status of critically endangered recognises that there is a very high risk of ecosystem collapse occurring in the near future and that any further reduction in extent constitutes a Serious and Irreversible Impact (SAIL) as defined under the BC Act (2016) (OEH 2107). Collapse of a community is analogous to the extinction of a species and refers to the point at which all examples of an ecological community have lost their defining features and the ecosystem no longer exists.

## ***2.2 Condition of remnants of MTCTGW and WTCTGW***

Notwithstanding the existence of remnants of MTCTGW and WTCTGW, the TSSC understands, on the basis of public submissions received, that all remaining areas are subject to a range of threats associated with pastoral exploitation, species introductions and changes in rainfall or temperature, including increased severity of drought conditions, that may occur as a consequence of human-induced climate change since European colonisation. These threats are ongoing and are described in detail in sections 3.1.7 - 3.1.10 of the respective final determinations by the TSSC. As a consequence, all remnants are affected to some extent by declines in species diversity due to the preferential consumption of palatable species by stock, 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 of new individuals.

## ***2.3 Localised ecosystem collapse***

The scientific foundation of the IUCN assessment protocol for ecological communities defines collapse as a conceptual end-point at which it may be considered that an ecosystem has ceased to exist. The point at which either MTCTGW or WTCTGW could be considered to have entirely collapsed is uncertain, and it is similarly uncertain when a particular remnant can no longer be considered as an example of either community. This is because:

- i) the pathway to collapse follows different trajectories and occurs at different rates depending on the combination of threatening processes present; and
- ii) the progression to collapse (or even the state of collapse itself) may be reversible depending on the nature of the threats and the type and scale of management interventions applied.

As a consequence, the point of collapse in the cases of MTCTGW and WTCTGW is inherently uncertain and no simple metric can be applied to establish the fact of the matter for any particular remnant. Consistent with these principles, as is appropriate for a finding of critically endangered (near collapse), it is the intent of the NSW TSSC that all examples of the MTCTGW and WTCTGW are covered by their respective final determinations, irrespective of their condition.

### **3. Local Land Services Amendment (Critically Endangered Ecological Communities) Regulation 2019**

#### ***3.1 Provisions for protection of critically endangered communities prior to amendment***

The NSW TSSC understands that prior to LLS Amendment (Critically Endangered Ecological Communities) Regulation 2019, clearing of native vegetation forming part of a critically endangered ecological community was not authorised under the Land Management (Native Vegetation) Code. Applications for clearing of Critically Endangered Ecological Communities were subject to approval by the Native Vegetation Panel, an independent agency under the Local Land Services Act. The Panel is bound to refuse approval under this Division if members are of the opinion that the proposed clearing of native vegetation is likely to have a Serious and Irreversible Impact on biodiversity values as defined under the Biodiversity Conservation Act (2016).

The NSW TSSC's understanding is based on its interpretation of LLS Act (2103), LLS Regulation (2014) and Land Management (Native Vegetation) Code 2018 (9 Mar 2018 - 1 Aug 2019) as follows:

#### ***3.1.1 Local Land Services Act (2013)***

1. Regulations governing the clearing of native vegetation in rural areas are described in Part 5A of the Local Land Services (LLS) Act 2013.
2. Areas subject to regulation are designated as Category 2 in the Native Vegetation Regulatory Map (Part 5A, Division 2).
3. Land mapped by the Environment Agency Head as land containing a critically endangered ecological community under the [Biodiversity Conservation Act 2016](#) is to be designated Category 2 regulated (Part 5A, Division 2, Section 60I (m)).

#### ***3.1.2 Local Land Services Regulation 2014***

1. Division 2, clause 108 provides for the designation of sensitive regulated land as a sub-category of Category 2 regulated land.
2. Land is to be designated as category 2-sensitive regulated land if the Environment Agency Head reasonably believes that the land is required to be designated as category 2-regulated land under Part 5A, Division 2, Section 60I (m) of the LLS Act.
3. Category 2-sensitive regulated land is excluded from application of codes (Part 4, Division 3, Clause 124).
4. Approval for clearing native vegetation not authorised under a Land Management (native vegetation) Code is subject to approval from the Native Vegetation Panel (Part 4, Division 14)
5. The Panel must refuse to grant approval under this Division if the Panel is of the opinion that the proposed clearing of native vegetation is likely to have

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serious and irreversible impacts on biodiversity values (Part 5A, Division 6, Section 60ZF(6) LLS Act 2103).

### **3.1.3 Land Management (Native Vegetation) Code 2018 (9 Mar 2018 - 1 Aug 2019)**

1. Clearing of native vegetation is not authorised by this Code if the native vegetation forms part of a critically endangered ecological community (Part 1, Clause 7).

## **3.2 Provisions for protection of Critically Endangered Communities post-amendment**

### **3.2.1 Local Land Services Act (2013)**

The NSW TSSC understands that inclusions to Schedule 5A, Part 4 of the Local Land Services Act (2013) have the effect that special provisions applying to category 2-vulnerable regulated land and category 2-sensitive regulated land also apply to areas containing Critically Endangered Monaro Tableland Cool Temperate Grassy Woodland and Werriwa Tablelands Cool Temperate Grassy Woodland. Although it appears that this achieves the same outcome as the provisions described in 3.1.1 and 3.1.2 above (and is therefore consistent with the original intent of the Act), the change is obviously inconsistent with the stated intention of the amendment to allow some clearing of native vegetation comprising these Critically Endangered Ecological Communities. It also appears that it is not intended that the Critically Endangered Communities constitute Category 2 sensitive lands under the Act. The implications of this are not clear.

### **3.2.2 Land Management (Native Vegetation) Code 2018 (current)**

Amendments to the Land Management (Native Vegetation) code (2018) appear to counter the original intent of the Act whereby vegetation clearing applications affecting the most sensitive lands (including Critically Endangered Ecological Communities) were afforded the highest level of scrutiny and oversight. Specifically, the inclusion of Clause 19A allows for Local Land Services to determine the viability of Critically Endangered Ecological Communities where previously this responsibility was limited to Vulnerable and Endangered communities. Vegetation determined not to be viable in the long term by Local Land Services will not be considered to meet the definition of a Critically Endangered Community and will not, therefore, receive the consideration of the Native Vegetation Panel. While Clause 19A(5) provides that “the Secretary of the Department of Planning, Industry and Environment may approve guidelines to assist Local Land Services in determining whether vegetation does not form a functioning ecological community that is likely to be viable in the long term”, the NSW TSSC is not aware that such guidelines have been produced and therefore is unable to determine their basis in ecological theory nor fitness for purpose. Based on the available literature, however, the TSSC has formed the opinion that

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guidelines suggesting the imposition of a threshold for viable condition on communities which have already undergone substantial reductions in their spatial extent (>90%) will not be based on sound evidence.

## 4. Development of Condition Metrics

Evidence in the scientific literature counsels strongly against the use of simple metrics in characterising the state of an ecological community and its long-term viability. The NSW TSSC specifically considers that it is inappropriate to impose a rule requiring the presence of at least 50% of the species listed as the characteristic assemblage to be present in order to meet the definition of the Community (as provided for the identification of Vulnerable and Endangered Ecological Communities under the LLS Act). Such a rule ignores widely accepted ecological principles relating to species turnover along environmental gradients, seasonal variation in composition and state and transition dynamics in relation to disturbance regimes. Conversely, any future condition assessment protocols must clearly articulate the nature and directional force of all relevant environmental drivers (natural and human-induced), the various states into which ecological communities are driven in response to those drivers, the circumstances under which state-changes may be reversed (and associated barriers) and relevant symptoms associated with states that are not reversible.

## 5. Conclusion

The NSW TSSC has, as required under the BC Act (2016), reviewed the status of the Endangered Ecological Community Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland and determined that the listing was not supported based on the available scientific evidence. The replacement of the listing with determinations of **Critically Endangered for Monaro Tableland Cool Temperate Grassy Woodland and Werriwa Tablelands Cool Temperate Grassy Woodland** has the effect of reducing the burden on those landholders whose properties contain vegetation for which there is insufficient evidence of a conservation risk, while simultaneously generating a greater focus on those ecosystems at greatest risk of collapse.

By virtue of the threats arrayed against MTCTGW and WTCTGW, few examples remain in a state free of degradation. As such, the Head of the Environment Department has determined that any further loss of these communities would constitute a Serious And Irreversible Impact as defined under the Biodiversity Conservation Act (2016) (OEH 2017). It is appropriate, therefore, that any further clearing of the communities is subject to the highest level of scrutiny and oversight. The delegation of any part of this process to individual officers of the LLS is a significant departure from the intent of the LLS Act and represents an abrogation of NSW Government's responsibility to ensure that conservation management decisions are undertaken in a transparent manner, follow accepted

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scientific principles and demonstrate a just balance between the interests of farming and conservation.

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## 6. References

Audit Office of New South Wales (2019) Managing native vegetation

<https://www.audit.nsw.gov.au/our-work/reports/managing-native-vegetation>

(accessed 4 July 2019)

Bland LM, Keith DA, Miller RM, Murray NJ, Rodríguez JP (2017) Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. (IUCN: Gland, Switzerland)

NSW DPIE (Department of Planning, Industry and Environment) (2019) The NSW Native Vegetation 2016-17 data spreadsheet. Available at <https://www.environment.nsw.gov.au/topics/animals-and-plants/native-vegetation/reports-and-resources/reports> (accessed 3/7/19)

OEH (2017) Guidance to assist a decision-maker to determine a serious and irreversible impact. Office of Environment and Heritage, New South Wales Government.

## 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 Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion as a CRITICALLY ENDANGERED ECOLOGICAL COMMUNITY in Part 1 of Schedule 2 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

Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion 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 Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion 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 Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (hereafter referred to as the Monaro Tableland Cool Temperate Grassy Woodland) is characterised by the assemblage of species listed below.

<i>Acacia dealbata</i>	<i>Acacia melanoxylon</i>
<i>Acaena echinate</i>	<i>Acaena novae-zelandiae</i>
<i>Ajuga australis</i>	<i>Asperula conferta</i>
<i>Asperula scoparia</i>	<i>Austrostipa scabra</i>
<i>Bossiaea buxifolia</i>	<i>Carex breviculmis</i>
<i>Carex inversa</i>	<i>Chrysocephalum apiculatum</i>
<i>Chrysocephalum semipapposum</i>	<i>Cymbonotus lawsonianus</i>
<i>Desmodium varians</i>	<i>Dichondra repens</i>

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<i>Elymus scaber</i>	<i>Epilobium billardierianum</i>
<i>Eucalyptus pauciflora</i>	<i>Eucalyptus rubida</i> subsp. <i>rubida</i>
<i>Eucalyptus stellulata</i>	<i>Eucalyptus viminalis</i>
<i>Euchiton japonicus</i>	<i>Geranium antrorsum</i>
<i>Geranium solanderi</i>	<i>Glycine clandestina</i>
<i>Gonocarpus tetragynus</i>	<i>Haloragis heterophylla</i>
<i>Hovea linearis</i>	<i>Hydrocotyle laxiflora</i>
<i>Hypericum gramineum</i>	<i>Leptorhynchos squamatus</i>
<i>Melicytus angustifolius</i> subsp. <i>divaricatus</i>	<i>Microlaena stipoides</i> subsp. <i>stipoides</i>
<i>Mirbelia oxylobioides</i> s	<i>Oxalis perennans</i>
<i>Panicum effusum</i>	<i>Plantago varia</i>
<i>Poa sieberiana</i>	<i>Poa labillardierei</i>
<i>Poranthera microphylla</i>	<i>Rubus parvifolius</i>
<i>Rumex brownie</i>	<i>Rytidosperma laeve</i>
<i>Rytidosperma pilosum</i>	<i>Scleranthus biflorus</i>
<i>Solenogyne gunnii</i>	<i>Themeda triandra</i>
<i>Veronica gracilis</i>	<i>Viola betonicifolia</i>
<i>Wahlenbergia communis</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. Annual species and geophytes may not be detectable at certain times of the year such as the cooler months.

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.

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## **Part 2. Particular area occupied by the ecological community**

- 2.1.1 The assemblage of species listed in Part 1.1 above which characterises the Monaro Tableland Cool Temperate Grassy Woodland occurs within the South Eastern Highlands Bioregion. This Bioregion is 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>
- 2.2 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 this bioregion be covered by this Determination.

## **Part 3. Eligibility for listing**

### **3.1 Reasons for determining eligibility for listing**

- 3.1.1 Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (MTCTGW) 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 this original 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 Monaro Tableland Cool Temperate Grassy Woodland is one of several related plant communities (*sensu* Keith 2004) which collectively comprised the Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland. Although these 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 – 3.1.10. 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 Monaro Tableland Cool Temperate Grassy Woodland broadly corresponds to the *Eucalyptus pauciflora* – *E. stellulata* alliance, subformation Savannah Woodland of Costin (1954) and includes Far South East Tableland Moist Herb/Grass Forest (VG150) of Gellie (2005) and Monaro Basalt Grass Woodland (MU23B) of Keith and Bedward (1999) which was subsequently included within Frost Hollow Grassy Woodland (GWp22) of Tozer *et al.* (2010). It is the intention of the NSW Threatened Species Scientific Committee that secondary grasslands derived from any of the communities listed above are covered by this Determination. Instances of Frost Hollow Grassy Woodland (GWp22) occurring north of the Monaro Tableland correspond to Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions which is being considered for listing as Critically endangered under the Act.

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- 3.1.4 Monaro Tableland Cool Temperate Grassy Woodland has undergone a very large reduction in distribution. Based on an analysis of maps produced by Gellie (2005) and Keith and Bedward (1999), together with maps depicting more recent vegetation clearing (Danaher 2011) the NSW Threatened Species Scientific Committee estimates that less than 15,660 ha of Monaro Tableland Cool Temperate Grassy Woodland remain, approximately 5% of its estimated pre-1750 distribution of 295,500 ha.
- 3.1.5 The distribution of Monaro Tableland Cool Temperate Grassy Woodland is highly restricted. The extent of occurrence of MTCTGW is 13,780 km<sup>2</sup> 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 53 10 km 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 Monaro Tableland Cool Temperate Grassy Woodland are poorly represented in the formal reserve network, and unreserved areas are subject to the threat of vegetation clearing. An estimated 1,293 ha of MTCTGW is distributed among 14 Reserves under the management of the NSW National Parks and Wildlife Service, the majority in Tallaganda National Park (NP), Kosciuszko NP and Paupong Nature Reserve. A further 147 ha occurs in Crown Reserves and 85 ha is preserved in perpetuity under Biobanking or Conservation Agreements. The total area under reservation is estimated to be 1,525 ha, equivalent to less than 1% of the estimated pre-1750 distribution or 8% of that remaining extant. Remnants are typically small and fragmented and are thus susceptible to attrition via clearing for routine land management practices. 'Clearing of native vegetation' is listed as a Key Threatening Process under the Act.
- 3.1.7 Monaro Tableland Cool Temperate Grassy Woodland has been subjected to grazing by domestic stock since the 1820s and extensive structural and compositional degradation was documented by the middle of the 20<sup>th</sup> century (Costin 1954). The loss of the tree stratum was associated with clearing and ring barking to facilitate pastoral activities coupled with a failure to regenerate due to grazing by rabbits and domestic stock. Degradation of the ground stratum has been associated with well-documented impacts of grazing including the erosion, compaction and nutrient enrichment of the topsoil (Yates *et al.* 2000; Eddy 2002; McIntyre *et al.* 2002; Prober *et al.* 2005; Lunt *et al.* 2007). This has resulted in the partial or complete replacement of tussock forming grass species such as *Austrostipa scabra*, *Poa labillardieri* and *Themeda triandra* with other grasses such as *Austrodanthonia* spp., *Enneapogon* spp. and *Aristida* spp. as well as herbs or sub-shrubs such as *Scleranthus* spp., *Helichrysum* spp., *Asperula* spp. and *Helipterum* spp. (Costin 1954). Extensive disturbance to the ground stratum has also resulted in the establishment of shrub or bracken thickets in certain areas dominated by species such as *Cassinia longifolia*, *Bossiaea buxifolia*, *Acacia dealbata*, *A. rubida* subsp. *rubida*, *Pimelea pauciflora* and *Pteridium esculentum* (Costin 1954). Grazing impacts have been further exacerbated by the application of chemical fertilizers, the removal of large trees, tilling of the soil and the sowing of exotic crop species to increase stocking rates (Keith 2004).

- 3.1.8 Remnants of Monaro Tableland Cool Temperate Grassy Woodland are subject to invasion by an extensive range of naturalised plant species. Major weeds include the shrub species *Rosa rubiginosa* (Sweet Briar), *Ulex europaeus* (Gorse) and *Lycium ferocissimum* (African Boxthorn), the forb species *Argemone ochroleuca* subsp. *ochroleuca* (Mexican Poppy), *Hirschfeldia incana* (Buchan Weed), *Hypericum perforatum* (St Johns Wort), *Lepidium draba* (Hoary Cress), *Sisymbrium officinale* (Hedge Mustard), *Verbascum thapsus* (Giant Mullein), *Carthamus lanatus* (Saffron Thistle), *Centaurea calcitrapa* (Star Thistle), *Cirsium vulgare* (Spear Thistle), *Dittrichia graveolens* (Stinkwort), *Trifolium* spp. (Clover), the annual grasses *Hordeum* spp. (Barley Grass), *Bromus* spp. (Brome Grass), *Vulpia myuros* (Rat's Tail Fescue), *Lolium perenne* (Perennial Ryegrass) and perennial grass species including *Eragrostis curvula* (African Lovegrass), *Phalaris aquatica* (Phalaris), *Dactylis glomerata* (Cocksfoot), *Festuca* spp. (Fescue) and *Nassella trichotoma* (Serrated Tussock). 'Invasion of native plant communities by exotic perennial grasses' is listed as a Key Threatening Process under the Act.
- 3.1.9 Remnants of Monaro Tableland 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 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 Monaro Tableland Cool Temperate Grassy Woodland is threatened by changes in rainfall or temperature that may occur as a consequence of human-induced climate change. A decline in annual rainfall is likely to precipitate a contraction of MTCTGW at the lower end of its present rainfall range and a concomitant expansion of temperate montane grasslands. Widespread dieback of *Eucalyptus pauciflora* observed in 2009 has been attributed to the effects of drought (J. Crooks *in litt.* December 2009). Under a warming climate, based on the climatic envelopes characterising related assemblages (as described by Costin 1954), the dominant tree species (*E. pauciflora*) may be replaced by *E. melliodora*, *E. blakelyi* and *E. bridgesiana*, and species characteristic of White Box Yellow Box Blakely's Red Gum Woodland may expand their distribution at the expense of species characteristic of MTCTGW. 'Anthropogenic climate change' is listed as a Key Threatening Process under the Act.
- 3.1.11 The threats to Monaro Tableland Cool Temperate Grassy Woodland listed above are ongoing and likely to cause continuing declines in geographic distribution and disruption of biotic processes or interactions.

## 3.2 Criteria for listing

Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion 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*:



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

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

<b>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:</b>			
	(a)	for critically endangered ecological communities	a very large reduction in geographic distribution
	(b)	<del>for endangered ecological communities</del>	<del>a large reduction in geographic distribution</del>
	(c)	<del>for vulnerable ecological communities</del>	<del>a moderate reduction in geographic distribution</del>

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.

<b>The ecological community's geographic distribution is:</b>				
	(a)	<del>for critically endangered ecological communities</del>	<del>very highly restricted.</del>	
	(b)	for endangered ecological communities	highly restricted.	
	(c)	<del>for vulnerable ecological communities</del>	<del>moderately restricted.</del>	
<b>and at least 1 of the following conditions apply:</b>				
	(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)	<del>The ecological community exists at:</del>		
		(i)	<del>for critically endangered ecological communities</del>	<del>an extremely low number of locations.</del>
		(ii)	<del>for endangered ecological communities</del>	<del>a very low number of locations.</del>
		(iii)	<del>for vulnerable ecological communities</del>	<del>a low number of locations.</del>

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

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

<b>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:</b>			
	(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.

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).

<b>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:</b>			
	(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).

<b>The probability of collapse of the ecological community is estimated to be:</b>			
	(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

Dr Marco Duretto  
Chairperson  
NSW Threatened Species Scientific Committee

## **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 Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (hereafter referred to as the Monaro Tableland Cool Temperate Grassy Woodland) in the field. Given natural variability, along with disturbance history, Monaro Tableland Cool Temperate Grassy Woodland may sometimes occur outside the typical range of variation in the features described below.

- 4.1 Monaro Tableland Cool Temperate Grassy Woodland 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 any of *Acacia melanoxylon*, *E. rubida* subsp. *rubida*, *E. stellulata* or *E. viminalis* as co-dominants. A number of other tree species have been recorded within the community, although very infrequently and always as canopy subdominants. These include *E. bridgesiana*, *E. dives*, *E. blakelyi* 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. At any given level of annual rainfall, variation in moisture availability may arise due to the influence of wind or soil water capacity. As a consequence, trees are sparser in areas subject to frequent high winds or which have heavy-textured soils (Costin 1954). 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 is highly variable in composition and cover as a function of grazing pressure from wild herbivores (native and exotic) and domestic stock. Ground cover species include *Themeda triandra*, *Poa sieberiana*, *Elymus scaber*, *Hydrocotyle laxiflora*, *Scleranthus biflorus*, *Oxalis perennans*, *Plantago varia*, *Euchiton japonicus*, *Poa labillardieri*, *Hypericum gramineum*, *Desmodium varians*, *Geranium solanderi*, *Acaena echinata*, *Gonocarpus tetragynus*, *Microlaena stipoides*, *Dichondra repens*, *Solenogyne gunnii*, *Asperula conferta*, *Asperula scoparia*, *Rumex brownii*, *Rytidosperma laeve*, *Rytidosperma pilosum*, *Chrysocephalum apiculatum* and *Chrysocephalum semipapposum*. The Community may develop a shrub or bracken layer as a consequence of the opening up of the ground stratum following excessive grazing by rabbits and sheep. This may include species such as *Pimelea pauciflora*, *Acacia dealbata*, *Acacia melanoxylon*, *Acacia rubida* subsp. *rubida*, *Cassinia longifolia* and *Pteridium esculentum* (Costin 1954).
- 4.2 The majority of current records of Monaro Tableland Cool Temperate Grassy Woodland occur in the Southern Tablelands of New South Wales (NSW) between Captains Flat in the north and Bombala in the south. The extent of its distribution largely coincides with the extent of the Monaro Tableland and Tindery-Gourock Ranges Physiographic Regions (Pain *et al.* 2011). Within those Regions, records of the Community predominantly lie within areas bounded by the 600 mm and 800 mm average annual rainfall isohyets. The eastern boundary corresponds approximately with the crest of the Great Dividing Range between Captains Flat and Nimmitabel, and the eastern catchment boundary of the Snowy River between Nimmitabel and the Victorian Border. To the west, records of Monaro Tableland Cool Temperate Grassy Woodland occur between the Adaminaby area in the north and Ingebyra in the south and are approximately bounded by the Eucumbene and Crackenback Rivers. As a consequence of the extensive rain-shadow

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centred on the Monaro Tableland, the western distribution of the Community is discontinuous with the distribution in the east, except for the areas of higher rainfall at the southern end of the Monaro plain between Bombala and Delegate.

- 4.3 Monaro Tableland Cool Temperate Grassy Woodland occurs on broad valley floors and the slopes and low rises of the moderately undulating tablelands on a wide variety of substrates including basalt, fine-grained sedimentary rocks, granite, acid volcanics and alluvium (Costin 1954). Records of MTCTGW fall within the following approximate ranges: elevation 700–1,200 m a.s.l.; average annual maximum temperature 22.5–25.5°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. Records of MTCTGW at lower elevations (700–900m a.s.l.) are most common in the far south (Bombala) and north (Captains Flat) of the range. Almost two thirds of records occur at higher elevations (1,000–1,200 m a.s.l.) along the eastern and western parts of the distribution but very few occur in the range 900–1,000 m a.s.l. This bias in the distribution of samples within the climatic envelope identified for the community may reflect more extensive clearing and degradation of the community at elevations intermediate to low in the Community's range.
- 4.4 Monaro Tableland Cool Temperate Grassy Woodland forms part of a continuum of related vegetation communities occurring on the broad valleys and moderately undulating hills 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 the purpose of this Determination by a joint analysis including more recently acquired plot data. Changes in the circumscription of these communities (their distributions and diagnostic taxa) reflect this more substantial information base as well as rationalisation of the existing units to reduce duplication and overlap. MTCTGW constitutes a single vegetation community type which corresponds broadly with Costin's (1954) *Eucalyptus pauciflora* – *E. stellulata* Alliance, Subformation Savannah Woodland, and includes Keith and Bedward's (1999) Monaro Basalt Grass Woodland (MU23B) in the south-east of Monaro Tableland. The plot samples which formed the basis of this Determination include a substantial number surveyed since 2013 in order to correct a dearth of plot data on the Monaro Tableland identified by Armstrong *et al.* (2013). As such, descriptions of vegetation community types such as those for VG150 (Gellie 2005) and GWp22 (Tozer *et al.* 2010) do not strongly resemble the description of MTCTGW contained herein. No equivalent vegetation type was described by Armstrong *et al.* (2013).
- 4.5 Patterns in the composition of the communities to which Monaro Tableland Cool Temperate Grassy Woodland is related correlate with gradients in moisture availability and temperature. In this context, MTCTGW represents the extreme end of the continuum in terms of exposure to cold and drought. MTCTGW shares this climatic envelop with Ribbon Gum – Snow Gum – *Cassinia longifolia* tall shrub-grass open forest of gullies in quartz-rich ranges in the Monaro and Kybeyan-Gourock subregions of the South Eastern

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Highlands bioregion (unit m31 of Armstrong *et al.* 2013 and incorporating vg73 of Gellie 2005). However, this latter community is restricted to areas of higher water availability on the deeper, moist soils of drainage lines and records of its occurrence are located in areas retaining substantially more cover of native vegetation (Armstrong *et al.* 2013).

Monaro Tableland Cool Temperate Grassy Woodland is replaced by Werriwa Tablelands Cool Temperate Grassy Woodland on the upper reaches of the Great Dividing Range north from Canberra, in areas with similar or slightly higher rainfall but where average summer temperature maxima are approximately 2°C warmer. In the Murrumbidgee River valley immediately to the north of the Monaro Tableland, MTCTGW is replaced by Armstrong *et al.*'s (2013) Yellow Box – Apple Box tall grassy woodland (u178), as rainfall falls below 650 mm and summer maxima are approximately 2°C warmer.

Where rainfall exceeds 800 mm, Monaro Tableland Cool Temperate Grassy Woodland grades into either Tozer *et al.*'s (2010) Tableland Swamp Flats Grassy Woodland (GWp520) or Armstrong *et al.*'s (2013) u118 Black Sallee grass-herb woodland in drainage depressions and moist valley flats (incorporating Gellie's (2005) vg146 Tableland Dry Herb/Grass Woodland and VCA303 of Benson *et al.* (2006)).

Monaro Tableland 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, the Community is replaced by either temperate montane grasslands or montane peatlands or swamps. In the latter case, the transition is characterised by the co-dominance of *Eucalyptus pauciflora* with *E. aggregata* or *E. ovata* (in warmer areas with relatively unimpeded drainage) or *E. stellulata*, *E. camphora* or *E. parvula* (in cooler areas with substantially impeded drainage) (Costin 1954). 'Natural Temperate Grassland of the Southern Tablelands (NSW and ACT)' is listed as a Threatened Ecological Community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). 'Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps' is listed as an Endangered Ecological Community under the NSW *Biodiversity Conservation Act 2016* (BC Act).

- 4.6 The transition from Monaro Tableland Cool Temperate Grassy Woodland into Ribbon Gum – Snow Gum – *Cassinia longifolia* tall shrub-grass open forest (unit m31 of Armstrong *et al.* 2013) is associated with an increase in the diversity and cover of shrub species and a corresponding decline in grass and forb species. Species which have been recorded more frequently in this community compared with MTCTGW include, in decreasing order of diagnostic power\*, *Ozothamnus conditus*, *Cassinia longifolia*, *Bossiaea buxifolia*, *Acacia rubida* subsp. *rubida*, *Acacia dealbata*, *Pultenaea procumbens*, *Clematis microphylla*, *Eucalyptus dives*, *Galium gaudichaudii*, *Hibbertia obtusifolia*, *Bursaria spinosa*, *Brachyloma daphnoides*, *Wahlenbergia stricta* and *Melichrus urceolatus*. Species which have been recorded more frequently in MTCTGW include, in decreasing order of diagnostic power\*, *Solenogyne gunnii*, *Poa labillardieri*, *Themeda triandra*, *Acaena echinata*, *Scleranthus biflorus*, *Asperula scoparia*, *Geranium antrorsum*, *Veronica gracilis*, *Wahlenbergia planiflora*, *Cullen microcephalum*, *Oxalis perennans*, *Panicum effusum*, *Eucalyptus stellulata*, *Desmodium varians*, *Carex breviculmis*, *Haloragis heterophylla*, *Dichondra repens*, *Chrysocephalum apiculatum*,

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*Leptorhynchos squamatus*, *Geranium solanderi*, *Rubus parvifolius*, *Asperula conferta*, *Carex inversa*, *Convolvulus erubescens* and *Austrostipa scabra*.

[\*species listed in sections 4.6 – 4.8 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 The transition from Monaro Tableland Cool Temperate Grassy Woodland into Yellow Box – Apple Box tall grassy woodland (u178) (Armstrong *et al.* 2013) is characterised by the replacement of *Eucalyptus pauciflora*, *E. stellulata*, *E. viminalis* and *E. rubida* subsp. *rubida* with *E. melliodora*, *E. blakelyi* and *E. bridgesiana* as the dominant trees. The two communities also differ substantially in the combinations of species comprising their ground strata. Species that have been recorded more frequently in Yellow Box – Apple Box tall grassy woodland, in decreasing order of diagnostic power\*, include *Crassula sieberiana*, *Solenogyne dominii*, *Austrostipa scabra*, *Convolvulus erubescens*, *Wurmbea dioica* subsp. *dioica*, *Acaena ovina*, *Vittadinia muelleri*, *Austrostipa bigeniculata*, *Bothriochloa macra*, *Goodenia pinnatifida*, *Eryngium ovinum*, *Bulbine bulbosa*, *Melichrus urceolatus*, *Tricoryne elatior*, *Aristida ramosa*, *Daucus glochidiatus*, *Lomandra filiformis*, *Drosera peltata*, *Euchiton sphaericus*, *Lomandra multiflora* subsp. *multiflora*, *Goodenia hederacea*, *Cheilanthes sieberi* subsp. *sieberi* and *Hibbertia obtusifolia*. Species that have been recorded more frequently in MTCTGW in decreasing order of diagnostic power\* include *Euchiton japonicum*, *Solenogyne gunnii*, *Poa labillardieri*, *Acaena echinata*, *Scleranthus biflorus*, *Asperula scoparia*, *Geranium antrorsum*, *Veronica gracilis*, *Wahlenbergia planiflora*, *Cullen microcephalum*, *Ajuga australis*, *Carex breviculmis*, *Dichondra repens*, *Arthropodium milleflorum*, *Rubus parvifolius*, *Oreomyrrhis eriopoda*, *Epilobium billardieranum*, *Viola betonicifolia*, *Asplenium flabellifolium*, *Acaena novae-zelandiae* and *Acacia dealbata*.
- 4.8 Intergradation between Monaro Tableland Cool Temperate Grassy Woodland and Werriwa Tablelands Cool Temperate Grassy Woodland is more or less precluded by a minimal overlap between their respective temperature and rainfall envelopes. Monaro Tablelands 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 a range of species which include, 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 oxylaboides*, *Desmodium varians*, *Ajuga australis*, *Carex breviculmis*, *Rytidosperma pilosum*, *Arthropodium milleflorum*, *Dichelachne inaequiglumis*, *Geranium solanderi*, *Rubus parvifolius*, *Oreomyrrhis eriopoda*, *Hydrocotyle laxiflora*, *Epilobium billardieranum*, *Viola bentonicifolia*, *Acaena novae-zelandiae*, *Bossiaea buxifolia*, *Luzula densiflora*, *Hovea linearis*, *Glycine clandestine* and *Acacia dealbata*. Species occurring more frequently in Werriwa Tableland Cool Temperate Grassy Woodland, in decreasing order of diagnostic power\*, include: *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*.

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- 4.9 Monaro Tableland Cool Temperate Grassy Woodland comprises part of Keith's (2004) Tableland Clay and Sub-Alpine Grassy Woodlands Classes. Parts of the distribution around Bombala occupy substantially lower elevations than other Sub-alpine Woodlands. The attribution of a single vegetation community to two different classes of vegetation highlights the anomaly of Sub-alpine woodlands occurring at relatively low elevations. Costin (1954) attributed the large elevational range occupied by his *E. pauciflora* – *E. stellulata* Savannah Woodland to a switching from climatic control at higher elevations to edaphic control at lower elevations.
- 4.10 Monaro Tablelands Cool Temperate Grassy Woodland may contain the following threatened animal and plant species listed under the BC Act or Commonwealth EPBC Act:

<b>Species</b>	<b>Common Name</b>	<b>BC Act*</b>	<b>EPBC Act*</b>
<i>Caladenia tessellate</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 aggregate</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 canaliculatum</i>	Summer Leek-orchid	Critically Endangered	Endangered
<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	Endangered	Endangered
<i>Rutidosia leiolepis</i>	Monaro Golden Daisy	Vulnerable	Vulnerable
<i>Rutidosia leptorrhynchoides</i>	Button Wrinklewort	Endangered	Endangered
<i>Swainsona sericea</i>	Silky Swainson-pea, Silky Pea	Vulnerable	
<i>Thesium austral</i>	Austral toadflax, Austral Toad-flax, Australian Toadflax	Vulnerable	Vulnerable
<b>Animals</b>			
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Vulnerable	
<i>Callocephalon fimbriatum</i>	Gang Gang Cockatoo	Vulnerable	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	Vulnerable	
<i>Melanodryas cucullata cucullate</i>	Hooded Robin	Vulnerable	
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	Vulnerable	

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<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>Myotis adversus</i>	Large-footed Myotis	Vulnerable	
<i>Miniopterus schreibersii</i>	Eastern Bent-wing Bat	Vulnerable	
<i>oceanensis</i>			
<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

\*Biodiversity Conservation Act 2016

+ Environment Protection and Biodiversity Conservation Act 1999

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## 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 km<sup>2</sup> 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).

<b>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:</b>			
	(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.

<b>The ecological community's geographic distribution is:</b>			
	(a)	for critically endangered ecological communities	very highly restricted.
	(b)	for endangered ecological communities	highly restricted.
	(c)	for vulnerable ecological communities	moderately restricted.
<b>and at least 1 of the following conditions apply:</b>			
	(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).

<b>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:</b>			
	(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).

<b>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:</b>			
	(a)	for critically endangered ecological communities	a very large disruption of biotic processes or interactions
	(b)	<del>for endangered ecological communities</del>	<del>a large disruption of biotic processes or interactions</del>
	(c)	<del>for vulnerable ecological communities</del>	<del>a moderately large disruption of biotic processes or interactions</del>

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).

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

Dr Marco Duretto  
 Chairperson  
 Threatened Species Scientific Committee

## **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*, *Leptorhynchos 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 <sup>+</sup>
<b>Plants</b>			
<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>Rutidosis leptorrhynchoides</i>	Button Wrinklewort	Endangered	Endangered
<i>Swainsona sericea</i>	Silky Swainson-pea, Silky Pea	Vulnerable	
<i>Thesium australe</i>	Austral Toadflax,	Vulnerable	Vulnerable
<b>Animals</b>			
<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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