

NSW Threatened Species Scientific Committee

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Notice of and reasons for Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions as an ENDANGERED ECOLOGICAL COMMUNITY in Part 2 of Schedule 2 of the Act and, as a consequence, to omit reference to Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion from Part 2 of Schedule 2 (Endangered Ecological Community) of the Act.

Summary of Conservation Assessment

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions was found to be eligible for listing as Endangered, as the highest threat category met by the taxon across all categories, under Clause 4.10 (b) (d i) (e) because it has a highly restricted distribution (EOO of 1,252 km² and AOO of 1,400 km²) and there is evidence of: i) continuing decline in spatial extent; and ii) threatening processes likely to cause continuing decline in environmental quality and biotic processes.

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 Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast 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 2 of Schedule 2 of the Act according to criteria as 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 Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (hereafter referred to as the Lower Hunter Spotted Gum Ironbark Forest) is characterised by the assemblage of species listed below.

<i>Acacia parvipinnula</i>	<i>Aristida vagans</i>
<i>Billardiera scandens</i>	<i>Bursaria spinosa</i>
<i>Callistemon linearifolius</i>	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>
<i>Correa reflexa</i>	<i>Corymbia maculata</i>
<i>Daviesia ulicifolia</i>	<i>Denhamia silvestris</i>
<i>Dianella revoluta</i> var. <i>revoluta</i>	<i>Dichelachne micrantha</i>
<i>Entolasia stricta</i>	<i>Eragrostis brownii</i>
<i>Eucalyptus fibrosa</i>	<i>Eucalyptus punctata</i>
<i>Glycine clandestina</i>	<i>Goodenia rotundifolia</i>
<i>Grevillea montana</i>	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>

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Hardenbergia violacea
Leptospermum parvifolium
Lomandra filiformis
Macrozamia flexuosa
Melaleuca nodosa
Opercularia diphylla
Panicum simile
Persoonia linearis
Platysace ericoides
Pomax umbellata
Pultenaea spinosa
Themeda triandra

Lepidosperma laterale
Lissanthe strigosa
Lomandra multiflora
Melaleuca decora
Microlaena stipoides
Ozothamnus diosmifolius
Paspalidium distans
Phyllanthus hirtellus
Podolobium ilicifolium
Pratia purpurascens
Rytidosperma pallidum
Vernonia cinerea var. *cinerea*

- 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 (see section 4).

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

- 2.1 Lower Hunter Spotted Gum Ironbark Forest is endemic to New South Wales (NSW) and is currently found in the Sydney Basin and NSW North Coast Bioregions. The assemblage of species listed in Part 1.1 above which characterises the Lower Hunter Spotted Gum Ironbark Forest occurs within the Sydney Basin and NSW North Coast 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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- 2.2 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 these Bioregions be covered by this Determination.

Part 3. Eligibility for listing

- 3.1 Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion was listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995* in 2005. 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 *Biodiversity Conservation Act 2016*.

- 3.1.1 The geographic distribution of Lower Hunter Spotted Gum Ironbark Forest is highly restricted. The best estimate of the extent of occurrence (EOO) is 1,252 km², based on a minimum convex polygon enclosing likely occurrences of the community, the method of assessment recommended by IUCN (Bland *et al.* 2017). The best estimate of the area of occupancy (AOO) is 1,400 km² based on 10 x 10 km grid cells (with a minimum of 1% occupied by the Community), the scale recommended for assessing AOO by IUCN (Bland *et al.* 2017). The best estimates of EEO and AOO exclude mapped occurrences of the community that have not been corroborated by multiple sources. Taking these areas into account, the upper bounds for the EOO and AOO of the community are 1,773 km² and 1,800 km², respectively.

- 3.1.2 Lower Hunter Spotted Gum Ironbark Forest has undergone a large reduction in geographic distribution, although the current extent of the community is difficult to estimate because a high proportion of remnants have suffered significant modification of either the tree or understorey layers, and remnants are hard to assign to community type using remote imagery. No quantitative estimates of the area of the community that retains a substantially unmodified understorey exist. Qualitative data suggest extensive areas have been subject to disturbance (see 3.1.4). Several authors have estimated the extent of reduction of the Community based on changes in tree cover, although not all incorporated the full extent of the pre-1750 distribution. Bell and Driscoll (2007) estimated 48% remained of an original 13,771 ha of Lower Hunter Spotted Gum Ironbark Forest in the core part of its distribution in the Cessnock area. House (2003) estimated the entire pre-1750 distribution amounted to 64,587 ha. Based on an analysis of aerial photographs dating from between 2000 and 2001, he estimated that some 26,518 ha (41%) of this area retained an open forest structure consistent with a low level of modification from its original structure. A further 4,768 ha (7%) of remnant vegetation exhibiting varying degrees of structural disturbance may retain the compositional elements of the community (House 2003). Therefore, the area extant in 2001 was likely to be higher than 26,518 ha with an upper bound of 31,286 ha (48% of the pre-1750 distribution). The most recent estimates of the extent of Lower Hunter Spotted Gum Ironbark Forest derive from Sivertsen *et al.* (2011), who estimated tree crown cover using a multi-temporal array of pan-sharpened SPOT imagery (2007, 2008 and 2009). Based on Sivertsen *et al.*'s (2011) estimate of tree cover, between 17,456 ha (open forest structure, 27% of pre-1750 distribution) and 26,298 ha (all structural forms, 41% of pre-1750 distribution) of the area mapped as Lower Hunter Spotted Gum Ironbark Forest by House (2003) remained in 2009. These estimates may indicate that a further reduction of between 7% and 14% of the pre-1750 distribution occurred between 2001 and 2009, although some of the apparent decline may be attributed to the use of a different method of estimation. The extent of vegetation corresponding to Somerville's (2009b) MU 67 and MU 68 (which

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correspond broadly with NPWS's (2000) Map Unit 17 upon which the original Determination was based) was estimated to be 18,616 ha by Sivertsen *et al.* (2011), although the estimated error of omission in this case is more than 38%. Taking into consideration the uncertain status of structurally modified remnants, the percentage of Lower Hunter Spotted Gum Ironbark Forest remaining may be as low as 27% but is more likely to be closer to the centre of the range 27- 48%.

3.1.3 Clearing and other disturbances have resulted in a high degree of fragmentation of Lower Hunter Spotted Gum Ironbark Forest. House (2003) estimated that prior to European settlement some 75% of its distribution comprised a core area in the Cessnock area with the remaining 25% distributed within a mosaic of other communities. In 2003 the distribution was estimated to comprise more than 4,800 fragments, of which more than 4,500 were less than 10 ha (House 2003). Clearing pressures from rural residential and residential subdivisions, industrial developments and new cropping enterprises (e.g. vineyards) continue to threaten the community, particularly in the Cessnock local government area where the core of this community occurs. In the Maitland local government area, Hill (2003) assessed Lower Hunter Spotted Gum Ironbark Forest as exposed to high levels of threat from development, tree dieback and grazing and under moderate levels of threat from fragmentation, weeds and fire. 'Clearing of native vegetation' is listed as a Key Threatening Process under the Act.

3.1.4 Much of the remaining Lower Hunter Spotted Gum Ironbark Forest shows evidence of disturbance. Logging, mining, expansion of unplanned tracks and trails, rubbish dumping, off-road vehicle use, arson and weed invasion affect remnants even within conservation reserves (Bell 2004). Past logging practices and fire regimes have heavily modified some parts of the community, resulting in simplified structure and floristics. Frequent fires (<3 years) have dramatically simplified understorey vegetation (Bell 2004). 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as Key Threatening Processes under the Act.

3.1.5 Lower Hunter Spotted Gum Ironbark Forest is currently known to occur within Werakata National Park (1,818 ha) and Werakata State Conservation Area (1,161 ha) (Bell 2013), and Columbe National Park (419 ha) and Columbe State Conservation Area (87 ha) (Bell 2016). The combined area under formal reservation is therefore 3,541 ha, or approximately 5% of the community's pre-European distribution. A further 175 ha occurs in Crown Land Reserves. Areas under reservation are predominantly structurally immature and dominated by young trees (Bell 2004).

3.2 Criteria for listing

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions is eligible to be listed as an Endangered Ecological Community as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a very high risk of extinction in New South Wales in the near future, as determined in accordance with the following criteria prescribed by the *Biodiversity Conservation Regulation 2017*:

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Clause 4.9 – Reduction in geographic distribution of ecological community
 (Equivalent to IUCN Red List of Ecosystems Criterion A)
 Assessment Outcome: Vulnerable

The ecological community has undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:			
	(a)	for critically endangered ecological communities	a very large 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

Clause 4.10 - Restricted geographic distribution of ecological community
 (Equivalent to IUCN Red List of Ecosystems Criterion B)
 Assessment Outcome: Endangered via Clause 4.10 (b) (d i) (e).

The ecological community's geographic distribution is:			
	(a)	for critically endangered ecological communities	very highly restricted
	(b)	for endangered ecological communities	highly restricted
	(c)	for vulnerable ecological communities	moderately restricted
and at least 1 of the following conditions apply:			
	(d)	there is a projected or continuing decline in any of the following:	
		(i)	a measure of spatial extent appropriate to the ecological community,
		(ii)	a measure of environmental quality appropriate to the characteristic biota of the ecological community,
		(iii)	a measure of disruption to biotic interactions appropriate to the 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, or
		(ii)	for endangered ecological communities a very low number of locations, or
		(iii)	for vulnerable ecological communities a low number of locations.

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Clause 4.11 – Environmental degradation of ecological community
 (Equivalent to IUCN Red List of Ecosystems Criterion C)
 Assessment Outcome: Data deficient

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

Clause 4.12 – Disruption of biotic process or interactions in ecological community
 (Equivalent to IUCN Red List of Ecosystems Criterion D)
 Assessment Outcome: Data deficient

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

Clause 4.13 - Quantitative analysis of probability of collapse of ecological community
 (Equivalent to IUCN Red List of Ecosystems Criterion E)
 Assessment Outcome: Data deficient

The probability of collapse of the ecological community is estimated to be:			
	(a)	for critically endangered ecological community	extremely high
	(b)	for endangered ecological community	very high
	(c)	for vulnerable ecological community	high

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Clause 4.14 - Very small number of locations – vulnerable ecological community
(Equivalent to IUCN Red List of Ecosystems Criterion B3)
Assessment Outcome: Not Threatened

For vulnerable ecological communities,	the number of locations of the ecological community such that the ecological community is prone to the effects of human activities or stochastic events within in a very short time period.
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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 Lower Hunter Spotted Gum Ironbark Forest in the field. Given natural variability, along with disturbance history, Lower Hunter Spotted Gum Ironbark Forest may sometimes occur outside the typical range of variation in the features described below.

- 4.1 Lower Hunter Spotted Gum Ironbark Forest is currently known to occur in the Lower Hunter Valley centred on the Cessnock-Beresfield area and approximately bounded by the towns of Paxton, Branxton, Clarence Town, Beresfield, Mt Vincent and the northern boundary of Watagans National Park. The northern and southern parts of its distribution are separated by the floodplain of the Hunter River.
- 4.2 Lower Hunter Spotted Gum Ironbark Forest is known to occur principally on Permian and Carboniferous geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures (NSW Department of Mines 1966, 1969). In the area of Paterson, Seaham and Clarence Town, the community occurs on Carboniferous sediments including the Wallaringa, Mt Johnstone and Seaham formations. The community is strongly associated with, although not restricted to, the yellow podsollic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991). These substrates are considered to produce 'moderately fertile' soils (Kovac and Lawrie 1991).
- 4.3 Lower Hunter Spotted Gum Ironbark Forest is usually dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), with *E. punctata* (Grey Gum) occurring less frequently. Other tree species have been recorded infrequently, including *E. crebra*, *E. moluccana*, *E. agglomerata*, *E. umbra*, *C. gummifera*, *Syncarpia glomulifera*, *E. globoidea*, *E. paniculata* subsp. *paniculata*, *E. sparsifolia*, *Angophora costata*, *E. acmenoides*, *E. fergusonii* subsp. *fergusonii*, *E. nubila* and *C. eximia* (NPWS 2000). None of these species are characteristic of Lower Hunter Spotted Gum Ironbark Forest. A sparse to moderately dense shrub stratum may be present and is variable in composition depending on the soils, drainage, topography and the history of disturbance. The most frequently encountered shrub species include *Acacia parvipinnula*, *Bursaria spinosa*, *Daviesia ulicifolia*, *Lissanthe strigosa*, *Melaleuca nodosa* and *Persoonia linearis*. The ground stratum is typically diverse, and its composition also varies as a function of the factors listed above. Species frequently observed in the ground stratum include *Aristida vagans*, *Cheilanthes sieberi*, *Dianella revoluta*,

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Entolasia stricta, *Glycine clandestina*, *Hardenbergia violacea*, *Lepidosperma laterale*, *Lomandra filiformis*, *Lomandra multiflora*, *Macrozamia flexuosa*, *Microlaena stipoides*, *Panicum simile*, *Phyllanthus hirtellus*, *Pomax umbellata* and *Themeda triandra* (Somerville 2009b).

- 4.4 Several different structural and compositional forms of Lower Hunter Spotted Gum Ironbark Forest have been identified (Bell and Driscoll 2007; Somerville 2009b; Bell 2013), however the relationships between these are complex and have not been examined quantitatively along environmental gradients (Sivertsen *et al.* 2011). In an undisturbed condition, the structure of the community is typically open forest. If thinning has occurred, it may take the form of woodland or a dense thicket of either shrubs or saplings, depending on post-disturbance regeneration. Somerville (2009a, 2009b) described two communities corresponding to Lower Hunter Spotted Gum Ironbark Forest. The first of these (MU 67 Spotted Gum/Red Ironbark/Large – fruited Grey Gum shrub/grass open forest) is the more widespread and is described as “open forests characterised by a canopy strongly dominated by *Corymbia maculata* and *Eucalyptus fibrosa* often in association with *E. punctata*. The shrubby understorey is characterised by a range of shrubs including *Daviesia ulicifolia*, *Persoonia linearis*, *Bursaria spinosa* and *Lissanthe strigosa*. The ground layer is characteristically grassy and dominated by a range of species including *Themeda australis* [syn. *Themeda triandra*], *Entolasia stricta*, *Aristida vagans* and *Panicum simile*. Various graminoids are also typically present in the ground layer in particular *Lepidosperma laterale*, *Dianella revoluta* and *Lomandra multiflora*, along with ground ferns, typically *Cheilanthes sieberi*, and scattered herbs” (Somerville 2009b). The second community (MU 68 Red Ironbark/paperbark shrubby open forest) is more restricted in distribution and is described as “open forests with a canopy strongly dominated by *Eucalyptus fibrosa* often in association with *Corymbia maculata*, with a tall shrub layer dominated by *Melaleuca nodosa* and commonly including *M. decora*. The open shrub layer may include various shrubs such as *Bursaria spinosa*, *Pultenaea spinosa*, *Acacia parvipinnula* and *Macrozamia flexuosa*, however climbing species are not an abundant feature of the community. The ground layer is typically dominated by grasses, in particular *Entolasia stricta*, *Microlaena stipoides* and *Aristida vagans* and ground ferns, predominately *Cheilanthes sieberi*” (Somerville 2009b). These communities correspond to the Cessnock Spotted Gum Ironbark Forest and Cessnock Ironbark Forest of Bell (2013). A third community described by Somerville (2009b), MU 66 Large-fruited Grey Gum/Rough-barked Apple open forest, is closely related to MU 67 and MU 68 and occupies a similar spatial and environmental envelope (Somerville 2009a), however this community is dominated by *E. punctata* in association with *Angophora floribunda*. MU 66 is also characterised by a higher frequency of occurrence of the shrub species *Acacia ulicifolia*, *Breynia oblongifolia*, *Exocarpos strictus*, *Jacksonia scoparia* and *Leptospermum trinervium* (Somerville 2009b). This Community does not fall within the circumscription of Lower Hunter Spotted Gum Ironbark Forest.
- 4.5 Lower Hunter Spotted Gum Ironbark Forest belongs to a continuum of related ecological communities which have been described and iteratively refined following incremental additions to a regional quantitative floristic survey dataset (NPWS 2000; Peake 2006; Somerville 2009a, 2009b; Sivertsen *et al.* 2011; Bell 2013). Patterns in the composition of communities dominated by Spotted Gum are broadly correlated with gradients in average annual rainfall and temperature (average minima and maxima), which are strongly influenced by elevation and distance from the coast (Bell 2013). Successive treatments have consistently recognised Lower Hunter Spotted Gum Ironbark Forest as an assemblage of species corresponding to vegetation occurring in areas approximately intermediate in this climatic

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range, where annual rainfall is in the range 750 – 1000 mm. However, these treatments differ in the compositional range attributed to the ecological community, and hence in the way the community is defined.

- 4.6 Lower Hunter Spotted Gum Ironbark Forest grades into Spotted Gum/Broad-leaved Mahogany/Red Ironbark moist shrubby open forest (MU 65 of Somerville 2009b) in areas with similar edaphic properties but receiving a higher average annual rainfall. This community includes vegetation described as Coastal Foothills Spotted Gum Ironbark Forest, Seaham Spotted Gum Ironbark Forest (MU 15 and MU 16 of NPWS 2000) and Hinterland Spotted Gum Ironbark Forest (Bell 2013). Spotted Gum/Broad-leaved Mahogany/Red Ironbark moist shrubby open forest differs from Lower Hunter Spotted Gum Ironbark Forest in the composition of the tree stratum, where *Corymbia maculata* dominates in association with *Eucalyptus umbra*, *E. fibrosa*, *E. siderophloia* and *Allocasuarina torulosa*. Spotted Gum/Broad-leaved Mahogany/Red Ironbark moist shrubby open forest also differs in the composition of the shrub stratum, with species such as *Grevillea montana*, *G. parviflora* subsp. *parviflora*, *Melaleuca decora*, *M. nodosa* and *Pultenaea spinosa* occurring less frequently than in Lower Hunter Spotted Gum Ironbark Forest, while others (*Acacia ulicifolia*, *Breynia oblongifolia*, *Leucopogon juniperinus*, *Notelaea longifolia*) have been recorded more frequently (Somerville 2009b). Subshrubs and herbaceous species recorded less frequently in MU 65 than in Lower Hunter Spotted Gum Ironbark Forest include *Dianella revoluta*, *Dichelachne micrantha*, *Goodenia rotundifolia*, *Rytidosperma pallidum*, *Macrozamia flexuosa*, *Opercularia diphylla*, *Phyllanthus hirtellus*, *Platysace ericoides*, *Podolobium ilicifolium*, and *Pomax umbellata*. Species recorded more frequently in MU 65 include *Cymbopogon refractus*, *Desmodium rhytidophyllum*, *Desmodium varians*, *Dianella caerulea*, *Dichondra repens*, *Echinopogon ovatus*, *Eustrephus latifolius*, *Geitonoplesium cymosum*, *Gonocarpus tetragynus*, *Goodenia heterophylla*, *Imperata cylindrica*, *Pandorea pandorana* and *Pseuderanthemum variabile* (Somerville 2009b).
- 4.7 Lower Hunter Spotted Gum Ironbark Forest grades into Somerville's (2009b) Spotted Gum/Narrow-leaved Ironbark/Red Ironbark shrub/grass open forest (MU 72) or Narrow-leaved Ironbark/Grey Box/ Spotted Gum shrub/grass open forest (MU 75) to the north west of its distribution as average annual rainfall declines. Both MU 72 and MU 75 comprise part of the Endangered Ecological Community Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions, listed under the Act. They differ from Lower Hunter Spotted Gum Ironbark Forest in the co-dominance of *Eucalyptus crebra* and *Corymbia maculata*, and in the lower frequency of occurrence (MU 72) or absence (MU 75) of *E. fibrosa*. Narrow-leaved ironbark/Grey Box/Spotted Gum shrub/grass open forest is also characterised by *E. moluccana* as a co-dominant, with *Brachychiton populneus* dominating a separate sparse stratum of small trees (Somerville 2009b). Compositional differences in the understorey of these drier communities include a higher frequency of occurrence of the species *Aristida ramosa*, *Breynia oblongifolia*, *Brunoniella australis*, *Calotis cuneifolia*, *C. lappulacea*, *Chrysocephalum apiculatum*, *Commelina cyanea*, *Cymbopogon refractus*, *Desmodium brachypodum*, *D. varians*, *Dichondra repens*, *Eremophila debilis*, *Fimbristylis dichotoma*, *Glossogyne tannensis*, *Glycine tabacina*, *Goodenia hederacea*, *Indigofera australis* and *Paspalidium aversum* (Somerville 2009b). Species characteristic of Lower Hunter Spotted Gum Ironbark Forest which occur less frequently in MU 72 and MU 75 include *Billardiera scandens*, *Correa reflexa*, *Dichelachne micrantha*, *Eucalyptus punctata*, *Goodenia rotundifolia*, *Grevillea montana*, *Rytidosperma pallidum*, *Melaleuca decora*, *M. nodosa*, *Panicum simile*, *Persoonia linearis*, *Platysace ericoides*, *Podolobium ilicifolium* and *Pultenaea spinosa* (Somerville 2009b).

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- 4.8 Lower Hunter Spotted Gum Ironbark Forest grades into Somerville's (2009b) Spotted Gum/ Red Ironbark/ Narrow-leaved Ironbark shrub/ grass open forest (MU 71) at very low elevations. This differs in the co-dominance of *Corymbia maculata* and *Eucalyptus fibrosa*, in association with *E. moluccana*, *E. crebra* and *E. tereticornis* (Somerville 2009b). Further to the north, and including areas at higher elevations and receiving higher rainfall, Lower Hunter Spotted Gum Ironbark Forest is replaced by Spotted Gum/ Narrow-leaved Ironbark shrub/grass open forest (MU 73). This community corresponds to Peake's (2006) Barrington Foothills Dry Spotted Gum Forest and differs in the co-dominance of *C. maculata*, *E. crebra* and, less frequently, *E. tereticornis*, as well as the presence of a small tree stratum dominated by *Allocasuarina torulosa* and *Brachychiton populneus* (Somerville 2009b). Other species occurring more frequently in MU 73 than Lower Hunter Spotted Gum Ironbark Forest include *Acacia implexa*, *Aristida ramosa*, *Arthropodium* species B, *Breynia oblongifolia*, *Brunoniella australis*, *Cheilanthes distans*, *Cissus opaca*, *Clematis glycinoides*, *Clerodendrum tomentosum*, *Cymbopogon refractus*, *Desmodium brachypodium*, *D. rhytidophyllum*, *D. varians*, *Dianella caerulea*, *Dichondra repens*, *Entolasia marginata*, *Eustrephus latifolius*, *Gahnia aspera*, *Geitonoplesium cymosum*, *Notelaea longifolia*, *Oplismenus aemulus*, *Pandorea pandorana*, *Pittosporum undulatum* and *Solanum stelligerum* (Somerville 2009b).
- 4.9 Lower Hunter Spotted Gum Ironbark Forest shares many species with the forests dominated by *Corymbia maculata* and *Eucalyptus fibrosa* in the Nowra region however the Nowra forests are characterised by the frequent occurrence of *C. gummifera* as a co-dominant with *C. maculata*, as well as the more frequent occurrence of species such as *Macrozamia communis*, *Persoonia mollis* subsp. *leptophylla*, *Gonocarpus tetragynus*, *Goodenia heterophylla*, *Lomandra confertifolia* subsp. *rubiginosa*, *L. glauca*, *L. obliqua*, *Monotoca scoparia* and *Patersonia sericea* (Gellie 2005). These Nowra forests are not included in Lower Hunter Spotted Gum Ironbark Forest.
- 4.10 On open depressions and drainage flats within the Cessnock-Beresfield area, Lower Hunter Spotted Gum Ironbark Forest may be replaced by Hunter Lowland Redgum Forest (NPWS 2000) (equivalent to Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC), in which *Eucalyptus tereticornis*, *E. punctata*, *E. crebra* and *Angophora floribunda* occur more frequently, as do *Breynia oblongifolia*, *Leucopogon juniperinus*, *Jacksonia scoparia* and *Brunoniella australis* (NPWS 2000).
- 4.11 Lower Hunter Spotted Gum Ironbark Forest is likely to contain a number of threatened plant species including those listed in the table below.

Species	BC Act*	EPBC Act [†]
<i>Callistemon linearifolius</i>	Vulnerable	
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Vulnerable	Vulnerable
<i>Persoonia pauciflora</i>	Critically Endangered	Critically Endangered
<i>Rutidosia heterogama</i>	Vulnerable	Vulnerable

* Biodiversity Conservation Act 2016

[†] Environment Protection and Biodiversity Conservation Act 1999

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4.12 Lower Hunter Spotted Gum Ironbark Forest is likely to contain a number of threatened animal species including those listed in the table below.

Species	Common name	BC Act*	EPBC Act ⁺
Birds			
<i>Anthochaera phrygia</i>	Regent Honeyeater	Critically Endangered	Critically Endangered
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Vulnerable	
<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo	Vulnerable	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	Vulnerable	
<i>Glossopsitta pusilla</i>	Little Lorikeet	Vulnerable	
<i>Lathamus discolor</i>	Swift Parrot	Endangered	Critically Endangered
<i>Melithreptus gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Vulnerable	
<i>Neophema pulchella</i>	Turquoise Parrot	Vulnerable	
<i>Ninox strenua</i>	Powerful Owl	Vulnerable	
Mammals			
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Vulnerable	
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Vulnerable	
<i>Petaurus australis</i>	Yellow-bellied Glider	Vulnerable	
<i>Petaurus norfolcensis</i>	Squirrel Glider	Vulnerable	
<i>Phascolarctos cinereus</i>	Koala	Vulnerable	Vulnerable
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	Vulnerable

* Biodiversity Conservation Act 2016

⁺ Environment Protection and Biodiversity Conservation Act 1999

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