

VAST-2 - Site-based recording of use and land management and their effects on native vegetation over time

Citation: Thackway, R (2012). Cumberland State Forest, NSW, old abandoned arboretum 3a, 7a, 7b and 7c. Ver.1. VAST-2: tracking vegetation transformation in Australian landscapes. Australian Centre for Ecological Analysis and Synthesis, University of Queensland, Brisbane.

1. Name of site/area

Cumberland State Forest compartments 3a, 7a, 7b and 7c.

2. Last modified (version no. 1)

Minor changes July 2013.

3. Location of site

State: New South Wales

Biogeographic context – N/A

REG_NAME_7:	REG_CODE_7:	SUB_NAME_7:	SUB_CODE_7:
Sydney Basin	SYB	Cumberland	SYB08

Co-ordinates: 33°44'35.39.84"S, 151°2'27.88"E.

Source: 2006 Cumberland State Forest compartment map 3 May 2006 Draft

4. Area of the site

Compartments 3a, 7a, 7b and 7c account for around 2 ha of the cleared area. These compartments comprise part of a cleared area shown in the 1943 air photo of approximately 13 ha.

5. Brief description of the natural undisturbed ecosystem of the site/area

The Cumberland State Forest is part of the Blue Gum High Forest (Daniel Connolly pers comm). It is a tall wet sclerophyll forest found on Wianamatta group Ashfield Shale. Soils derived from this Shale are deep, red, podsollic soils of clay loam texture with heavy clay layers in the B horizons (Forestry Commission of NSW 1984). Wianamatta Shale comprises claystone, siltstone, laminite and fine to medium grained lithic sandstone weathering to low fertility soils ranging in texture from loam to heavy clay (Tozer 2003).

Cumberland S.F. receives an average annual rainfall of approximately 900 -1300 mm and moderate daily temperatures (January mean max. 29°C, min. 16°C; Jul y mean max. 16°C, min. 5°C) (Forestry Commission of N SW 1984). Monthly rainfall records from 1970 to 2003 for Cumberland S.F. were used to calculate White's Moisture Stress Index (White 1986). Standard normal deviates of their long-term means (33 years) were calculated for the periods November to February and May to August. (Stone and Simpson 2006, DECCW 2009).

Mild frosts can occur from May to September.



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Blue Gum High Forest is dominated by Sydney blue gum (*E. saligna*), blackbutt (*E. pilularis*), and Turpentine (*Syncarpia glomulifera*) with a number of other Eucalypts occurring patchily (DECCW 2009). A sparse open cover of small trees includes a variety of sclerophyllous and mesophyllous species. The ground layer is variable in composition and cover; including ferny, grassy or herbaceous and/or vines and climbers. The characteristics of the ground cover are related to topographic position.

6. Current purpose (2011) of the site/area

State Forest is managed as a day use natural area recreation, consisting of 39 ha. Most of the State Forest is intensively managed regrowth forest (Stone and Simpson 2006).

7. Reference or benchmark vegetation description: pre-clearing or pre-European community

Area of the plot: Area of the plot = e.g. 20 m x 20 m (0.4 ha): 22 quadrats were surveyed by Tozer; each survey site was described within a quadrat of area 0.04 ha (Tozer 2003).

The reference state for Cumberland State Forest compartments 3a, 7a, 7b and 7c. is Unit 15 Turpentine Ironbark Forest (Tozer pers comm 2012).

NVIS level VI – sub-association	Overstorey	Midstorey	Understorey - ground layer
Dominant Species	Eucalyptus saligna (Sydney blue gum) +/- Eucalyptus pilularis (Black butt) +/- Eucalyptus paniculata (Grey Ironbark) +/- Syncarpia glomulifera (Turpentine) +/- Angophora costata (Smooth-barked apple)	Pittosporum undulatum +/- Syncarpia glomulifera +/- Elaeocarpus reticulatus +/- Acacia implexa	Shrub layer: Polyscias sambucifolia, Pittosporum undulatum, Pittosporum revolutum, Breynia oblongifolia, Leucopogon juniperinus, Ozothamnus diosmifolius, Notelaea longifolia, Clerodendrum tomentosum, Maytenus silvestris, Trema tomentosa Ground cover layer: Entolasia marginata, Pseuderanthemum variabile, Oplismenus aemulus, Lomandra longifolia, Microlaena stipoides, Dianella caerulea, Dichondra repens, Poa affinis, Oplismenus imbecillis, Sigesbeckia orientalis, Adiantum aethiopicum, Pratia purpurascens
Species richness 42.2 ±8.4	4	4	Shrub = 14 Ground cover = 20
Growth form	Tree	Tree	Shrub and forb Ground layer: mixture of herbs and grasses
Structural Formation Class	Tall Open Forest	Sparse to open low woodland	Open shrubland Forbland
FPC	33% ±12 8 – 50%	24% ±18 2 - 60	Shrub layer 4.3m ±3.2, 1.5 – 15.0 Ground layer 52% ±31, 2 - 95
Height	32m ±8 20 – 55 m	13m ±7 2 – 30	Shrub layer 2.6 +/- 0.9 Ground layer 0.7 +/- 0.5



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			Vines & Climbers Eustrephus latifolius, Pandorea pandorana, Clematis glycinoides var. glycinoides, Tylophora barbata, Cayratia clematidea, Glycine microphylla. N = 6
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Soil	Type, compaction, hydrology, depth of A0 horizon, chemistry (NPK),
Fire	Importance for regeneration and reproduction, frequency, area burnt.

Source: DECCW 2009 and Tozer (2003)

8. Brief history of the site/area:

- 1788- Area managed by indigenous people speaking Darug people
- 1788-1824 Region explored - un-modified native forest Blue Gum/Ironbark on shale
- 1825 Parcel selected by Mr Shepherd
- 1860 Tree cover likely to have been thinned ~ selective logging for fences and housing
- 1826-1907 Grazing stock on native pastures
- 1908 Land parcel cleared and sown to improved pasture, and evidence of chicken farm and fruit orchards
- 1909-1937 Managed as improved pasture and grazing
- 1937-38 Purchased by NSW Forestry Commission
- 1941-42 Remaining native forest trees cleared to establish an arboretum
- 1943-45 Arboretum planted as a future urban working forest
- 1946-73 Arboretum managed for education and demonstration – infilling regrowth native forest observed
- 1974-84 Arboretum increasing managed for recreation – infilling regrowth native forest observed
- 1985-2012 Area managed for recreation (ex-arboretum and regrowth native forest)

9. Proximity to large area of intact and largely intact and unmodified remnant

Small patches (1-3 ha) of remnant native forest found within 200 m.



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10. Sources of data and information used to complete description of use and management and their effects of native vegetation over time

- A. Tim Liston pers, comm. 2012. Senior Ranger Cumberland State Forest
- B. 1941 Aerial photograph. Black and white. Map: 1312/ Broken Bay: Run: 17, 1942. 8'4" RF 1/14550 restricted. 3735
- C. 1943 Aerial photograph. Black and white. No details
- D. 1951 Aerial photograph. Black and white. No details
- E. 1978 Aerial photograph. Black and white. NSW 2710 466. County of Cumberland. 1:16000 (I.S.G) (Misc. 1029) Run 10. 29.3.1978. 2590 m ASL. Land and Property Information
- F. 1982 Aerial photograph. Colour. 10 Aug 1982, Run 17, 146-195. NSW 3242. 1:16000. Sydney (M1474) 2560 M ASL. Land and Property Information
- G. 1984 Aerial photograph. Colour. Cumberland National Forest. 1:5000. 13 Feb 1984. FC 18 03 83-13. 209.73 mm. 1219 m ASL. Forestry Commission.
- H. 1999 Aerial photograph. Colour. Product of QASCO Australia. 5050 ASL. 1:10000. Run 1, 3540-3542. QAS 3241c 18 April 1999. Cumberland Forestry.
- I. 2006 Cumberland State Forest Compartment Map 3 May 2006 Draft
- J. 2012 Google earth image.
- K. Inferred by Richard Thackway 2012
- L. Cumberland State Forest. Escape the everyday in Australia's only metropolitan State forest, West Pennant Hills, Sydney. <http://www.gwsjoeys.org.au/wp-content/uploads/2011/10/cumberland-rec-brochure.pdf>
- M. Forestry Commission of N.S.W. (1984) Management plan for Cumberland Management Area. Forestry Commission of New South Wales
- N. Indigenous Language Map <http://www.abc.net.au/indigenous/map/>
- O. Land and marine exploration <http://atlas.nsw.gov.au/public/nsw/home/topic/article/exploration.html>.
- P. Stone C. and Simpson J. (2006). Leaf, tree and soil properties in a Eucalyptus saligna forest exhibiting canopy decline. *Cunninghamia* 9(4): 507–520
- Q. Christine Stone pers, comm. 2012.
- R. http://warragamba.net.au/warra/index.php?option=com_content&view=article&id=66&Itemid=73.
- S. Metropolitan Water Plan (2006) Chapter 3: Managing drought—a new approach. www.waterforlife.nsw.gov.au/about/publications
- T. NSW National Parks and Wildlife Service (2002). Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney, NSW NPWS, Hurstville. <http://www.environment.nsw.gov.au/resources/nature/cumbPlainMappingInterpguidelines.pdf>
- U. Tozer, M (2003) The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. *Cunninghamia* 8(1): 1–75
- V. Tony Yates pers, comm. Oct 2012
- W. David Thomas pers, comm. field visit 8 January 2013



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X. DECCW (2009) The Native Vegetation of the Sydney Metropolitan Catchment Authority Area Draft report to the Sydney Metropolitan Catchment Authority. DECCW

Description of use and management and their effects on native vegetation over time (explanation of numbered codes in Attachment 1)

Year	Source: year	Temporal reliability	Land use (ALUM) ¹	List of LU ² and LMP ³	Source: LMP	Reliability LMP	Observed effects and consequences on ecological function and native vegetation	Source: effects	Reliability effects
1788-1820	K	4	Managed resource protection 1.2.0	Area managed by indigenous people speaking Darug language	N	7			
1810	U	4	Managed resource protection 1.2.0	By 1810, the combined area under cultivation in Parramatta and Hawkesbury had grown to almost 29 000 ha, approximately 42% of the present area dedicated to agricultural production. p3	U	4			
1825	K	5	Other minimal use 1.3.0	... originally a land grant made to a John Shepherd.	M	7			
1850	U	5	Other minimal use 1.3.0	By the mid- nineteenth century the majority of the Cumberland Plain was either under cultivation or subject to grazing. p3	U	7	Unmodified Turpentine Ironbark Open Forest. Overstorey height: 30.5 +/- 2.5m. Overstorey FPC: 30-70%	K	7
1860	K	5	Grazing native vegetation 2.1.0	Likely thinning of overstorey trees to promote pasture	K	8	Foliage projective cover dropped from 36% to around 20%	K	8
1897-1902	R	4	Grazing native vegetation 2.1.0	Successive droughts in the period	R	7			
1908	P	5	Grazing modified pastures 3.2.0	Area was cleared for [pasture for grazing and] fruit tree orchards	P	8			

¹ ALUM = Australian Land Use and Management Classification

² LU = Land Use

³ LMP = Land or Vegetation Management Practice



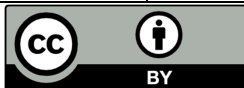
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1904-1910	R	4	Other minimal use 1.3.0 Grazing modified pastures 3.2.0. Land in transition 3.6.0	Prolonged drought	R	7			
1908	L	4	Grazing modified pastures 3.2.0/ Land in transition 3.6.0	Originally privately-owned land, the forest was cleared for agriculture [pasture for grazing and fruit tree orchards]	L	8	Assume what was cleared in 1908 remained open and cleared of regrowth until 1941-43	K	7
1908	K	5	Grazing modified pastures 3.2.0.	Area likely to have been ploughed on the gentler slopes and sown to non-native improved pasture species.	K	8			
1910	K	5	Grazing modified pastures 3.2.0.	Managed as improved pasture for grazing cattle and horses	K	8			
1920	K	5	Grazing modified pastures 3.2.0.	Managed as improved pasture for grazing cattle and horses	K	8			
1925	M	4	Grazing modified pastures 3.2.0/ 0	Major fire recalled by neighbours. p28	M	7			
1925	K		Grazing modified pastures 3.2.0.	Managed as improved pasture for grazing cattle and horses	K	8			
1930	K		Grazing modified pastures 3.2.0/ 0	Managed as improved pasture for grazing cattle and horses	K	8			



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1934-1942	R	4		Drought	R	7			
1935	K	4	Grazing modified pastures 3.2.0.	Managed as improved pasture for grazing cattle and horses	K	8			
1937	M	4	Grazing modified pastures 3.2.0. Land in transition 3.6.0	The search for an area to fulfil all these requirements [set by the Commissioner] ended with the selection of the area known locally as "Shepherds Bush", originally a land grant made to a John Shepherd. (p46) The northern section was partly cleared, thus suitable for arboretum establishment, and the remainder timbered with what was regarded as second growth forest. p46	M	7	When originally purchased, little of the original vegetation remained on the arboretum portion of Cumberland State Forest i.e. 13 ha shown in the aerial photos 1941 and 1943	B	7
1937-38	M	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	Four adjoining properties, with a total area of 33 hectares, were purchased ... in 1937 and 1938. p46	M	7			
1938	L	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	Site was taken over by the then NSW Forestry Commission with one third of the land planted as an arboretum and the rest allowed to naturally regenerate. The aim was to create an urban forest for all Sydney siders and visitors to enjoy.	L	7			
1938	M	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	The wet sclerophyll native forests of the Cumberland - I.B.M. Area were certainly substantially logged in the past. The forest was regarded as second growth when purchased by the Forestry Commission in 1938. The presence of blackbutt saplings, "six inches in diameter at breast		7			



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				height", was recorded and it was observed that veteran trees present were non-commercial species.					
1939	M	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	Four adjoining properties were dedicated as Cumberland State Forest on 10th July, 1939. p46	M	7			
1939	M	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	Area dedicated as the Cumberland National Forest under the Forestry Act 1916	K	7			
1939	M	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	Planting of Australian species in circular plots irregular gully plantings and boundary windbreak plantings commenced. p46	M	7			
1939-44	M	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	Circular plot design consisted of a tree in the centre of the grove with trees planted around the perimeter of a 3m (10 ft.) radius circle. Large species were planted at 2.4m (8 ft.) spacings around the perimeter, giving a total of 9 trees per grove, ranging down to 1.2m (4 ft.) spacings for small species. Distance between the perimeters of adjoining groves was set at 6m (20 ft.). Larger groves of 6m (20 ft.) radius were also planted. Minor shrub species, with similar climatic habitat to the chief species of the grove, were also planted around the groves. p18	M	7			
1939-84	M	4	Land in transition - treed 2.3.0.	Broad area burning was excluded. p27	M	7			



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			Plantation forestry 3.1.0						
1939-44	K	4	Land in transition - treed 2.3.0. Plantation forestry 3.1.0	A multi-strata tree and shrub screen was planted to a random design along the southern boundary and the western side of the main creek. P19	M	7	Shale soils tend to exhibit greater longevity of native plant seeds than do sandstones. It is expected that given prior use and management of the site that the soil was relatively high in phosphate. Its expected that these higher levels over time would have somewhat stabilised and equilibrated as the arboretum and the forest regeneration established and developed	W	
1939-74	K	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Management development of Cumberland State Forest since ... 1939 has been directed primarily at the development of the nursery and arboretum. P21	M	7			
1940-45	K	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Most gullies in Cumberland State Forest were planted with rainforest species in conjunction with plantings in the main arboretum area. P12	M	7	Most gullies in Cumberland State Forest were planted with rainforest species in conjunction with plantings in the main arboretum area. Among such non-endemic flora are hoop pine (<i>Araucaria cunninghamii</i>), black booyong (<i>Heritiera actinophylla</i>), water gum (<i>Tristaniaopsis laurina</i>), bungalow palm (<i>Archontophoenix cunninghamiana</i>), cabbage tree palm (<i>Livistona australis</i>), red cedar (<i>Toona australis</i>) and Queensland maple (<i>Flindersia brayleyana</i>). P12	M	7
1940-84	K	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0				[in the arboretum, weeds that] established in the early stages, particularly lantana (<i>Lantana camara</i>) and privet (<i>Ligustrum lucidum</i> and <i>L. sinense</i>), have persisted in the understorey.	M	7
1940-1984	K	4	Managed resource protection 1.2.0				An absence of fires in Cumberland State Forest probably has helped perpetuate moist elements in the understorey, which in turn inhibit the regeneration of eucalypts.	M	7



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							Turpentine, being more shade tolerant, regenerates more readily under these conditions which, no doubt, favour its spread. P12		
1941	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	2 hectares were added to the northeast of the original dedication; dedicated as Extension Nos. 1 on 4th February, 1941. p46	M	7			
1939-41	V	7	Production forestry 2.2.0	Site preparation for the arboretum	V	7	Removal of any residual native vegetation including trees and shrubs	V	7
1941	B			Aerial photo interpretation - date of photo: 1941	K	7	Small areas of remaining woody vegetation were present in 1941. Of the area already cleared by 1941 of tree cover, it appears that pasture grasses had been established.	K	7
1941	B			Small areas of remaining woody vegetation were present in 1941 aerial photo	K	7			
1943	C	6	Grazing modified pastures 3.2.0	Aerial photo interpretation - date of photo: 1943. Tree cover of the site very heavily logged to remove all but a few large trees.	K	8	Tree cover of the site - all large crowned trees removed. Estimated overstorey height 0m Estimated cover of overstorey 0% Structural diversity is nil It appears that pasture grasses have been established over 100% of the area	K	8
1943	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	4.2 hectares were added to the southwest of the original dedication; dedicated as Extension Nos. 2 on 28th September, 1943. Number 2 Extension is generally referred to as "the boot. p46	M	7			
1951	D	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Aerial photo interpretation - date of photo: 1951	K	8	Tree cover appears to be naturally rehabilitating i.e. not regular planting over 100% of area. Estimated overstorey height 5m Estimated cover of overstorey 10%	K	8



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							Structural diversity is very low Ground layer appears a mix of woody plants and pasture grasses have been established. Wood y cover occurs as scattered clumps not even spread.		
1960	K	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0				... the combination of fertile soil and open canopy during the establishment period allowed the simultaneous growth of an assortment of introduced weeds. P24	M	7
1964	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0				Natural regeneration of Sydney blue gum, endemic shrubs and some of the planted species have filled in gaps and given a more natural appearance. p19		7
unknown	?	6	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Four research plots established by the Wood Technology and Forest Research Division are maintained on Cumberland State Forest to provide data for long-term research projects. Details of these plots are: Two nutrient cycling study plots in the Turpentine/Blackbutt forest type near the southern boundary. A similar study plot in the Sydney Blue Gum forest type north of the gully adjoining Wood Technology and Forest Research Division buildings. A soil fauna research plot in Blackbutt forest type west of the Wood Technology and Forest Research Division buildings. p22	M	7			
1968	T			Drought	T	7			
1970-84	K	6	Land in transition -				Fuel quantities, particularly if understorey is included, are relatively high but in	M	7



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			treed 2.3.0/ Plantation forestry 3.1.0				equilibrium. P27		
1964	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Survey to assess survival and health. p19 & p21	M	7	assessment recorded 255 species in plots and gully plantings in blocks A to I. p25	M	7
1972	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	first formal management plan was written in 1972 and was directed toward improvement and enlargement of the nursery; maintenance of the arboretum; maintenance of natural forest areas; expansion of the recreation role and associated facilities; and regulation of inappropriate uses. p21	M	7			
1974-84	M		Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	... weekend prison labour from Silverwater was used manually to remove weeds. This operation would not have been financially feasible without this labour source. Manual methods have been preferred to alternative methods such as poisoning or mechanical slashing, both of which tend to inhibit natural regeneration of desirable species. While follow-up treatment is essential, each operation should become easier, with natural regeneration of endemic and some introduced species progressively filling in the gaps. p27	M	7	<p>The more effective endemic colonisers of weeded areas included tick bush, Parramatta wattle and sally wattle in open areas, and sweet pittosporum in shaded areas. Some arboretum species themselves are active colonisers. p27</p> <p>Along with these welcome colonisers, removal of the dominant lantana and privet can be followed by a new generation of invaders including honeysuckle (<i>Lonicera japonica</i>), crofton's weed (<i>Ageratina adenuphorum</i>) and blackberry (<i>Rubus vulgaris</i>). Blackberry in particular is a potentially very serious problem, increasing in some areas at an alarming rate. p27</p> <p>The weed control program in the arboretum has had the effect of fuel reduction by the manual stacking and burning of unwanted vegetation and some woody material from</p>	M	7



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							the forest floor. p27		
1974-84	K	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	... with repeated manual of lantana by hand using a method similar to the Bradley method. p27	M	7	... well-established lantana can be replaced by endemic shrubs such as Helichrysum diosmifolia and Dodonaea triquetra. P28	M	7
1974-84	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	increasing attention over the recent decade to public recreation. p21	M	7			
1974-84	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Most of the arboretum was manually treated to remove identified weeds. Generally each area has been followed-up at least once. p27	M	7	While the total bio-mass of weeds has been greatly reduced, and native species are slowly re-colonising weeded areas, actual weed numbers may be higher in some areas with a continuing need for follow-up.		7
1975	K	5	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0				By the 1970s lantana had grown to dense masses up to 5 metres high in more open areas, with privet growing as closely spaced tall shrubs in shaded areas. These weed species, together with the endemic Pittosporum undulatum, dominated the understorey throughout the arboretum, no doubt favoured by the absence of fires. Density of these shrubs resulted in an almost impenetrable bush and must have caused the demise of many of the shrubs planted in conjunction with tree species.	M	7
1978	E	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Aerial photo interpretation - date of photo: 1978	K	8	Poor quality photo. Tree cover now dense extending over 100% of area. Estimated overstorey height 20m Estimated cover of overstorey 60-70% Structural diversity is low (even aged regrowth)	K	8



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							Tree cover too dense to see ground cover		
1980	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0				Natural regeneration of Sydney blue gum, endemic shrubs and some of the planted species have filled in gaps and given a more natural appearance. p19	M	7
1980	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Surveys to assess survival and health. p19	M	7	192 species had survived of the 255 species recorded in 1964. p25	M	7
1982	M	4	Land in transition - treed 2.3.0/ Plantation forestry 3.1.0	Initial stages in the development of an arboretum on the Western Suburbs Forestry Centre were completed. p19	M	7			
1982	F	4	Managed resource protection 1.2.0	Aerial photo interpretation - date of photo: 1982	K	8	Tree cover dense extending over 100% of area. Estimated overstorey height 25m Estimated cover of overstorey 70% Structural diversity is low (even aged regrowth) Tree cover too dense to see ground cover	K	8
1982-??	K	4	Managed resource protection 1.2.0	Severe drought	K	7			
1983	M	4	Managed resource protection 1.2.0				Subsequent growth of planted species and ingrowth of endemic vegetation has now resulted in a reasonable forest canopy with a fairly natural appearance. p24 However, the combination of fertile soil and open canopy during the establishment period allowed the simultaneous growth of an assortment of introduced weeds. p24	M	7
1983	M	4	Managed				As a general observation it can be said that	M	7



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Year	Source: year	Temporal reliability	Land use (ALUM) ¹	List of LU ² and LMP ³	Source: LMP	Reliability LMP	Observed effects and consequences on ecological function and native vegetation	Source: effects	Reliability effects
			resource protection 1.2.0				the arboretum is in decline with a continual loss of species being recorded and the health of many of those remaining is under threat. p24		
1984	M	4	Managed resource protection 1.2.0	Survey to assess survival and health. p19	M	7	183 species had survived of the 255 species recorded in 196? .p25	M	7
1984	M	4	Managed resource protection 1.2.0	Survey to assess survival and health. p19	M	7	Notwithstanding severe drought, initial survival of the 2000 seedlings planted has been about 80%. p19	M	7
1984	M	4	Managed resource protection 1.2.0				Introduced weeds are a serious problem in the arboretum area. p26		7
1984	M	4	Managed resource protection 1.2.0				Natural regeneration of Sydney blue gum, endemic shrubs and some of the planted species have filled in gaps and given a more natural appearance. p19 ... after 45 years growth, some impressive forest stands have developed. These stands have developed by natural thinning without silvicultural treatment. p24	M	7
1984	G	4	Managed resource protection 1.2.0	Aerial photo interpretation - date of photo: 1984	K	8	Tree cover dense extending over 100% of area. Estimated overstorey height 25m Estimated cover of overstorey 70% Structural diversity is low (even aged regrowth) Tree cover too dense to see ground cover.	K	8
1984	M	4	Managed resource protection 1.2.0				Some planted species are regenerating within the moist understorey. These include sandpaper fig (<i>Ficus coronata</i>), <i>Austrobuxus swainii</i> , corkwood (<i>Duboisia myoporoides</i>), native hibiscus (<i>Hibiscus diversifolius</i>) red ash (<i>Alphitonia excelsa</i>) and whalebone tree (<i>Streblus brunonianus</i>). Other such species could be present. p12	M	7



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Year	Source: year	Temporal reliability	Land use (ALUM) ¹	List of LU ² and LMP ³	Source: LMP	Reliability LMP	Observed effects and consequences on ecological function and native vegetation	Source: effects	Reliability effects
							On shale ridges, northern to western aspects and on the fringes of sandstone gullies in the southern section of Cumberland State Forest (type B2) a somewhat drier understorey develops with black she-oak (<i>Allocasuarina littoralis</i>), sweet pittosporum, native cherry (<i>Exocarpus cupressiformis</i>) and turpentine regeneration. Associated species are sweet bursaria (<i>Bursaria spinosa</i>), juniper wattle (<i>Acacia ulicifolia</i>), tick bush (<i>Helichrysum diosmifolium</i>), <i>Leucopogon juniperinus</i> , <i>Dillwynia retorta</i> and white kunzea (<i>Kunzea ambigua</i>). p12		
1990	K	4	Managed resource protection 1.2.0						
1991-94	P	4	Managed resource protection 1.2.0	Small sections of the forest had been treated with hazard reduction burns in 1991, 1993 or 1994. p510	P	7			
1992-1998	S			Drought	S	7			
1999	H	4	Managed resource protection 1.2.0	Aerial photo interpretation - date of photo: 1999	K	8	Tree cover dense extending over 100% of area. Estimated overstorey height 30m Estimated cover of overstorey 70-80% Structural diversity is low (even aged regrowth) Tree cover too dense to see ground cover	K	8
2000	K	4	Managed resource protection 1.2.0						
2002-03	P	4	Managed resource protection 1.2.0	Survey to assess leaf, tree and soil properties in a <i>Eucalyptus saligna</i> forest exhibiting canopy decline	P	7	Plot 6 Estimated overstorey height: 30.5 +/- 2.5m Estimated cover of overstorey 70-80% Structural diversity is low (even aged	P	8



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Year	Source: year	Temporal reliability	Land use (ALUM) ¹	List of LU ² and LMP ³	Source: LMP	Reliability LMP	Observed effects and consequences on ecological function and native vegetation	Source: effects	Reliability effects
							regrowth) Stem per ha diameters over 2.0 cm at DOBBH est: 3675 Relatively dense midstorey		
2002-03	P	4	Managed resource protection 1.2.0	Survey to assess leaf, tree and soil properties in a Eucalyptus saligna forest exhibiting canopy decline	P	7	A common factor [in plot 6 as well as plots 1-5] was the presence of mature trees of Eucalyptus saligna. Other tree species present in the overstorey included Eucalyptus pilularis, Eucalyptus paniculata and non-eucalypt species such as Pittosporum undulatum and Glochidion ferdinandi. The understorey varied considerably because of manual weed control and control burning, and ranged from grass (Microlaena stipoides) that was regularly mowed, to dense mesic shrubs that included the exotic weeds Lantana camara and Ligustrum spp. p510 Lantana was present in plot 6 but was not dense because of manual weed removal. p515	P	7
2006	I	4	Managed resource protection 1.2.0	Aerial photo interpretation - date of photo: 2006	K	8	Tree cover dense extending over 100% of area. Estimated overstorey height 30.5 +/- 2.5m Estimated cover of overstorey 80% Structural diversity is low (even aged regrowth) Stem per ha diameters over 2.0 cm at DOBBH 3675	P	7
2012	Q	4	Managed resource protection 1.2.0	Field survey	Q	7	Overstorey species composition comprises mostly of species planted during the early 1940s. Some natural regeneration (e.g. E. saligna and E. pilularis) has occurred in gaps arising from failed planted species Overstorey height: 30.5 +/- 2.5m Overstorey FPC: 70-80% Overstorey structural diversity is mostly multilayered comprising a mixed (but variable) abundance of tree growth stages.	Q	7



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							<p>Again in stands affected by Bell Miner Associated Dieback there would be a higher proportion of senescent trees and trees that might appear over mature but in fact are suffering from crown dieback. In the northern stands, nearly all the grey ironbarks (<i>E. paniculata</i>) have died from this process and many <i>E. saligna</i> have died or have unhealthy crowns. The rainforest species planted in the gullies appear to be relatively healthy, along with most of the <i>E. pilularis</i> stands which are less susceptible to Bell Miner Associated Dieback.</p> <p>Stem per ha diameters over 2.0 cm at DOBBH est: 3675</p> <p>Relatively dense midstorey</p> <p>Understorey species composition is variable in quality because it struggles with a suite of exotic weed species (common to the surrounding suburbs). The assistance from volunteer workers helps to manage this weed problem in some but not all stands.</p> <p>Understorey height is variable, in part due to active intervention, but in some stands it would be approximately equivalent to that expected of a regrowth stand for the reference plant community.</p> <p>Understorey cover is very variable, with FPC estimated to be 40%, especially in the gullies and lower slopes (vines at present are prolific due to the past couple of very wet years).</p> <p>Understorey structure diversity is variable, in part due to active intervention, but in some stands it would be approximately equivalent to that expected of a regrowth stand for the reference plant community.</p> <p>Ground cover is variable, in part due to active intervention, but in some stands it would be approximately equivalent to that expected of a regrowth stand for the</p>		



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Year	Source: year	Temporal reliability	Land use (ALUM) ¹	List of LU ² and LMP ³	Source: LMP	Reliability LMP	Observed effects and consequences on ecological function and native vegetation	Source: effects	Reliability effects
							reference plant community. Understorey ratio of native to weeds: Est 50:10		
2013	W	4	Managed resource protection 1.2.0	Field survey and GPS point placed on the western side of plot 117, a cluster planting of <i>Eucalyptus paniculata</i> . The survey method for the plot is that used by NSW NPWS which collects species information in 20 m x 20 m quadrat. Very dry conditions at the time of the survey. Upper slope (5%) of a low ridge with a 125° aspect.	W	7	The condition of the plot was scored as a per cent change relative to an imputed reference state of expected cover of local indigenous species: Overstorey: 100% (i.e. 0% richness, 0% FPC) Mid-storey: 100% (i.e. 0% richness, 0% FPC) Understorey: 25% (i.e. 75% richness, 75% FPC) Ground layer: 1% (i.e. 99% richness, 99% FPC) The overstorey and mid-storey of the site is dominated by species that are not locally indigenous. No indigenous local canopy species, except for planted <i>Eucalyptus paniculata</i> . The understorey and ground cover is dominated by species that are locally indigenous. The site showed numerous incursions of species not locally indigenous to the area including Wilga, Bunya pine, Cordyline and <i>Alectryon subcinereus</i> . The planted <i>E paniculata</i> was 12-18 m high with 5% cover of the plot.	W	

11. Data Use and Accuracy Disclaimer

These data are compiled to the best of our knowledge and ability. The information contained in this document is subject to revision. The user accepts all risks and responsibility for loss, damages, costs and other consequences (direct or indirect) resulting directly or indirectly from using this information.

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Attachment 1

Reliability standards used to compile historic and contemporary site-based chronologies.

Reliability level standards	Spatial precision (Scale)	Temporal precision (Year of observation)	Attribute accuracy (Land use, land management practices, effects on condition)
HIGH "Definite"	Reliable direct quantitative data. Examples: Site, plot and transect based records. Code: 1	Reliable direct quantitative data. Examples: Day-month-year, season-year and year. Code: 4	Reliable direct quantitative data. Examples: Inventory and counts, recorded observations from field survey and monitoring, farm records Code: 7
MEDIUM "Probable"	Direct (with qualifications) or strong indirect data. Examples: Land unit and soil-landscape reports. Code: 2	Direct (with qualifications) or strong indirect data. Examples: Mid 1850s Code: 5	Direct (with qualifications) or strong indirect data. Examples: Reconnaissance surveys, medium and moderate resolution remote sensing, regional mapping Code: 8
LOW "Possible"	Limited qualitative and possibly contradictory observations. More data needed. Examples: Land system, sub-bioregion and bioregion reports. Code: 3	Limited qualitative and possibly contradictory observations. More data needed. Examples: Early 1800s and first half of 19 th century. Code: 6	Limited qualitative and possibly contradictory observations. More data needed. Examples: Generalised descriptions and narratives, census-based surveys Code: 9

