



The Eucalypt Forests of Northeast New South Wales

A Preliminary Assessment and Documentation of their World Heritage Values

by Boudicca Cerese



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Guy Fawkes Wilderness, Guy Fawkes National Park: Covering an area of 84,500ha, this wilderness protects spectacular examples of large gorge systems along the Great Eastern Escarpment and significant areas of old growth forest (DEC 2009). **Photo:** B. Cerese



NATIONAL PARKS ASSOCIATION OF NSW

protecting nature through community action



Bjarne K
Dahl Trust

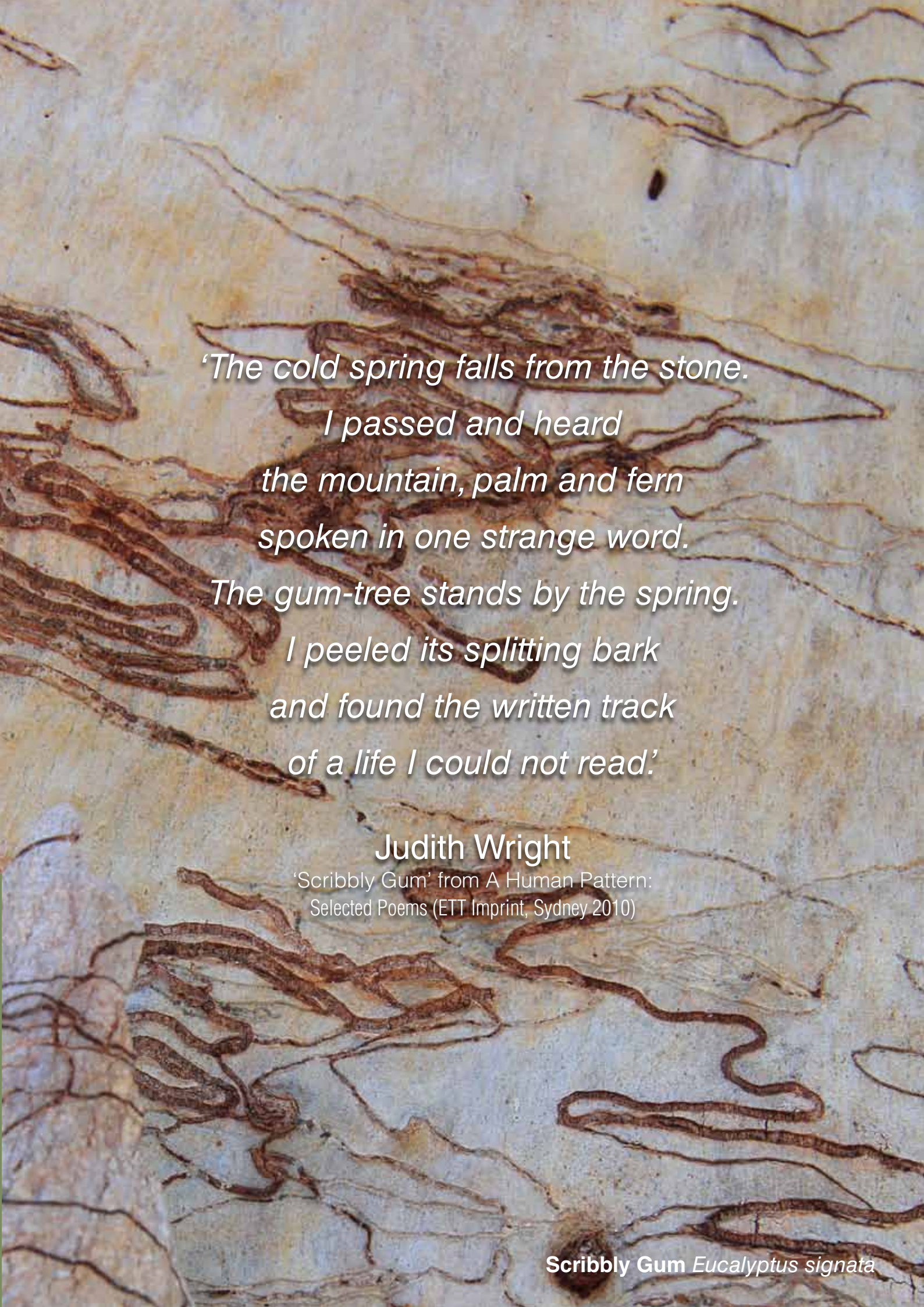
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I would like to dedicate this report to the generation of conservationists who, inspired by the majesty and diversity of the old growth eucalypt forests of northeast NSW, made an unyielding commitment to protect them. Their legacy is a million living hectares of quiet, green splendor, where the chainsaws no longer intrude.



*'The cold spring falls from the stone.
I passed and heard
the mountain, palm and fern
spoken in one strange word.
The gum-tree stands by the spring.
I peeled its splitting bark
and found the written track
of a life I could not read.'*

Judith Wright

*'Scribbly Gum' from A Human Pattern:
Selected Poems (ETT Imprint, Sydney 2010)*

Scribbly Gum *Eucalyptus signata*



Foreword

‘As ubiquitous as the Australian eucalypt’ is one phrase I have heard which may well sum up the long held view by many Australians of their eucalypt heritage, that eucalypts are common and ordinary, sadly a part of our ‘cultural cringe’ that undervalues our own. And yes, as a botanical group the eucalypts are ubiquitous, at least within Australia - more than 800 species growing in almost every habitat from snow clad Mount Kosciusko, to wet rainforested valleys of Tasmania, to the rocky landscapes of tropical Arnhem Land, to the fringes of the vast deserts of the inland. To many Australians the eucalypts may seem such ordinary everyday trees that they fail to see them the way overseas visitors might see them, so distinctly Australian, especially if accompanied by an iconic koala!

Dutch navigator Abel Janszoon Tasman is credited with the first European documented reference to a eucalypt; describing how his men, when stepping ashore in Tasmania in 1642 had,

“... seen two trees about 2 or 2½ fathom in thickness measuring from 60 to 65 feet from the ground to the lowermost branches,...”

Not only impressed by the huge size of the Tasmanian tall eucalypts, Tasman was taken with the

“gum of a seemingly very fine quality which had exuded from [the] trees”.

The second documented record of an encounter with Australian eucalypts came from William Dampier in 1688 when he landed on the desert coast of Western Australia and similarly took an interest in the gum exudate, hence his name for the eucalypts of ‘gum dragon trees’. Tasman, Dampier and later Sir Joseph Banks and Captain James Cook shared a fascination with the gum exudate, something of great interest in their era because of the medicinal potential of the gum. And that is how the eucalypts came to be known as ‘gum trees’.

Our perceptions and knowledge of eucalypts have evolved greatly since the first encounters by Tasman, Dampier and Banks with ‘gum trees’. Today most Australians are unlikely to even notice the gum exudate and instead may notice some of the many other features that distinguish the eucalypts. Like the aroma of the oil emitted by eucalypt leaves on hot days, the woody fruits, the large leathery leaves of some, the masses of annually shed bark of others, the huge size of some trees, the susceptibility of eucalypt forest to wildfire and indeed the phoenix-like capacity of eucalypt forests to rapidly



'...increasingly many Australians have come to recognise [eucalypts] as a quintessential part of Australia's natural heritage... This report provides the first comprehensive case for recognition of the subtropical eucalypt forests of Australia as an important and integral part of the story of eucalypts as World Heritage.'

recover from apparent death-dealing defoliation by wildfire. Truly very variable and remarkable trees that are found in many different places, sizes and forms.

For some it remains difficult to move beyond the cultural cringe of how 'ordinary' are the eucalypts. But increasingly many Australians, particularly those that have travelled beyond our shores, have acquired a greater knowledge and appreciation of eucalypts and come to recognise them as a quintessential part of Australia's natural heritage. Indeed, increasingly we proudly accept that they are of global heritage significance - even a part of the World Heritage.

We have been unsustainably chopping, chipping, burning and clearing our eucalypt forests since the first day of colonisation but at last the way we see eucalypts is moving from that of hindrance to a heritage. Like no other genus of trees in the world, the eucalypts dominate the vegetation of a continent and do not occur naturally on any other continent. A total of more than 800 species are now recognised, all but a few confined to Australia, underscoring how synonymous the eucalypt is with Australia.

370 years after Tasman first documented the first European encounter with eucalypts, this report represents an important step in our updated documentation and presentation of what we have

learned about eucalypts, of their outstanding heritage value, and the key role played by the eucalypts in subtropical Australia in articulation of their global heritage significance.

The debate over the World Heritage significance of the tall eucalypts of Tasmania has echoed around for decades but the Tasmanian eucalypts don't tell anything like the complete story of why eucalypts are of global significance; they are the first chapter in the greater story. This report provides the first comprehensive case for recognition of the subtropical eucalypt forests of Australia as an important and integral part of the story of eucalypts as World Heritage. National Parks Association of New South Wales is to be commended for this important first step in updating and articulating the contribution of the forests in North Eastern New South Wales to recognition of the eucalypts as a part of the global natural heritage.

It is to be hoped that this case will be persuasive in prompting the necessary follow up for full and formal recognition of the outstanding heritage significance of eucalypts in this region.

Peter Hitchcock AM

Summary

‘Eucalypts are the defining feature of the Australian biota, with almost 900 species occurring continent wide. They have been recognised for their outstanding universal values including domination of an entire continent across a broad range of environments and extraordinary taxonomic and ecological diversity.’

The Northeast NSW Eucalypt Assessment Project (the Project) was undertaken by the New South Wales National Parks Association with funding from the Dahl Trust, a philanthropic organisation with the vision of promoting and conserving the iconic eucalypts. The Project aims to update and enlarge on the work of the World Heritage Expert Panel convened during the Comprehensive Regional Assessment of Australia’s forests, by undertaking a preliminary assessment of the World Heritage values and current conservation status of the eucalypt forests of northeast New South Wales. Further to this, the Project aims to characterise and document the World Heritage values of the eucalypt forests of the region with a view to building knowledge and community support to trigger a comprehensive and rigorous assessment by State and Commonwealth Governments. The northeast New South Wales study area delineated for the assessment extends from the Hunter River floodplain in the south, to the Queensland border in the north, and from the coast to the western slopes of the Great Dividing Range.

Eucalypts are the defining feature of the Australian biota, with almost 900 species occurring continent wide. They have been recognised for their universal outstanding values including domination of an entire continent across a broad range of environments and extraordinary taxonomic and ecological diversity. Under the World Heritage Convention the theme of eucalypt dominated vegetation represents criterion (ix) of the Operational Guidelines (UNESCO 2008), which reads:

“Nominated properties shall therefore: (ix) be outstanding examples

representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.” (UNESCO 2008)

The Project analysis quantified and documented the species diversity, endemism, rarity, and ecological diversity of eucalypts in the study area as a means of assessing and characterising the World Heritage values of these forests. Given the exceptional and well documented biodiversity values of northeast New South Wales, a supplementary analysis of the biological diversity of the region was also carried out, using a range of standard biodiversity indices as indicators for the values as represented in criterion (x) of the World Heritage Operational Guidelines. This criterion reads:

“Nominated properties shall therefore: (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.” (UNESCO 2008)

Whilst not directly evaluated in the Project analysis, three other World Heritage criteria with likely relevance to the northeast New South Wales region, namely criteria (v), (vi) and (vii), are also briefly considered in the report. The preliminary assessment undertaken in the Project involved spatial analysis in a Geographic Information System. This analysis was made up of three parts, and included analysis of the conservation status of the eucalypt forests of the study area, and evaluation of the diversity and significance of both the eucalypt

flora and biodiversity more broadly. The results of the analysis for the study area can be summarised as follows:

- 1. Eucalypt species:**
 - i. Overall species richness - 143
 - ii. Number of endemic species - 43
 - iii. Number of threatened species - 21
 - iv. Number of ROTAP-listed species - 43

- 2. Forest ecosystems and communities:**
 - i. Total number of eucalypt ecosystems - 159
 - ii. Number of endangered ecological communities (with a eucalypt component) - 11

- 3. Vertebrate fauna species:**
 - i. Total number of species - 695
 - ii. Number of threatened species - 148

- 2. Vascular flora species:**
 - i. Total number of species - 3412
 - ii. Number of threatened species - 231
 - iii. Number of ROTAP species - 390

The significant eucalypt attributes detailed in the report suggest that the northeast NSW region is likely to make a significant contribution to the recognition of the outstanding universal value of the eucalypts in Australia. The ecological diversity apparent in the large numbers of eucalypt dominated communities in the study area; the high level of species diversity and endemism; the wide range in structural forms of eucalypt vegetation present in the region; and the domination of the terrestrial environment across a broad latitudinal range from the coast and across the higher altitudes of the escarpment ranges to the western slopes of the Great Dividing Range, all add considerably to the representation of the World Heritage Eucalypt

theme. The unique biogeographic placement of the region within a zone of subtropical/temperate overlap, and the altitudinal range and geologic/edaphic variation across the Study Area, means that this region supports a diversity of eucalypt vegetation mosaics that is possibly unique continent wide. The exceptional wet sclerophyll forests of the region form an integral component of this unique ecological diversity. In addition, the biological diversity attributes detailed in the report, and the dependence of the flora and fauna of the region on the essential habitat requirements provided by the eucalypt biota, suggests that these forests contain the most important and significant natural habitats for in-situ conservation of biological diversity in the region.

It is recommended that State and Commonwealth Governments urgently decide on a strategy for ensuring that the outstanding universal values of the eucalypt biota of Australia are incorporated into a program of World Heritage nominations. This strategy should include prioritisation of a comprehensive assessment of the World Heritage eucalypt values of the subtropical biogeographic region of Australia, including northeast New South Wales and southeast Queensland. This assessment should be directed towards identifying the 'best of the best' of eucalypt vegetation across all tenures (including existing World Heritage Areas) so as to identify that suite of areas that best represents the outstanding eucalypt biodiversity of this biogeographic region.

Given the significant areas of eucalypt forest located within existing Gondwana Rainforests World Heritage Area (and the proposed additions to this area) as well as the recent fossil evidence confirming the Gondwanan origins of the eucalypts, this report concludes that the most effective and appropriate way to recognise and protect the eucalypt values of the forests of northeast NSW is to include them within a new and revised 'Gondwana/Gondwana Forests World Heritage Area'. It is therefore recommended that all those areas of outstanding eucalypt forest in the subtropical biogeographic region that are identified by a further assessment process are then incorporated into a renomination or additional nomination for this property. This would be a significant and commendable step forward on the path to achieving international recognition of the unique and exceptional eucalypt biota of Australia at a continental scale.

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Introduction

The Convention Concerning Protection of the World Cultural and Natural Heritage, more commonly known as the World Heritage Convention, was adopted by UNESCO in 1972 with the aim of protecting places on earth that are of outstanding universal natural or cultural value. Through the inscription of identified places on the World Heritage List, UNESCO aims to protect the “best of the best” of natural environments and cultural sites across the globe. As at May 2012, there are 936 properties on the World Heritage List across 153 countries, with 19 of these located in Australia. Australia ratified the Convention in 1974 and World Heritage listing now recognises and celebrates some of the country’s most iconic places, from the marine diversity of the Great Barrier Reef and the Ningaloo Coast to the vastness of the remote Tasmanian Wilderness, and from the Aboriginal cultural landscape of Uluru-Kata Tjuta to the modern architecture of the Sydney Opera House.

As a signatory to the World Heritage Convention, the Australian Government has an obligation to ensure that the World Heritage values of places in Australia are identified and protected. The adoption of a National Forest Policy in 1991, following a major

inquiry, provided all governments with a framework for forest conservation and management. During the subsequent Comprehensive Regional Assessment (CRA) of Australia’s forests undertaken in partnership by State and Commonwealth Governments, a World Heritage Expert Panel (the Expert Panel), drawn from Australia’s leading professionals in the relevant fields, was convened to investigate and assess the World Heritage values of forested areas in Australia (World Heritage Report 1999). A number of forested places were identified by the Expert Panel as having outstanding universal values associated with their eucalypt vegetation (Appendix 1). Some of these forests were located within existing World Heritage Areas (Kakadu and the Tasmanian Wilderness), whilst others were identified as warranting further investigation and assessment as possible best representations of World Heritage themes. Out of the eight potential forested places identified across the continent by the Expert Panel, two major peaks of eucalypt diversity were recognised- the greater Blue Mountains region and northeast New South Wales (NSW) (extending into south east Queensland) (QLD) (World Heritage Report 1999).



Yellow Box *Eucalyptus melliodora*: Occurring across south-eastern Australia, this heavily cleared woodland species provides an important source of nectar and pollen for nectarivorous birds and mammals and is a favoured food tree of Koalas. **Photo:** D. Milledge

Since the Expert Panel made its recommendations, only one of the areas identified as warranting further investigation and assessment, namely the Greater Blue Mountains, has been added to the World Heritage List. The peak in eucalypt diversity identified by the Expert Panel in the Blue Mountains region 'occurs in the sandstone country centred on the Blue Mountains area and extending from the Hawkesbury area to the Shoalhaven area' (World Heritage Report 1997). This region was described by the Expert Panel as the Blue Mountains 'in the broad sense' (*sensu lato*), in comparison to the narrower area (*sensu stricto*) comprising the conservation reserves of the Blue Mountains. Following extensive documentation of the values of the area (Mosley 1989) and a sustained campaign by conservation groups (Colong Foundation 2008), a formal nomination by the NSW and Australian governments for the Greater Blue Mountains (the Expert Panel's *sensu stricto* area) was made in 1998 (NPWS & EA 1998). This successful nomination resulted in an area of over one million hectares of predominantly eucalypt forests being added to the World Heritage List on the 29th November 2000 (Colong Foundation 2008). This World Heritage Area was the first to be nominated principally on the basis of its eucalypt-dominated

vegetation, though eucalypt vegetation was identified as a supplementary attribute in several of the properties listed prior to this (Mosley 1989; Kirkpatrick 1994).

Another region identified by the Expert Panel that has been investigated for its eucalypt World Heritage values but not yet formally nominated or listed is the 'natural forest areas of south-eastern Australia extending from the sea to the alps and the inland slopes' (World Heritage Report 1999). In relation to this area the Expert Panel noted:

The Kosciuszko National Park, and the contiguous National Parks in Victoria and the Australian Capital Territory, together with the larger non-contiguous natural forest areas in south-east New South Wales, provide an outstanding cross-section of natural eucalypt forests which is almost continuous from the inland woodland-forest boundary to the alpine treeline, and then to the coast. Forests in this area are amongst the tallest hardwood forests in the world. (World Heritage Report 1997).

Since the 1970s (Mountain Journal 2012), there has been substantial work done by voluntary groups and



Coastal Dune Dry Sclerophyll Forest, Yuraygir NP: The nutrient-poor coastal sand mass on which this vegetation is growing sees normally large trees, such as *Angophora costata*, adopting stunted woodland forms (Bale 2003). **Photo:** B. Ceresse

government agencies to investigate, document and promote the World Heritage values of the eucalypt forests across southeast New South Wales, northeast Victoria and the Australian Capital Territory (for example see Blakers 1987; Busby 1990; Costin 1989; Kirkpatrick 1994; Lembit 1987; Moseley 1988; Mosley & Costin 1992). Despite a concerted campaign over several decades by conservation groups to advance an Alps/South East Forests nomination, the initiative has not yet progressed to an official inter-government nomination for this cross-border area (Mountain Journal 2012).

More recently, the heritage values of eucalypt forests in Tasmania outside of the existing Tasmanian Wilderness World Heritage Area have been considered as part of the Tasmanian Forests Intergovernmental Agreement (Capstone 2012). As part of the assessment and verification of the conservation values of proposed reserve areas nominated by environmental non-government organisations in that state, some 572,000ha of high conservation value native forests were assessed for their National and World Heritage values. This assessment focused on the World Heritage values of the tall forests, or 'giant trees', for which Tasmania is renowned- the four to five species of tall growing

eucalypts that make up the tall eucalypt forest ecosystem (Hitchcock 2012). Hitchcock's report (2012) concludes that as an ecologically unique and globally recognised class of forest, 'tall eucalypt forests', qualify against most if not all World Heritage natural criteria, and that as a class of forest they are of outstanding universal value.

As part of their commitments during the CRA processes for northeast New South Wales, which are outlined in the Regional Forest Agreement (RFA), the NSW and Commonwealth governments agreed to 'actively investigate and jointly participate in the further World Heritage assessment' of the forested places identified by the Expert Panel in northeast NSW (COA & NSW Govt. 2000). Despite this commitment, government agencies have not undertaken any significant investigation or assessment of these areas (Pugh 2011), with only one brief unpublished overview available (Benwell 2000). To the author's knowledge, there has been no other substantial work undertaken by non-government organisations or individuals.

Given that the Expert Panel identified the forests of northeast NSW (extending into southeast Queensland) as one of two places of peak eucalypt diversity for the entire Australian continent, and the lack of subsequent



North Coast Wet Sclerophyll Forest: Reaching heights of 70m, this diverse and variable class of vegetation occurs in NSW on coastal ranges, foothills and slopes and on lowland river and creek flats north from the Illawarra region (Keith 2006). **Photo:** B. Cerase

action by government or other groups, the National Parks Association of New South Wales determined that a further assessment of the World Heritage values of these forests would be a worthwhile project and therefore commissioned the Northeast NSW Eucalypt Assessment Project. Whilst limited resources meant that it was not possible to include the forests of southeast Queensland (QLD) in the assessment, it is recognised that there is a need for a similar complementary exercise to be undertaken across the border as World Heritage values are obviously not constrained by sub-national boundaries. For a proper appraisal of the World Heritage values of the overall subtropical biogeographic region it is clear that any formal assessment undertaken in the future must include the eucalypt forests of both northeast NSW and southeast QLD.

The Expert Panel identified a single east-west forested transect in the northeast NSW region, the Moonee-Binderay area, as worthy of further assessment for its World Heritage values. However, the outstanding eucalypt values of the broader region identified in the Expert Panel report, in addition to more recent work by other authors (Benwell 2000; National Land and Water Resources Audit 2002), suggest that any investigation of the heritage values of these eucalypt forests should be undertaken at a broader geographic scale. In light of these findings, the assessment of eucalypt related World Heritage values undertaken in the Project was focussed across an extensive section of northeast NSW. The northeast NSW Study Area delineated for the assessment extends from the Hunter River floodplain in the south to the Queensland border in the north and from the coast to the western slopes of the Great Dividing Range.

The Northeast NSW Eucalypt Assessment Project (the Project) sets out to do four things:

1. Undertake a preliminary assessment of the World Heritage values and current conservation status (including threatening processes) of the eucalypt forests of northeast NSW, at a landscape scale and across all tenure, to update and enlarge on the work of the Expert Panel.
2. Characterise and document the World Heritage values of the eucalypt forests of northeast NSW with a view to building knowledge and community support to trigger a comprehensive and rigorous assessment by State and Commonwealth Governments.
3. Summarise any important issues and concerns arising from the assessment that should be considered in any formal assessment by government.
4. Formulate a set of recommendations for delivery to State and Commonwealth Governments to encourage them to take urgent action to ensure that the outstanding universal values of the eucalypt biota of northeast NSW are incorporated into a program of formal protection and World Heritage nominations.



Wattle-leaved Peppermint *Eucalyptus acaciiformis*: Endemic to the Northern Tablelands, this eucalypt occurs at higher altitudes on the margins of wet heaths and swamps and along creek lines (Hunter 2011). **Photo:** B. Ceresse

Approach

The first step in the approach taken in the Project was to convene a reference group of professionals in relevant fields to provide guidance and input at each stage of the project. A desk top review of literature relating to the World Heritage Convention, Australian World Heritage nominations and proposals, and the natural values of the northeast NSW region was then undertaken. Following this, a data set of relevant eucalypt records and flora and fauna records was compiled for the

northeast NSW region, along with relevant geographic and environmental data. Data analysis was then undertaken within a Geographic Information System (GIS) to spatially assess and document the natural values of the eucalypt forests of northeast NSW. Following compilation of a draft report, a knowledge gathering workshop was convened to consult with local conservation groups and ecologists to seek feedback and advice on the project to incorporate into the final report.



Tableland Wet Sclerophyll Forest, Barrington Tops NP: These tableland forests can be distinguished from the shrubby escarpment moist forests by their sparser shrub layer and greater abundance of grasses (Keith 2006). **Photo:** C. Flint

3. Assessment of the World Heritage Values of Eucalypt Forests of Northeast NSW

3.1 Overview of Eucalypt Biota

‘Of particular significance in the evolution of the eucalypts is their relationship with fire, which has a profound effect on the ecology of eucalypt-dominated communities. Not only have the eucalypts... adapted to survive fire, they have also adapted features that promote an ideal fire environment’

Eucalypts can be considered the defining feature of the Australian biota, with almost 900 species (including the genera *Eucalyptus*, *Angophora* and *Corymbia*) present on the continent (EUCLID 2006). They are globally unique amongst woody plants in having diverged almost entirely on a single continent. All but four species and one variety are endemic to Australia, with several additional species having ranges extending into Papua New Guinea or adjacent islands within south-east Asia (see Figure 1) (Wrigley & Fagg 2010). The eucalypts dominate the majority of Australia’s woody vegetation, and are ubiquitous in their distribution in most environments continent-wide, across an extremely broad range of climatic, latitudinal, altitudinal, and edaphic conditions.

The Expert Panel (World Heritage Report 1999) details the ways in which the evolution of the eucalypts was influenced by the environmental changes that took place on the Australian continent as it drifted slowly northwards. During this time declining soil fertility, increasing climatic variability, periods of aridity, and increases in the incidence and intensity of fires are believed to have had a significant influence on the evolutionary development of the eucalypts. A consequence of the climatic drying and variability was the dramatic contraction of rainforests (closed forests), thereby removing the main site competitors of eucalypts and releasing vast new areas of habitat for eucalypt colonisation.



Figure 1: Map of Global Eucalypt Distribution (EUCLID 2006)



Brown Gum *Eucalyptus brunnea*: Bark shedding in many species makes an important contribution to the fuel load in eucalypt dominated communities such as this fire-adapted dry sclerophyll forest in Torrington SCA (World Heritage Report 1999). **Photo:** B. Ceresse



Regeneration from fire in Dry Sclerophyll Forest, Torrington SCA: Fifteen months after a very severe bushfire, this vegetation displays the regeneration typical of fire-adapted eucalypt communities. **Photos:** B. Cerese

The Expert Panel (World Heritage Report 1999) notes that the ‘ecological and evolutionary responses of the eucalypts to these factors are likely to have been important in enabling them to exploit an increasingly wide range of habitats and environments across the continent over time and, eventually, to dominate most of its woody vegetation communities’. Whilst drier climates are likely to have contributed to increased incidence of fires and the subsequent expansion of the eucalypts (Hill 1994), it is widely believed that Aboriginal burning regimes may also have favoured this expansion (Kershaw 1986; Singh et al. 1981; Wrigley & Fagg 2010).

Of particular significance in the evolution of the eucalypts is their relationship with fire, which has a profound effect on the ecology of eucalypt-dominated communities. Not only have the eucalypts of woodlands and forests adapted to survive fire, they have also adapted features that promote an ideal fire environment (World Heritage Report 1999; Wrigley & Fagg 2010). These fire conducting features include the flammable oils and waxes found in eucalypt leaves and the significant quantities of combustible litter produced when eucalypts shed their bark, leaves and branches. There are a range of characteristics that allow eucalypts to survive the effects of fire, including insulating bark

and woody seed capsules which moderate the effect of fire by protecting generative tissue and seeds. The eucalypts have also evolved dormant growth centres that activate after fire to facilitate regeneration, including epicormic buds, located beneath the bark, and lignotubers- regenerative and storage organs located at the base of the stem.

Fire occurs across all eucalypt-dominated communities, and indeed, most eucalypts are heavily dependent on disturbance, particularly fire, for regeneration¹. However, the nature, frequency and season of occurrence of those fires varies widely across the continent, as do the adaptive responses of different classes and species of eucalypt to fire impacts (Gill 1997 cited in World Heritage Report 1999; Hitchcock 2012). As a result, different classes of forests are adapted to different fire frequencies. For example, it is estimated that *Eucalyptus regnans* forests in the wetter southeast of the continent and Tasmania are adapted to a fire frequency of 75-150 years, whilst Mallee shrublands in the semi-arid interior may be adapted to a fire frequency of just 5-10 years (Wrigley & Fagg 2010). Fire incidence in the northeast NSW region ranges from highly exposed dry forests where lightning strikes are a frequent source of fire right through to dense rainforest where fire rarely penetrates.

¹ *Eucalyptus deglupta*, a tall eucalypt occurring in New Guinea, Indonesia and the Philippines, grows in very wet conditions and depends on disturbance from erosion and siltation on rivers to regenerate (P. Hitchcock 2012, pers. comm., 9 May).

3.2 Relevant World Heritage Criteria

Nominated properties shall therefore: (ix) be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals. (UNESCO 2008)

3.2.1 Eucalypt-dominated Vegetation

In its consideration of the World Heritage themes relevant to forested places in Australia, the Expert Panel identified eucalypt-dominated vegetation as having outstanding universal value within the theme of 'Evolution of landforms, species and ecosystems under conditions of stress' (World Heritage Report 1999). This theme represents the ninth criterion of the 'Criteria for the assessment of outstanding universal value' (paragraph 77) in the World Heritage Operational Guidelines (UNESCO 2008), which reads:

Nominated properties shall therefore: (ix) be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals. (UNESCO 2008)

The Expert Panel identified eucalypt-dominated vegetation in Australia as an outstanding example of continental scale domination of forest and woodland vegetation by a single genus², noting that much of this vegetation has evolved under stress, including conditions of high climatic variability, nutrient deficiency, and high fire frequency (World Heritage Report 1997). Since the convening of the Expert Panel there have been significant changes in the knowledge and understanding of the eucalypt biota, especially the evolution, taxonomy and ecology of eucalypt species and ecosystems. These changes continue to inform and change the way in which eucalypts are valued from

a heritage perspective. Of particular interest in this regard is the 52 million year old fossil evidence of eucalypts from South America, which confirms the ancient lineage of the eucalypts and suggests their widespread distribution in Gondwana prior to the break up and northward drift of the super-continent (Hitchcock 2012). This knowledge has significant ramifications for consideration of the World Heritage values of the eucalypts, particularly in the northeast NSW region, a topic which is explored later in this report (see section 5).

The features nominated by the Expert Panel and other authors (Blakers 1987; Hitchcock 2012; Kirkpatrick 1994; Moseley and Costin 1992; World Heritage Report 1999) that contribute to the outstanding universal value of Eucalypt vegetation include:

- Ancient Gondwanan origins and ongoing evolution paralleling the geological and ecological evolution of the continent;
- Domination of the woody ecosystems of the whole continent across large altitudinal and climatic gradients;
- Extraordinary taxonomic diversity and high degree of speciation;
- Diverse range of eucalypt growth forms and wide diversity of eucalypt-dominated communities;
- Adaptation of the eucalypts to fire, climatic variability and low soil fertility, rainforest habitat/ high rainfall;
- Evolutionary dependence and co-evolution of many fauna species with eucalypts.

²The Expert Panel took a wide view of the genus *Eucalyptus*, interpreting it as *Eucalyptus sensu lato*, i.e. in the broad sense, including the genera *Eudesmia*, *Corymbia* and *Angophora* (World Heritage Report 1997).

The primary focus of the assessment undertaken in the Project was the evaluation and documentation of the eucalypt related World Heritage values of the forests of northeast NSW. The conceptual approach undertaken in this analysis was guided by the Expert Panel’s ‘Summary of the outstanding universal values and significant attributes of eucalypt-dominated vegetation in Australia’ (see Appendix 2) (World Heritage Report 1999). This summary identifies how the significant attributes of eucalypt-dominated vegetation are expressions of a range of outstanding universal values. The Project analysis undertook to quantify and document these significant attributes as a means of assessing and characterising the World Heritage values of eucalypt-dominated vegetation in the northeast NSW region. The attributes that were able to be assessed within the data and resource constraints of the Project and the World Heritage values they relate to are outlined in Table 1.



Large-leaved Spotted Gum *Corymbia henryi*: Restricted to the coastal ranges of far northern New South Wales and south-eastern Queensland, this attractive eucalypt occurs in dry sclerophyll forest on poor sandy soils (Bale 2003). **Photo:** D. Milledge

Outstanding universal value of eucalypt-dominated vegetation	Significant attributes identified in relation to eucalypt-dominated vegetation
Ancient origins in Gondwana and evolution in Australia	<ul style="list-style-type: none"> • Peaks of total eucalypt species richness • Spatially-restricted species • Rare taxa
Domination of an entire continent	<ul style="list-style-type: none"> • Extremes of environmental classes
Diverse range of growth forms	<ul style="list-style-type: none"> • Structural classes
Wide diversity of eucalypt dominated communities	<ul style="list-style-type: none"> • Vegetation types
Unique ecology of eucalypt dominated communities	<ul style="list-style-type: none"> • Environmental classes • Vegetation maps including structural classes and vegetation types

Table 1: Excerpt from the “Summary of outstanding universal values and significant attributes of eucalypt-dominated vegetation in Australia” Expert Panel Report 1999.

3.2.2 Other World Heritage Criteria

A review of literature pertaining to the World Heritage Convention and Australian World Heritage properties (and proposals) highlights the fact that nomination of properties for more than one criterion adds considerably to the strength of a nomination (Kirkpatrick 1994; UNESCO 2008; Valentine 2006). Notably, the Greater Blue Mountains World Heritage Area, the only area that has been listed under the World Heritage Convention principally on the basis of its outstanding eucalypt vegetation, was also nominated for its outstanding biological diversity.

Whilst the principal focus of the Expert Panel’s recommendations for the northeast NSW region, and hence this project, was the expression of Criterion (ix) through the eucalypt related World Heritage values, the

Expert Panel also identified other outstanding values and themes that might contribute to any future World Heritage nomination of northeast NSW. The additional criteria identified by the Expert Panel were considered to have potential as either best global expressions or as having associative value, i.e. not quite in the class of a best global expression on a stand-alone or serial basis, but having exceptional value that would be likely to contribute to the overall World Heritage significance of a place.

The additional theme that was identified by the Expert Panel as deserving of further investigation in the forested places of northeast New South Wales was the outstanding universal cultural value of Indigenous religious expression, in particular, Dreaming sites and Bora grounds. The Expert Panel identified the ‘potential for the forests of northeast NSW and south-east QLD



Masked Owl *Tyto novahollandiae*: The main threats to this large forest owl are loss of nesting and roosting trees and reduced availability of prey, which are mainly small to medium sized mammals (DEC 2006). **Photo:** G. Clancy