THE GREATER BLUE MOUNTAINS AREA

World Heritage Nomination
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THE GREATER BLUE MOUNTAINS AREA
World heritage nomination
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Coxs River Valley, Blue Mountains National Park. Photo I Brown
THE GREATER BLUE MOUNTAINS AREA

World Heritage Nomination
1. IDENTIFICATION

World Heritage Nomination

AUSTRALIA

THE GREATER BLUE MOUNTAINS AREA

World Heritage Nomination

AUSTRALIA
THE
GREATER
BLUE
MOUNTAINS
AREA

World Heritage Nomination


prepared by

the New South Wales National Parks and Wildlife Service in association with Environment Australia
Mist on Mt Cloudmaker, Kanangra-Boyd National Park. Photo I Brown
THE GREATER BLUE MOUNTAINS AREA

World Heritage Nomination

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Australia is pleased to present this nomination of the Greater Blue Mountains Area for inclusion on the World Heritage List. The nomination has been prepared jointly by the Australian government and the State government of New South Wales, following years of public concern for recognition of the area and dedication to its conservation. Many experts, together with stakeholder groups and local governments, have contributed to the project.

The Greater Blue Mountains Area is a dissected sandstone tableland that cradled the birth of new continental flora, while at the same time sheltering in its deepest recesses the floristic remnants of Gondwana. This vast and beautiful area of upland reserves, inhabited by indigenous people over millennia, stands adjacent to the largest metropolis in Australia.

Through their scale and symbiosis with the City of Sydney, the Greater Blue Mountains exemplify the links between wild places and human aspirations. Their nomination supports this decade’s work by the World Heritage Committee to consider in unison the outstanding natural and cultural values of properties.
THE GREATER BLUE MOUNTAINS AREA
World Heritage Nomination
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1 IDENTIFICATION
THE GREATER BLUE MOUNTAINS AREA
World Heritage Nomination

[84x794]2
1. IDENTIFICATION

1.1 NAME

The Greater Blue Mountains Area.

1.2 LOCATION

The Property is located in Australia, in the State of New South Wales.

The area of the Property is 1,032,649 hectares (10,326 square kilometres).

The Property is adjoined by seven other protected areas which form a buffer area of 86,200 hectares.

The geographical co-ordinates of the Property are:

149° 54’ 00” E – 151° 07’ 00” E
32° 22’ 00” S – 34° 23’ 00” S
1. CONTINENTAL BIOGEOGRAPHIC PROVINCES

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(based on Udvardy and Nix)
2. GREATER BLUE MOUNTAINS NOMINATED AREA

Nominated Area

Sydney Metropolitan Area
THE GREATER BLUE MOUNTAINS AREA

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2

JUSTIFICATION
2. JUSTIFICATION

2.1 STATEMENT OF SIGNIFICANCE

18: In keeping with the spirit of the Convention, States Parties should as far as possible endeavour to include in their submissions properties which derive their outstanding universal value from a particularly significant combination of cultural and natural features. Operational Guidelines 1998

Context

The Greater Blue Mountains nominated area represents an extraordinary story of natural antiquity, diversity, beauty and human attachment.

It is an environment in which key aspects of Australia’s exceptional natural and cultural histories are protected and presented to a wide spectrum of the public. Its ancient landforms lie within the eastern margin of the continent, as uplands of the Sydney Sandstone Basin, resulting from Gondwanan tectonics, followed by stability and long isolation.

This isolation, together with the complex, dissected landform of the area, has allowed a unique Australian biota to evolve, while earlier remnant species from the time of Gondwana survive in sheltered refuges. Diverse eucalyptus-related vegetation dominates the area, typifying the scleromorphy evolved across the continent under dry climatic regimes, nutrient deficiency and high fire frequency.

Within a continent settled over millennia by indigenous peoples, this protected area is rich in evidence of the cultural continuity of its Aboriginal occupants and their artistic and spiritual expression. The landscape is scattered with dreaming sites and rock art. For 18th and 19th century British colonists, the Blue Mountains were
simultaneously a challenging barrier to the inland and a spectacular wild country. Explorers crossed the mountains with difficulty and convict labour followed, constructing a road to western pastoral lands. This ridge-line route, and subsequent railway line, formed the spine for a series of townships, with economic reliance on mining, health promotion and recreation for Sydney-dwellers, associated with access to the surrounding wild scenery.

**Significance**

The proposed Greater Blue Mountains World Heritage Area consists of some one million hectares of contiguous protected reserves over ancient dissected sandstone plateaus, interrupted by basalt outcrops and limestone karsts, of great geo-diversity. Major stages of earth’s history are represented, along with significant geomorphic and physiographic features and examples of geological processes in the development of landforms. The questions raised by its complex form are currently the subject of active scientific debate, which may well establish in the future a case for inscription under Criterion 44 (a)(i).

The area’s continuing ecological and biological processes of adaptation are significant in the evolution of highly diverse ecosystems and communities of plants and animals. It has also provided significant habitats for the *in situ* conservation of biological diversity, including, in recessed canyons and perpetually moist areas, ancient and threatened species of outstanding value [Criteria 44 (a)(ii) and (iv)]. The crux of the case for its World Heritage listing could be said to lie in the outstanding universal significance of eucalypt-dominated vegetation, of which it represents the best single example through its outstanding richness of species in a protected area with large components of wilderness.

The combination of dramatic landforms and colour, complex patterns of water...
Baltzer Lookout, Grose Valley, Blue Mountains National Park. Photo AJ Morison
flow, highly variable atmospherics, diverse eucalypt-dominated vegetation, rich wildlife and extensive areas for the experience of nature in solitude has created an area of exceptional natural beauty and aesthetic importance which contains superlative natural phenomena [Criterion 44 (a)(iii)]. The property is characterised by the blue haze of its name and the contrast of dry ridges and rainforested valley floors.

The nominated upland sandstone country is tangibly associated with Aboriginal occupation, and their custodianship of the land, over some 14,000, possibly 22,000 years, to the present, through extensive archaeological evidence and displays of rock paintings and engravings. The cultural continuum of caring for country appears more recently, through the evolution here of conservation concepts and practice by later (post-Industrial Revolution) settlers. Their focus is the human obligation to respect, enjoy and protect the natural environment [Criterion 24 (a)(vi)].

The boundaries of the nominated property encompass an area that comprehensively represents the natural values and cultural associations discussed. Together its protected components, of seven national parks and one karst conservation reserve, have for decades been identified by the public as the Greater Blue Mountains.

In formal terms, the integrity of the area is fully protected [Operational Guidelines para. 44(b)]. Its legal status is that of eight publicly owned protected areas, which include large areas of declared wilderness protected under separate legislation. The areas are managed by State authorities, in accordance with statutory plans adopted following community consultation. Several state recreation areas and lower-lying national parks adjacent to the area offer further protection. Integrity is also enhanced by specific legislation to protect threatened species and to control adjoining development through thoughtful environmental planning. The Blue Mountains City Council, which manages the narrow stretch of towns across the mountains (excluded from the nominated area), has adopted policies under its development control powers to minimise impact on the protected areas.
Scribbly gums, Blue Mountains National Park. Photo I Brown
The Greater Blue Mountains area has, in addition, an outstanding history of community endeavour to protect its natural values. These embody the highest wilderness qualities (naturalness, remoteness and size) in the temperate region related to the Great Dividing Range. Yet it lies in close proximity to Sydney, Australia’s largest city. The depth of community involvement with the area over decades is now entrenched and offers a further guarantee for its ongoing protection.

2.2 GEOLOGICAL BACKGROUND

The Operational Guidelines to the World Heritage Convention identify four criteria, any one of which may establish the outstanding universal value of a natural heritage property. The first of these, criterion 44 (a)(i), refers to *outstanding examples representing major stages of earth’s history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.*

The Greater Blue Mountains dissected sandstone plateaus are an intriguing example of all these aspects of the earth’s evolution. Its geological beginnings through convergent (active) margin tectonics; its uplift through the subsequent divergent (passive) margin tectonics; its dissection through the cutting of the gorges and its extraordinarily diverse features of note from pagoda-like formations to limestone caves are described at 3.2 Geo-diversity.

The area is at present a scientific laboratory of ardent debate on certain questions over this landscape’s origin and evolution – such as, whether its drainage has remained stable since Miocene times, or is much more recent. The questions raised over its passive margin tectonics are of global significance.

While this nomination does not at this time rely on criterion 44 (a)(i), quoted above,
2. JUSTIFICATION

Gorge, Wollemi National Park. Photo I Brown
to claim inscription of the Greater Blue Mountains on the World Heritage List, such a case may well be mounted in the future, when there is greater resolution of the present debate on aspects of the area’s geology.

The geology and geomorphology of the Greater Blue Mountains, of course, underpin their outstanding natural values. This is discussed next, under criterion 44 (a)(ii) because of their crucial role in the evolution of the area’s ecosystems and plant and animal communities.

2.3 CRITERIA: BIO-DIVERSITY

Biological diversity and ecological processes

44 (a)(ii): ...be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals...

Operational Guidelines 1998

One of the great evolutionary stories of the planet is the drift of the Australian plate from Gondwana at far southern latitudes to its collision with Asia near the equator (Hill, 1994). In this process Australia became the most arid, climatically variable, fire-prone and nutrient-poor continent not under ice. The long period of isolation before the collision with Asia gave rise to the most distinct biota of any continental landmass, but yet the living evidence of past connections remains. In the few surviving moist places on this dry continent live the remnants of the Gondwanan biota.
2. JUSTIFICATION

Grose Valley, Blue Mountains National Park. Photo I Brown
The Greater Blue Mountains area is one such place. Although the number and extent of primitive species with Gondwanan affinities in the area does not rival the wet tropics or western Tasmania, some of the best single examples of such species are present. The Wollemi pine (*Wollemia nobilis*) is the ultimate such relict. This recently discovered tree is known from only two small stands in deep gorges (Jones *et al.*, 1995; Hill, 1997). It is quite distinct, with no close living relatives, and is therefore placed within its own genus. Another primitive gymnosperm, *Microstrobus fitzgeraldii*, in a genus with just one other extant species, survives only in the spray zone of a few waterfalls in the Blue Mountains (Smith, 1991).

It is the juxtaposition of such relict species and vegetation types with the profuse and diverse evolutionary products of post-Gondwanan environmental change that gives the Greater Blue Mountains its outstanding significance in terms of the evolution of plant life.

One of the most distinct features of Australia’s flora is the large proportion of scleromorphic species - plants with small leaves and hardened cuticles. There are three main regions on Earth where these plants are particularly diverse: the part of Southern Africa with a Mediterranean climate, the Mediterranean south-west of the Australian continent, and the sandstone area centred on the Blue Mountains of New South Wales. The three regions have few species in common and all are therefore of high scientific value. Of the three, the area centred on the Blue Mountains provides the best example of the juxtaposition of scleromorph diversity with species of the original Gondwanan vegetation from which the explosion of scleromorphs emerged. The area is also the only one of the three regions largely dominated by trees and without a Mediterranean climate.

The environmental changes in Australia during and since the Tertiary were not only associated with a massive radiation of scleromorphic species. They also resulted in an almost continent-wide dominance of the prolifically-speciating eucalypts (*Eucalyptus,*
Wentworth Falls, Blue Mountains National Park. Photo J Plaza
Corymbia, Angophora) – genera of trees and shrubs with unusual morphological and ecological characteristics that make them of outstanding global significance (Kirkpatrick, 1987). The Greater Blue Mountains area is the centre of diversity of eucalypts, providing an outstanding record of the products of evolutionary processes associated with the global climatic changes of the late Tertiary and the Quaternary.

**Biological (evolutionary) processes**

The Greater Blue Mountains provide a globally outstanding example of species divergence occurring in a relatively small area.

Species formation has occurred within continuous populations (in this case, of eucalypts) – technically referred to as allopatric and parapatric speciation. Species have overlapping distributions, but are segregated locally into different habitats on the basis of differences in soil, microclimate and other factors. Hybridization is common between such related eucalypts on their mutual boundaries, providing raw material for further evolution in response to environmental change. The degree of interspecific hybridization between eucalypts is globally exceptional for forest genera, and this is most strikingly expressed in the Blue Mountains because of the large number of eucalypts (90) that occur close together.

Levels of local endemism that are among the highest in the world for a temperate forest region indicate a high level of evolutionary specialisation. One hundred and fourteen plant species and subspecific taxa are endemic to the Greater Blue Mountains nominated area, of which substantial numbers belong to each of the genera *Eucalyptus* and *Grevillea*. Local endemism is also relatively high at generic level (*Wollemia, Acrophyllum, Apatophyllum, Rupicola, Allania, Atkinsonia*).
Rainforest/tall open forest, Kedumba Valley, Blue Mountains National Park. Photo I Brown
Processes creating outstanding diversity

Species turnover along environmental gradients is one of the major ecological processes creating plant diversity within the region. Regional gradients are clearly seen in the turnover of eucalypt species, but are also reflected in changes in understorey composition (Keith & Benson, 1988).

Fine-scale environmental variation is also an important mechanism in the maintenance of high species diversity. Gradients in soil moisture and fertility are related to the turnover of two to four congeneric taxa within a few metres (Keith, 1991; Keith & Myerscough, 1993). The variety in the soil environment over small distances has led to complex vegetation mosaics (Keith & Myerscough, 1993; Pickard & Jacobs, 1984), and this is what distinguishes the Sydney sandstone woodlands and heathlands from the high-diversity heathlands of southern Mediterranean climatic regions.

Fire regimes are another major process creating diversity in the Greater Blue Mountains, which is one of the world’s major fire-prone regions. Through their effects on life-cycles and competitive interactions, recurrent fires maintain the co-existence of plant species that would otherwise not be expected to come together in communities. (Keith 1996).

Animal-plant interactions

Australia is the world’s main centre for ant-dispersed plants, and the Greater Blue Mountains region has the greatest concentration of these plants within the continent (Berg, 1975). Nearly all genera of ant-dispersed plants are Australian endemics of dry sclerophyll eucalypt forest, woodland and heathland – the first two of which are represented to an outstanding degree in the nominated area. The eucalypt forests, woodlands and associated heathlands of the Blue Mountains region are thus the world’s single best example of this fascinating co-evolutionary process.

Many of the thousands of moth species in the region use eucalypts during their life
2. JUSTIFICATION

*Bushfire, Yengo National Park. Photo I Brown*
cycle. Their interactions with the flora of the region are little explored, but are likely to be of considerable scientific significance.

Vegetation dynamics related to fire
Australia provides many examples of the influence of fire on ecosystem dynamics. This is most clearly illustrated in areas where species that require fire for their persistence are juxtaposed with vegetation that is destroyed by single or successive fires. The Greater Blue Mountains Area is a good example, as it has both fire-requiring and fire-susceptible vegetation but, in contrast to western Tasmania, the fire-requiring component covers most of the landscape.

Many aspects of fire regimes and associated environmental variables have been shown to influence plant populations in the nominated area. These include fire frequency (Bradstock & O’Connell, 1988), fire intensity (Auld & O’Connell, 1991), fire season and post-fire rainfall (Keith, 1996), as well as competition from cohabiting species (Keith & Bradstock, 1994). Different species have different requirements in relation to these factors and it has been suggested that the maintenance of diversity is dependent on the variability of fire regimes which precludes dominance of any one group of species (Morrison et al., 1995, Keith, 1996).

The unusual dynamic ecology of eucalypt-dominated communities
The crux of the case for World Heritage listing of the Greater Blue Mountains lies in the outstanding universal significance of eucalypt-dominated vegetation. The nominated area represents the best single example of this existing in a region that is still largely wilderness.

Eucalypt-dominated vegetation is unusual on a global scale for three main reasons:
1. Eucalypts are almost totally dependent on fire for their regeneration. The trees naturally have a high flammability, and thereby encourage the spread of fire.
2. JUSTIFICATION

Post-fire regeneration of Xanthorrhoea sp. Photo R Lembit
2. Most eucalypt canopies allow about half the sunlight to reach the understorey. This single fact makes eucalypt forests unique on a global basis, as all other forests either let very little light penetrate or, in the case of deciduous forests, only allow most light to penetrate during the season unfavourable for growth. In eucalypt forests there is thus a relatively high ecological independence between understorey and overstorey.

3. The sparseness of the forest canopy allows the development of species-rich understoreys which can contain light-demanding species. These understoreys can be quite variable in their composition and structure, even under canopies dominated by the same eucalypt species. They tend to be more variable in their response to disturbance by fire than do the eucalypts.

Eucalypts can be eliminated from a site if the interval between fires exceeds their life span. This is most likely to occur where non-inflammable understoreys, such as rainforest, become established. The probability of this happening is of course reduced by the capacity of eucalypts to encourage and propagate fire.

The Greater Blue Mountains area provides an outstanding example of the dynamic interactions between eucalypts, understorey, environment and fire. These range from forests in which eucalypts form a dynamic boundary with co-existing rainforest to communities in which mallee (multi-stemmed) eucalypts co-exist with rich and equally flammable heaths on frequently burned sandstone plateaus.
Blue gum forest, *Eucalyptus deanei*, Blue Mountains National Park. Photo I Brown
**Operational Guidelines 1998**

**Vascular plant species**

The Greater Blue Mountains and adjacent sandstone areas have outstanding levels of vascular plant diversity in all three of the measures usually used. (These are alpha diversity, which is local species richness; beta diversity, or the turnover of species across environmental gradients; and gamma diversity, or regional species richness.) Gamma diversity is also extremely high when considered against the relatively small area, in global terms, of the Greater Blue Mountains (James, 1994). It is interesting to note that the Wet Tropics of Queensland World Heritage Area, which is almost entirely tropical rainforest, has fewer vascular plant species than the nominated area.

Australia is the natural home of approximately one-tenth of the vascular plant species known in the world and the nominated area supports almost one-tenth of the Australian vascular plant flora. Almost all the species in the area are endemic to Australia and 8% are confined to the region. The flora of the nominated area is also outstandingly rich at the family and genus levels, with 152 families and 484 genera. These high levels of richness at all three taxonomic levels make the Greater Blue Mountains unique for temperate forest environments within Australia, and perhaps the globe (James, 1994).

The nominated area has the highest concentrations of eucalypt species of any comparable area in the world, with 90 of the approximately 700 known taxa. Six of these species are endemic to the area. The area is also important because it contains approximately one-third of the global total of *Acacia* Section *Botrycepalae*. 

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**44 (a)(iv) ...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...**

Operational Guidelines 1998
Sunshine wattle, *Acacia terminalis*. Photo J Plaza
Other taxonomic groups

Bird diversity in the nominated area is particularly rich for temperate latitudes, with 265 native species (more than one third of the Australian total). There is a particularly good representation of honeyeaters.

The Greater Blue Mountains are also noted for their globally outstanding richness of Lepidoptera (moths and butterflies) (James, 1994). More than 4000 lepidopteran species (mainly moths) are thought to occur in the region. The remaining invertebrate fauna is poorly-known. However, the total number of invertebrate species could be reasonably expected, on extrapolation from elsewhere in Australia, to be ten times the number of vascular plants - a high figure for temperate latitudes.

Communities

It is difficult to make global comparisons of community richness because the means for discriminating communities differ widely even within the one country, resulting in marked differences in the degree of taxonomic differentiation. However, more than 70 plant communities have been recognized from the nominated area, of which almost half are confined to the Greater Blue Mountains. While it is difficult to compare this figure with other areas, there is no doubt that the Blue Mountains contain the world’s most outstanding representation of eucalypt-dominated communities.

Threatened species of outstanding conservation or scientific importance

More than 120 vascular plant species or subspecies within the nominated area are considered to be rare or threatened – that is, they are on the Australian national list and are Australian endemics. Of these species, approximately half are solely or mainly confined to the Blue Mountains. Australia has many rare and threatened species, and therefore the Greater Blue Mountains constitute one of the world’s most important and significant habitats for in situ conservation of threatened plant species. There is no
New Holland Honeyeater, *Phylidonyris novaehollandiae*. Photo WJ Labbett/Nature Focus
doubt that many of these plant species are of inestimable value from the point of view of science and conservation.

The outstanding example of such species is the Wollemi pine (*Wollemia nobilis*). The discovery of the only two extant stands of this species in 1994 generated considerable international interest. *Wollemia* is a monospecific genus in the gymnosperm family Araucariaceae (Jones et al., 1995). It has a highly unusual architecture (Hill, 1997) and considerable palaeogeographic interest (Enright, 1995). Two other genera that are confined to the Blue Mountains contain only one species, *Acrophyllum australe* in the Cunoniaceae and *Atkinsonia ligustrina* in the Loranthaceae. *Microstrobus fitzgeraldii* is a threatened species of southern gymnosperm in a two species genus in the Podocarpaceae.

**Vertebrate fauna**

Although approximately 10% of the more than 400 vertebrate species that are found in the Blue Mountains are rare or threatened, the region is not as important for the conservation of this taxonomic group as for plants, as most of the threatened species have wider ranges and more important areas for their conservation. One exception is the Blue Mountains water skink (*Eulamprus laeraensis*), which is considered to be threatened and which is confined to swampy heathland in the Greater Blue Mountains region.

**Summary**

The Greater Blue Mountains are the most biologically diverse part of the Eastern Sclerophyll Open Forest biogeographic province and contain the globally most diverse expression of eucalypt-dominated ecosystems. The integrity of the area remains high.
2.4 CRITERION: NATURAL BEAUTY

44 (a)(iii): ...contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance... Operational Guidelines 1998

The Greater Blue Mountains are generally well named. They are great because of their vast panoramic scale, encompassing over a million hectares of dissected uplands, embued with the aesthetic qualities of wilderness, age and natural integrity.

They are also blue. This is not only the effect of distance but also of the characteristic and evocative atmospheric blue haze from the fine drops of oil, which are dispersed by their eucalypt-dominated vegetation and perfuming the air. The Greater Blue Mountains are, however, not mountains but rather deeply incised sandstone plateaus, with spectacular cliffs, valleys and gorges.

As will be shown, the nominated area contains superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance and these attributes define its identity.

...the blue bulk of the eastern highlands stands up to bar your way...we spend our days almost in sight of that great crescent of tableland, escarpment and gorge; it shapes our perceptions of the country as strongly as the inland plains and deserts.

Primeas, 1997
2. JUSTIFICATION

Jamison Valley, Blue Mountains National Park. Photo AJ Morison
Superlative natural phenomena

In a continent renowned for its unique fauna and flora and superlative natural phenomena, such as the Great Barrier Reef or Uluru-Kata Tjuta World Heritage Areas, the distinctive landscape of the Greater Blue Mountains remains outstanding.

The various protected areas within the nomination are diverse in character, ranging from the grandeur of cliffs to the subtle undulations of the plateau horizons and forested valley floors, from sentinel rock formations and cascading waterfalls to the fine-grained mosaic patterns of different plant communities. Gorges, bottleneck valleys, slot canyons, limestone caves and ‘pagodas’ are striking natural phenomena.

It is a time-weathered cross-section of sculptured sandstone, carpeted by diverse endemic vegetation and etched by complex water patterns. Trees, shrubs and grasses are assembled as gully forests, heath, hanging swamps, mallee, woodland or open upland forests – offering a panoply of fauna habitats. The flora responds to each change of micro-climate and soil with a variety of texture, colour and perfume. One is the most startling and vivid of flowering plants, the scarlet *Telopea speciosissima* (the Waratah), whose name means ‘most beautiful’.

The extraordinary juxtaposition of topography and biota, over largely pristine areas of wild country, is affected by the intense atmospherics of the area’s changeable climate. Flashes of light and racing clouds alter the colour of rocks, trees, scrub and the layered hills in seconds.

Exceptional natural beauty

Throughout recent history, the spectacular scenery of the Greater Blue Mountains has been acknowledged and described by explorers, travellers, scientists, writers and artists. The scientist, Charles Darwin, already an experienced global traveller, in 1836
Waratah in snow, Telopea speciosissima, Blue Mountains National Park. Photo I Brown
described the Blue Mountains as *striking, magnificent* and *profound*.

...*a sound of pouring water reached us, the cause of which was soon explained by one of the more stupendous scenes I ever beheld, bursting unexpectedly upon us. Suddenly, we found ourselves standing on the brink of a tremendous precipice*...

Meredith, 1844

Visitors can appreciate the exceptional strength of the natural landforms and the ephemeral effects of rising mists, bird calls, water sounds and the pungent scents of the unique assemblages of eucalypt-dominated forest and woodland, from balcony views, tracks and lookouts along the exposed sandstone ridges. All without disturbing these natural qualities. The rugged country allows only the most dedicated and experienced bushwalkers to penetrate their vast, wild interiors.

The exceptional natural beauty of the nominated area has been recognised by Australian heritage authorities, on the Registers of the National Estate and of the National Trust of Australia (NSW).

**Aesthetic importance**

_The stream spilled water from a flute-edged rim,_
_once its bank, down half a hill._

_Star-flowers in the never-rained overhangs_  
_pulled water from the yielding air._

*In a Cloud*, O'Connor, 1988
Wheeny Creek, Wollemi National Park, Photo I Brown
Much of the Greater Blue Mountains has been statutorily declared, or identified, as wilderness. These awesome natural areas are remote, hard of access and offer a sense of harmony with the environment and spiritual satisfaction, through solitude. The aesthetic quality of wilderness is one of the most significant in the area.

The creation of images in response to the Mountains began millennia ago. Aboriginal rock engravings of three language groups are scattered over horizontal platforms throughout the area, and caves and rock overhangs shelter hundreds of images – drawn, painted and stencilled, communicating measures not yet fully deciphered. As a body of thousands of years of artistic expression, they are of outstanding scientific and aesthetic importance.

The striking beauty of the Greater Blue Mountains has continued to inspire great artists and writers (see 3.4 Natural beauty). The 'sublime' waterfalls, rock formations, expansive vistas and wildlife of the area feature prominently in Australian landscape painting and photography. Through this work, much of the area is now instantly recognisable. Since European colonisation, the features and atmospheric moods of the area have been further documented in maps, drawings, etchings, woodcuts, lithographs, ceramics, sculpture, literature, verse and music.

As the continent’s, and perhaps the world’s, largest wild, protected uplands so close to a major city, the Greater Blue Mountains receives both national and international visitors, attracted by its superlative natural phenomena and exceptional natural beauty. The Mountains environment refreshes and inspires, not only creative artists, but everyone. One important aesthetic strength is the ability to touch everyday lives with wonder at the scale, power and fascinating minutiae of nature in the wild.
Govett’s Leap, Blue Mountains, Grace Cossington Smith, c1933. Private Collection


2.5 CRITERION: CULTURAL ASSOCIATIONS

24 (a)(vi) ...be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.

Operational Guidelines 1998

The rugged upland country of the Greater Blue Mountains is not only of exceptional natural diversity, and of spectacular and ephemeral beauty, but is also closely tied to the lives of people who have occupied, visited, thought about it and cared for it over thousands of years. The property represents, in fact, the combined works of nature and man.

The direct and tangible cultural association with the million hectares of wild country is expressed in two physical forms. First are the widespread Aboriginal occupation sites, rock shelter paintings and rock platform engravings. Second is the narrower network of historic walking tracks, staircases and lookouts, festooned from the edges of the ridge crossing the Mountains and down to the valley floors.

Both rock art and tracks are intact and authentic. The texts which follow, on Aboriginal rock art and on pioneering conservation movements in the area, explain the significance of these tangible links with events, traditions, ideas, beliefs, and artistic works of outstanding universal significance.

It is stated in this criterion, by way of addendum, that the Committee considers this criterion should justify inclusion in the List only in exceptional circumstances and in conjunction with other criteria cultural or natural.

In this case, the criterion has been justified in conjunction with natural criteria 44 (a)(ii), (iii) and (iv). The exceptional circumstances of the Greater Blue Mountains are
Aboriginal grinding grooves, Mt Horne, Newnes Plateau, Blue Mountains National Park. Photo J Brown
the scale, intensity and longevity of the cultural association. It is a place where ancient custodianship over the million hectares of dissected plateaus has been replaced by another, more recent form of custodianship, significant nonetheless.

The intense inter-relationship of nature and people over tens of thousands of years make the Greater Blue Mountains a classic example of the nature-culture continuum, which has exercised the minds of the World Heritage Committee over recent years and was given expression in its Global Strategy meeting of March 1998.

**Rock Art**

*Aboriginal traditions and artistic works*

The Greater Blue Mountains sandstone parks within the Sydney region are of outstanding universal value for their cultural associations. The contiguous protected areas included in the nomination represent extensive tracts of highland country with minimal disturbance and much archaeological evidence of the presence of Aboriginal life over millennia. Within these areas are registered many known Aboriginal art sites. The potential for many more significant sites to be located here is enormous. Consisting of the combined works of nature and man they satisfy the above criterion in that they are directly and tangibly associated with events or living traditions...with artistic...works of outstanding universal significance.

*Distinctive features*

The art of the Sydney Region, which includes the Greater Blue Mountains, is unique within Australia in that it contains two synchronous forms. Both pigment and engraved forms were being produced by the same groups of people at the same time. In no other area of Australia does this occur on such a grand scale. Usually one art form appears to have developed to the exclusion of the other (such as in Arnhem Land/Kakadu,
Aboriginal art, Red Hands Cave, Blue Mountains National Park. Photo I Brown
Cobar, Laura and Port Hedland), or the two are diachronically distinct (such as in western New South Wales and central western Queensland). Even along the south-east coast of Australia, north and south of the Sydney region, open engraving sites disappear from the artistic repertoire.

**Regional variation and similarities**

The rock art in the nominated area represents an important constituent of the Sydney region art style – an extensive example of one of the continent’s Simple Figurative styles. The stylistic variability within it can be attributed to cultural variation, based on language groupings and social organisation.

The nominated area lay in the territories of at least three language groups at the time of European contact – Darkinjung, Daruk and Gundungurra. Although it does not include the entire territorial area for any of the groups, the nominated area transcends cultural boundaries. This means that the Aboriginal sites within it record the diversity of evidence from the three language groups – including their centres and boundaries. As such, it preserves a vital record of social interactions and artistic activities of the people who produced the art corpus of the western side of the Sydney region.

**Scientific significance**

The art of the area’s inhabitants was among the earliest references made by Governor Phillip:

*In all the excursions...the figures of animals, of shields and weapons, and even of men have been carved upon the rocks...On the top of one of the hills the figure of a man, in the attitude usually assumed by them when they begin to dance, was executed in a still superior style.*

Phillip, 1789
Kangaroo motif. Photo J McDonald
Since that time, there has been a steady fascination for the art of the sandstone area, including the uplands (eg. Barralier 1802; Angas 1847; Mathews 1897, 1898, 1910; Campbell 1899). From the 1940s, the recording activity and professional interest in this Aboriginal art and archaeology grew and there are now many university research theses at honours and doctoral level dedicated to the subject. The extensive interest in the art and archaeology, however, has not yet been matched by systematic archaeological investigation in the somewhat inaccessible and protected areas of the Greater Blue Mountains. Despite this, an extensive record of Aboriginal occupation has been established. A large number of sites are recognised for their significance by listing on the Australian Heritage Commission’s Register of the National Estate.

Archaeological research in the Sydney sandstone region has demonstrated not only the extensive and intensive Aboriginal occupation of the Greater Blue Mountains plateaus, but also the dynamic nature of life in this area:

- Human occupation extends back at least 14,000, and possibly 22,000, years.
- People adapted to a wide variety of climatic conditions during this time.
- Technology and material culture changed, as did preferred locations.
- The Rock art occurred in several forms and in two distinct social contexts.

Through stylistic behaviour, the local peoples, who were not in continual verbal contact with one other, were able to communicate important social messages and demonstrate both broad-scale group cohesion and within-group distinctiveness.

The dissected sandstone plateau country of the Greater Blue Mountains is of outstanding universal value for the scientific significance of its suite of some 700 known Aboriginal occupational and rock art sites across extensive undisturbed areas. These reveal the longevity and intensity of cultural associations with this complex landscape. The area has a high potential for the discovery of further important sites and works of art, containing further diverse evidence of past Aboriginal occupation and custodianship of this landscape.
Conservation history

Background

The sandstone parks of the Greater Blue Mountains are of outstanding universal value for their association with cultural movements to protect the natural environment from the depredations of modern industrial society.

Indigenous societies with a hunter-gatherer culture have tended to enjoy a holistic and spiritual relationship with the natural environment. In contrast, Western agricultural and industrial societies tended to treat the land largely as a source of materials production, regarding the ‘wilderness’ as an unattractive and hostile environment. In the 19th century however a notable change of attitude towards wild areas occurred, investing them with positive values for recreation, inspiration and science. This coincided with the spread of industrial cities and the transformation of land by agriculture and industry, threatening the very survival of natural beauty. In Europe, this re-evaluation was directed to conserving the quality of combined wild and rural landscapes, whereas in North America and Australasia preservation of natural areas were by means of national parks.

In this significant change of attitude towards the environment, certain areas and events were seminal. One of exceptional significance is the bush-covered sandstone plateaus of the Sydney Basin – including the Greater Blue Mountains. Here, the beauty of the natural scenery and the demand for recreation coincided with the relatively low value of the land for agriculture and industry. The result was the development of an extensive system of connected parks.

In the second half of the 19th century, a symbiotic relationship developed between the citizens of Sydney and the nearby Blue Mountains bushlands which persists to this day in a living protective cultural association.
Depth of community involvement

Most significant events in conserving this upland landscape were driven by the community. Both the continuity and the evolution of voluntary effort are remarkable. Four distinct phases are evident:

1. The health-based movement starting in the 1870s which resulted in the first parks and the track systems.
2. The bushwalker conservation movement of the 1930s, out of which came the large visionary parks and the wilderness reserves.
3. The conservation revival of the 1960s which created mass public support for the implementation of the earlier large park proposals and the wilderness systems.
4. The 1990s move to consolidate and confirm environmental values, including the recognition of World Heritage values.

Typical at the outset was the 1870s health-based movement for public recreation reserves and parks. In the Greater Blue Mountains the establishment of reserves became closely intertwined with the building of systems of tracks. Intermediate between new settlements and the wilder bush, between civilisation and wilderness, they helped to reinforce the community’s interest and pride in the natural environment.

During all stages, the community, local and state authorities played important complementary roles. Together they were involved in park and reserve administration, the development of tracks, the extension of the parks systems and the understanding of the area’s aesthetic and scientific values. Critical was the interaction between recreationists and the natural beauty of the forest-covered plateaus. The spectacular landforms also intrigued scientists and inspired artists and photographers, whose works in turn helped to create the sublime image and recognisable regional identity of the Mountains. Absorbed into the community psyche, such experiences and images
Postcard from the J Smith Collection
have been the life force of conservation and the reason for the continuing natural state of so much of the country.

The recreational association with places now primarily seen as conservation areas is a close one today. Many of the walking tracks built in the 19th century, extending over some 90 kilometres in the Grose and Jamison Valleys alone, are still in use and bushwalkers continue to enjoy the remote, trackless wilderness areas.

**Innovation**

Many conservation-associated actions in the Mountains area were pioneering from a global perspective. The placing of Jenolan Caves under public management in 1866 is a specific example. Later it was the first viewing cave to be lit by electricity. (By way of comparison the inscribed United States natural property Mammoth Cave was not protected until 1926.) There were, however, more momentous developments in the sandstone bushlands of the Sydney region.

In his 1835 Guide to the Lakes District, the English poet William Wordsworth referred to the district as ‘a sort of national property’. During the 1870s, in North America, Australia and New Zealand, however, the word ‘national’ began to be used for areas of high importance for preservation. In 1875 in New South Wales, the term was used in the investigation for the reservation of the Grose valley within the Greater Blue Mountains, the surveyor making the report describing it as a ‘national spectacle’. The first official use of the term ‘national park’ in the statutory authorisation of a reserve was in 1879 for ‘The National Park’, a coastal park in the same Sydney sandstone basin as the Blue Mountains. It was followed only some years later by the establishment of national parks in other self-governing colonies: Banff (Canada) 1885; Tongariro (New Zealand) 1887, Belair (South Australia) 1891; and Tower Hill (Victoria) 1892.

For an area whose boundary was as close as 60 kilometres to the centre of a major metropolitan area, the major Greater Blue Mountains national parks proposal of 1932
Jenolan Caves. Photo J Plaza
was remarkably innovative. Most other large parks at this time, mainly in the United States of America and South Africa, were distant from large cities.

The proposal to establish a system of wilderness areas in the Blue Mountains area was second only to the USA. Its progenitor, the National Parks and Primitive Areas Council, was the first conservation group in the world with a major wilderness conservation objective. These events influenced other places, especially after the State government passed the first Australian legislation to place the control of national parks and wilderness under a single professional service (1967), and provided the first explicit legislative provision in Australia for wilderness reserves.

Comparison

A remarkable feature of the Greater Blue Mountains sandstone landscapes is the sheer scale of conservation achievement. The contiguous national parks and state recreation areas alone cover some 1,200,000 hectares. This vast park estate, much of it in pristine wilderness condition, is on the doorstep of Australia’s largest city. There are few, if any, parallels to this elsewhere in the world. Evidence of this endeavour and affection for the wild landscape remains in the extent of the community inspired network of walking tracks providing access to the spectacular cliffs on either side of the central Blue Mountains townships.

Whilst well-developed track networks providing recreational access in conservation areas exist in other parts of the world, those of the Blue Mountains are exceptional in their complexity, intensity and crafted construction in a hard rock environment. Forty-six are protected on heritage lists.

Because of the innovations involved, the scale of the achievement and the depth and continuity of the community’s engagement with conservation, the national park system of the Greater Blue Mountains is an outstanding example of the international national parks phenomenon. The nominated system of parks, resulting from
Photo Wal Green, 1940. J Smith Collection
community-based effort in a unique setting close to a large city, complements other outstanding but more remote national parks, such as Yosemite and Yellowstone (USA) and national parks representative of the protected landscape variety, such as those of England and Wales, where planning measures are used to preserve mixed rural and natural environments. The three categories are like different species of a single genus, each with its own outstanding value.

2.6 INTEGRITY AND AUTHENTICITY

The condition of the Greater Blue Mountains nominated area is set out in 3.6 State of conservation. It is described as close to pristine, reflecting the very high level of integrity of the area. Developmental and environmental pressures and the protective conservation responses to them are described in detail at 5.1 Development and tourism and 5.2 Environmental pressures and natural disasters. The following section establishes the integrity and authenticity of the area, under the headings:

• Strategic planning and plans of management
• Protection against off-park impacts
• Reserve boundaries
• Level of protection and buffer areas
• Authenticity of cultural sites
Strategic planning and plans of management

44 (b)(v): the natural properties described in 44 (a) ...should have a management plan. Operational Guidelines, 1998

The Greater Blue Mountains area meets this requirement through individual plans of management prepared for each protected area (see 4.3 Management documents) and, if inscribed on the World Heritage List, through the proposed Strategic Plan, to be developed cooperatively by the New South Wales and Commonwealth Governments. This Plan will co-ordinate management activities across all protected areas.

The Strategic Plan will co-ordinate the plans of management for all the protected areas making up the Greater Blue Mountains nominated area and ensure that management activities are consistent across the whole area. It will provide a single mechanism, and a vision, for ensuring the protection, conservation and presentation of the Property’s outstanding universal values and for appropriate monitoring and reporting on the condition as a World Heritage site. It will (as in the 25 year Strategic Plan for the Great Barrier Reef World Heritage Area, 1994) be based on a program of community and stakeholder participation.

Some plans of management for protected areas in the nominated area already recognise the potential World Heritage values of the area and the need to manage them in a co-ordinated way. For example, the plan of management for Wollemi National Park recognises the potential for the park to be included in a World Heritage nomination, and that listing the park would need to be reflected in its future management, as follows:
In the event of World Heritage listing being achieved for Wollemi National Park, the park will be managed by the Service in accordance with the ‘Convention for the Protection of the World Cultural and Natural Heritage (1972)’. A strategic plan will be developed to co-ordinate the management of all tenures which form part of the World Heritage listed area. If necessary, this plan of management may be amended to ensure that all park values which are recognised as having universal natural or cultural values are adequately protected.

Similarly, the plan of management for Jenolan Caves Karst Conservation Reserve adopted in 1989 recognises the importance of managing the Reserve’s potential World Heritage values. The plans of management for Blue Mountains and Kanangra-Boyd National Parks also recognise the fact that these parks form part of a large area of protected lands (approximately 1.2 million hectares), and that the whole protected area needs to be managed strategically. To that end, each plan includes the following major management emphases:

- Implementation of a co-ordinated management strategy with adjacent protected areas to enhance their ecological integrity as the largest natural area in eastern New South Wales and to protect their wilderness values; and
- Promotion of appropriate land use planning and management amongst relevant land management authorities to ensure the protection of the park’s outstanding natural and cultural values from adverse external impacts.

Plans of management for most of the parks in the nomination include objectives of management which recognise the role of each park as part of an integrated network of protected areas across the Greater Blue Mountains. By way of example, some relevant extracts from the plans are listed below:
Blue Mountains National Park

Protection of the park as part of the system of protected lands of the Sydney Basin, with emphasis on maintenance of the ecological relationships between the park and adjoining protected areas.

Wollemi National Park

To manage Wollemi National Park in recognition of its role as part of a contiguous system of parks, reserves and other protected lands.

Yengo National Park

Promotion of wildlife corridors that link the park to the system of protected lands and enhance its conservation value.

Nattai National Park

Specific objectives [for the park] will be implemented as part of a coordinated management strategy with the adjoining Kanangra-Boyd, Blue Mountains and Thirlmere Lakes National Parks.

Protection against off-park impacts

The integrity of protected areas in the Greater Blue Mountains can be threatened by developments in areas adjacent to reserves. Impacts may be caused by inadequate environmental protection measures during construction, such as clearing of native vegetation on erodible sandstone soils and poorly designed sedimentation controls. In addition, vegetation communities in the Blue Mountains are adapted to the very infertile, skeletal soils derived from Hawkesbury and Narrabeen Sandstones, which make them susceptible to weed invasion and other floristic changes as a result of nutrients in urban and
rural runoff and in poorly treated sewage.

To reduce sewage impacts, the Sydney Water Corporation has invested in a major 25 year program to connect 2500 houses to sewerage, close inadequate treatment plants in the upper Mountains, and transfer sewage, via tunnel, to an upgraded tertiary treatment plant in the lower Mountains, outside the nominated area. The closure of old plants and transfer of sewage is already seen to have resulted in significantly improved water quality in previously polluted streams in the Blue Mountains (pers.comm., K Muir, Director, Colong Foundation for Wilderness).

The State Government has recognised the importance for the integrity of the nominated area of reducing the impacts of polluted stormwater on natural bushland in the central area. It has recently commenced a major Urban Runoff Control Program in the Blue Mountains. Works include sealing roads to reduce stream sedimentation, restoration of degraded sites, installation of stormwater detention basins, weed control and bush regeneration.

**Reserve boundaries**

The boundaries of several of the protected areas correspond to formerly vacant Crown land. The convolutions in the northern boundary of Wollemi National Park, for example, are the result of the early granting and clearing of arable land in the narrow valleys below the sandstone outcrops and cliffs. Because the cleared areas are generally 100 metres or more below the sandstone plateau, these dominant landforms enable the parks to perform an effective conservation role without being adversely influenced by the land uses below.

A similar situation occurs in the large area between Yengo and Wollemi National Parks (shown as excluded on the location map), which consists of Putty State Forest (Crown land managed for low intensity logging) and private grazing land and hobby farms. The conservation significance of Putty State Forest (which occupies about half
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Wollemi National Park near Newnes Plateau. Photo J Plaza. Sydney Royal Botanic Gardens
the area) and the potential for it to be added to Wollemi National Park is likely to be considered in the next few years.

Some parks, especially Yengo National Park, have numbers of ‘inholdings’, areas of freehold or leasehold land surrounded by the park but not reserved as part of it. The National Parks and Wildlife Service is progressively purchasing these lands when offered for sale, depending on the availability of funds, allocated according to the significance of each area for conservation and park management purposes.

Other sources of funds for purchasing inholdings include the Dunphy Wilderness Fund, established by the NSW Government in memory of Milo Dunphy, a leading conservation advocate and son of the author of the original proposal for a ‘Greater Blue Mountains National Park’. The Fund is used to purchase inholdings in areas of ‘identified’ wilderness so that the land may be declared as wilderness. The NSW Government spends $2.5 million a year from the Dunphy Fund and is currently purchasing inholdings for addition to wilderness areas in Wollemi, Kanangra-Boyd and Blue Mountains National Parks.

**Level of protection and buffer areas**

The identified values of the nomination are protected by two additional mechanisms: wilderness areas and adjoining protected areas. Over 500,000 hectares of the nominated area consists of wilderness within national parks, which protects these large areas of intact natural ecosystems from disturbance (see 4.2 Legal status and protective measures for further discussion).

Several protected areas (two national parks and five state recreation areas), outside but immediately adjoining the boundaries of the nomination, enhance its integrity as illustrated on the map of protected areas and developmental pressures. Although Dharug (adjoining Yengo National Park) and Goulburn River National Parks (adjoining Wollemi National
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Park) have the same protected status as the parks in the nomination, they are not perceived to form part of the identity of the Greater Blue Mountains because of their lower lying character. They cover a total area of 86,200 hectares.

The state recreation areas adjoining Nattai National Park and Blue Mountains National Park (Bargo, Burragorang, Yerranderie and Nattai SRAs) cover 38,500 hectares. Parr State Recreation Area adjoining Wollemi National Park and Yengo National Park covers 35,600 hectares. State Recreation Areas are a class of protected area reserved under the *National Parks and Wildlife Act 1974* which allows a greater level of access and recreational use than in national parks, and which permits underground mining and surface exploration subject to statutory environmental impact assessment requirements. Otherwise, they are managed in a similar way to national parks, with the primary management emphasis on the protection of natural features and conservation of plants and animals.

**Authenticity of cultural sites**

The outstanding human cultural ties with the Greater Blue Mountains, through long prehistoric and historic caring for the country, are described in 2.5 and 3.5 *Cultural Associations* of this document. Their physical expression is embodied in the rich resources of rock art spread across the nominated area and in the elaborate early network of cliff face walking tracks linking the east-west chain of Blue Mountains towns to their immediately adjacent protected valleys and gorges. These places retain their authenticity.

The rock art is scattered throughout the protected, remote portions of the nominated area and thus, through its inaccessibility, remains intact and well preserved. Known sites, displayed to the public, are professionally managed and well conserved by the National Parks Service. The historic walking tracks continue to perform their
original role of serving sightseers and walkers in their appreciation of the wild splendour of the Blue Mountains. Their care and maintenance is discussed at 3.5 Cultural associations. After a period of neglect, much of the extensive network has been restored. Current community work on the tracks is concerned with consolidation, through managed conservation.

2.7 COMPARATIVE ANALYSIS

60: Each natural site should be evaluated relatively, that is, should be compared with other sites of the same type, both inside and outside the State Party’s borders, within a biogeographic province or migratory pattern. Operational Guidelines 1998

The Greater Blue Mountains nominated area of upland reserves is extraordinary in several ways. First, in its representation of the extent, integrity and diversity of its eucalypt dominated vegetation. Second, in the symbiosis of natural and cultural values, through the depth of associations with people over time – from the light hand on the landscape of its Aboriginal occupants over thousands of years to the recreation and custodianship of a neighbouring metropolis. On a world scale, it is extremely rare to find a city of over 3.7 million inhabitants, as Sydney is, surrounded on all landward sides by large areas of protected bushlands and wilderness. The difficult topography of the Mountains has allowed only one major crossing from east to west. This provides easy access for visitors to this spectacular part of the property. It is rare to find visitation so channelled to maximise peripheral access and enjoyment, yet conserve the remaining million protected hectares.
Scribbly gums, E. sclerophylla, above Grose Valley, Blue Mountains National Park. Photo I Brown
While the World Heritage List already includes properties with forested ecosystems on the Australian continent, the Greater Blue Mountains area is, nonetheless, outstanding in both continental and global contexts for the evolution and diversity of its eucalyptus related vegetation.

To support this assertion, the nominated natural site is compared with other sites of the same type, in three rigorous ways. The outstanding universal value of the Greater Blue Mountains area, under criteria 44 (a)(ii) and (iv), has been:

- Established through the application of the biogeographic province approach, quoted in the above extract from the Operational Guidelines to the Convention.
- Confirmed through the evidence of a detailed continent-wide eucalyptus species map and the many comparative references in the text of the nomination itself.

**Thematic comparison**

As part of an inter-governmental (federal and state governments of Australia) comprehensive regional assessment process, a thematic methodology has been adopted to identify forested places of outstanding universal value on continental Australia. It is based on a systematic, comparative framework developed in 1992 to identify properties of outstanding universal value (Domicelj *et al.*, 1992).

The methodology assesses significance by developing themes of outstanding universal value and then testing specific places against these, through a rigorous series of steps, drawn from the requirements of the Convention, such as the criteria for evaluation, integrity/authenticity and management, under paragraphs 24 and 44 of the Operational Guidelines.

In 1996 and 1997, the first steps of this methodology were applied by a World
Heritage Expert Panel, drawn from Australia’s foremost experts of international standing in relevant disciplines, and chaired by Professor Ralph Slatyer, former Chair of the World Heritage Committee (1979-1982).

The Panel first identified thematic contexts and themes of outstanding universal value, relating to natural and cultural values of terrestrial Australia, within a worldwide context. Because of its focus on forested areas, its second task was to select forested areas warranting further assessment to identify the best global expression of the themes.

Amongst the outstanding themes identified by the Panel is the *Evolution of Landforms, Species and Ecosystems under Conditions of Stress*, with the sub-theme of *Eucalyptus dominated vegetation*. The Panel concluded that

*a large section of the natural, aesthetically-outstanding sandstone country centred on the Blue Mountains represents a single large area of natural forest that includes one of the two major peaks of eucalypt diversity and that it is an exceptional area in relation to this sub-theme.*

It advised that the sandstone National Parks forming the Greater Blue Mountains warrant further investigation in relation to their outstanding contribution as an expression of this sub-theme. The Panel noted the importance of the large sandstone area, centred on the Blue Mountains, and added that there are excellent reasons for assessing its international significance as the expression of the additional sub-themes of passive continental margins, refugia and relicts, and scleromorphy.
Biogeographic province comparison

Out of the fourteen biomes for the world, one is allocated to Evergreen Sclerophyllous Forests, Scrubs and Woodlands. In 1984, MDF Udvardy published for the World Conservation Union (IUCN), in cooperation with the United Nations Environment Program (UNEP), a biogeographical classification system for terrestrial environments, incorporating a revised classification for the Australian realm. Within this, Udvardy recognises sixteen biogeographic provinces. In the Sclerophyll Forest Domain, the biogeographical province relevant to this nomination for comparative purposes, is the Eastern Sclerophyll Open Forests.

The Wet Tropics World Heritage Area of northern Queensland lies within this Eastern Sclerophyll Open Forests biogeographic province identified by Udvardy, as do the Central Eastern Rainforest Reserves World Heritage Area (straddling the Queensland/New South Wales border), and Fraser Island (just off the Queensland coast). While the Greater Blue Mountains lie within the temperate zone, the first of these World Heritage Areas is tropical, the second sub-tropical and both cover primarily rainforest, not sclerophyll open forest. Fraser Island is listed for its geomorphological qualities, rather than its eucalypt dominated vegetation, which is not outstanding.

In comparing these areas, the Expert Panel, mentioned above, noted that the Central Eastern Rainforest Reserves World Heritage Property, while including a range of vegetation types, principally represents rainforests. It does not, however, cover the variety of species and forest types of the region and it is in this respect that the Greater Blue Mountains area is outstanding. The Greater Blue Mountains are, in fact, the most biologically diverse part of this biogeographic province and contain the globally most diverse expression of eucalypt dominated ecosystems.
2. JUSTIFICATION

Mountain gums, Loombah Plateau, Blue Mountains National Park. Photo I Brown
It appears that an extensive sclerophyllous reserve (World Heritage) proposal is impossible outside Australia...

A comparative evaluation of the south-eastern Australian sclerophyll forests with areas of sclerophyll vegetation overseas confirms its uniqueness. The sclerophyll vegetation of the Cape, Chile and California are all scrub types. The Mediterranean once had an evergreen sclerophyll oak forest but this has been reduced to scrub by human influences...

Mosley, 1989

**Continent-wide eucalyptus species distribution analysis**

The detailed map prepared by Environment Australia’s Environmental Resources Information Network from data extracted from its Specimen Database, identifies the Greater Blue Mountains area as a continental concentration of eucalyptus diversity and species richness. This evidence reinforces the area’s fulfilment of criteria 44 (a)(ii) and (iv) on a comparative basis.

*There are some better expressions of eucalypt communities in the Alps to the sea area – but if you are to pick one area to demonstrate eucalypts in terms of extent, integrity and diversity you would choose the Greater Blue Mountains.*

J Kirkpatrick, pers. com. to PHC Lucas
3

DESCRIPTION
3.1 CONTEXT, HISTORY AND TIME

The time-lines essential for depicting the various histories of the Greater Blue Mountains vary dramatically in scale. For its outstanding natural values, they range from the geological to the biological and, for its cultural associations, from the prehistoric to this century. For this reason, each aspect is presented within its own time-frame.

The explanation of the nominated area as it now appears extends from the area’s tectonic beginnings, hundreds of millions of years ago, to the long evolutionary processes of sedimentation and erosion, which continue to mould its dramatic landforms. Its extraordinary biota carries both relict species originating from Gondwanaland, when it was still intact, and diverse, sclerophyllous vegetation which evolved on the separated, dry Australian continent. Today, questions raised by the area’s geomorphological and biological histories continue to stimulate advanced and passionate scientific investigation.

Aboriginal people have occupied the complex country of dissected sandstone plateaus and valleys for at least 14,000 (possibly 22,000) years, leaving traces of their presence in occupation sites, rock paintings and engravings. In the late eighteenth century, the British set up their first colony on the continent on the nearby coast and various attempts were made to cross the precipitous tableland from the east. In the second decade of the 19th century, an east-west route along ridgelines was established, leading to the western plains. This alignment continues as the main highway and railway mountain crossing, serving a string of small settlements and channelling visitors to adjacent lookouts and walking tracks to appreciate the outstanding wild beauty below and beyond the cliffs. This human-made line is barely visible on the map of a million hectares of protected wild upland country.
The following description of the nominated area is offered in sequence. It touches first on the geological evolution and diversity of the Greater Blue Mountains, second on the wealth of its bio-diversity, third on the natural beauty arising from its outstanding natural features and fourth on the strength of its cultural associations.

### 3.2 GEO-DIVERSITY

**Introduction**

The Greater Blue Mountains area – more than one million hectares of protected reserves – represents a major geological feature of eastern Australia. The area is not mountainous in the classic, alpine sense, but nonetheless acquires its distinctive character by its relief. Steeply dissected plateaus, precipitous cliffs, waterfalls, broad gorges and dark, narrow canyons are its instantly recognisable features.

The area exemplifies gorge scenery, with predominant rock types of shale and sandstone, both laid down during the Triassic period. The deep gorges were created by the erosive effect of rivers. Indeed, it was the spectacle of the Grose River Gorge that astonished Charles Darwin when he visited the area in 1836.

_The first impression is that [the gorges] have been hollowed out, like other valleys, by the action of water, but when one reflects on the enormous amount of stone, which on this view must have been removed through mere gorges or chasms, one is led to ask whether these spaces may not have subsided._
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Grose Valley, below Baltzer Lookout. Photo AJ Morison
Darwin thought that the mountains had been uplifted only a few million years ago and that the incised valleys were therefore of even more recent origin. He wondered how a river could carve so deeply in such a short time. The answer is that much more time was spent than Darwin thought. Since the 1970s, scientific opinion has come to accept that the uplift of the hills and the beginnings of their dissection began some 60 to 90 million years ago. When the Colorado River was just beginning to cut North America’s 1.5 kilometre-deep Grand Canyon six million years ago, the gorges of the Greater Blue Mountains were already old. With less uplift (the plateaus are lower), the Australian gorges are shallower than the Grand Canyon – although still spectacular at their maximum fall of about 900 metres. Nevertheless, they bear testimony to the remarkable effect that millions of years of small but continuous erosion can have.

The landscape diversity that has come from this erosion has resulted in a large range of ecological niches. From the dark, damp, ferny canyons to the high, dry plateaus, the biological diversity of the Greater Blue Mountains owes much to its geological evolution.

**Geological beginnings – convergent (active) margin tectonics**

The following account of the geological history of the region is necessarily brief and simplified. Many details remain the subject of vigorous debate.

From at least the Late Cambrian, when Australia was still part of the supercontinent of Gondwana, the east coast of the landmass appears to have been a convergent tectonic plate margin, now called the Lachlan Fold Belt (Veevers, 1984). A plate pushing from the east was forced beneath the ancient Australian landmass, creating a subduction zone with a volcanic arc. Over the subsequent 300 million years, the
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Canyon, Blue Mountains National Park. Photo I Brown
convergent margin jumped a number of times eastwards, gradually accreting more land onto continental Australia.

During the Siluro-Devonian, environments developed in which deposition could occur. There were shallow, marine regions, including carbonate reefs – which have now been transformed into the limestone of the Jenolan Caves. Volcanics, such as the Bindook Porphyry Complex in the southern part of the Blue Mountains National Park, also date from this time (Fergusson, 1980).

Following deformation of the Siluro-Devonian rocks, shallow marine and terrestrial sediments were laid down during the Late Devonian period. Subsequently, during the Carboniferous, there was a major uplift and a period of erosion before the deposition of the Sydney Basin sequence. The basal unconformity of the Sydney Basin is spectacularly exposed at Kanangra Walls, in the southern part of the nominated area. The geometry of the unconformity suggests that the surface on which the sediments of the Sydney basin were deposited may have had a relief of 600 metres in this area (Herbert, 1972). At this time, Australia was located close to the South Pole and the development of an ice sheet may have stopped sedimentation for a time. Retreat of the ice sheet had occurred towards the end of the Carboniferous and there is evidence of glacial activity in some of the oldest units of the Sydney Basin (Bembrick, 1980).

The Sydney Basin sedimentation may have been triggered by another eastwards jump of the convergent margin during the Late Carboniferous-Early Permian. The Sydney Basin appears to have been a foreland basin wedged between a volcanic island arc to the east and the more ancient continental landmass (the craton) to the west. It was fed with sediments from both those sources, each dominating at different periods in the history of the basin.

Marine sediments are found towards the base of the Sydney Basin sequence. When the sea gradually retreated, coal developed in the vast swamps and lakes that were left
Grand Column, Jenolan Caves. Photo C Holland. Jenolan Caves Reserve Trust
behind and this is now exposed as the Illawarra Coal Measures, interleaved with ash from ongoing volcanic eruptions (Conaghan, 1982; Cameron et al., 1982).

By the Late Permian, active volcanism in the island arc to the north-east had declined and sediments derived from the more ancient western continental and mass began to dominate. The boggy, coastal environments of this time, with their deciduous swamp forests of the giant fern-like plant *Glossopteris*, gave way to river systems and coniferous forests of *Voltziopsis* (Retallack, 1980).

The rocks that give the Blue Mountains their modern dramatic character, the sandstones of the Narrabeen Group and the Hawkesbury Sandstone, were deposited as river sediments in the Late Permian-Mid Triassic. The Narrabeen Group sandstones are volcanolithic and were derived from the now quiescent volcanic arc by southward flowing rivers. Later, quartz-rich sands from the ancient continental landmass to the south-west became dominant, carried into the foreland basin by a northward flowing river comparable in size to the modern Brahmaputra. These cratonic sands were to become the Hawkesbury Sandstone (Conaghan et al., 1982). The uppermost unit of the Sydney Basin sequence, the sandstones and shales of the Wianamatta Group, is largely preserved beneath the basalt caps of the higher peaks and on some isolated ridges in the eastern edge of the mountains.

**Uplift – divergent (passive) margin tectonics**

The next major event to affect the Sydney Basin signals a shift in the tectonic forces operating on the eastern seaboard. In the later Cretaceous, rifting began along the southern margin of what is now Australia. Antarctica and Australia, previously part of the supercontinent of Gondwanaland, gradually separated as Australia began its northward drive towards Asia. Rapid seafloor spreading also occurred in what is now
Top: Weathered sandstone, Capertee Gorge, Wollemi National Park. Photo I Brown
Bottom: Weathered sandstone, Erskine Ck, Blue Mountains National Park. Photo I Brown
the Tasman Sea, and the eastern seaboard entered a phase of divergent tectonics from about 100 to 60 million years ago, in contrast to the earlier convergent margin which existed in the Permo-Triassic (Veevers, 1984).

Divergent or passive margins are a major geological feature found in many parts of the world, including southern Africa, India and eastern South America. They commonly have a high plateau separated from coastal lowlands by a Great Escarpment. The escarpment of the Greater Blue Mountains is thus not merely the result of erosion, but is part of the Great Escarpment associated with the opening of the Tasman Sea, with uplift possibly beginning some 90 million years ago.

In the formation of a passive margin, the plateau is warped down to the coast. The Lapstone complex on the eastern flank of the Greater Blue Mountains is a feature of controversy which may be the result of such warping along an earlier line of weakness as the Cumberland Plain subsided more rapidly than the Blue Mountains.

The evolution of passive margins is currently a controversial topic, both on the world scene and on the New South Wales margin in particular. Until recently it was thought that before continents broke up there was a period of stretching, faulting and thinning, and after separation the edge would sag down (Ollier & Pain, 1997). However, there is alternative evidence that, rather than sagging, uplift towards the coast may occur (Brown et al., 1994; Gilchrist, 1995). Such uplift would require an offshore fault. Such a fault may exist as a continuation of the Hunter Thrust, running offshore and parallel to the coast.

The situation between the Blue Mountains and the coast is even more complicated because of extra faults and monoclines giving more scope for investigation. The New South Wales coast, in conjunction with the Greater Blue Mountains, is a world laboratory for the study of passive margins and much work is already underway.
Grose Valley, Blue Mountains National Park. Photo A J Morison
Consideration of the geological development of the Greater Blue Mountains is incomplete without discussing the evidence of volcanic activity. The Siluro-Devonian Bindook Porphyry Complex has already been mentioned. In addition, many Jurassic diatremes (volcanic necks) are known in the region (Crawford et al., 1980; Jones & Clark, 1991). The volcanoes may have signalled the start of Gondwana’s breakup. Since then, the diatremes have eroded to form circular depressions or amphitheatres, some of which are interesting features well-known to bushwalkers. More recent patches of Miocene basalt ranging in age from 14 to 18 million years are also found (Wellman & McDougall, 1974). They were originally lava flows, but now stand as the resistant caps to hills such as Mounts Wilson, Banks and Tomah. The source of the basalt is not known – as with many aspects of the geology of the Greater Blue Mountains, there is controversy over their emplacement and significance.

Dissection – the cutting of the gorges

The drainage pattern of the Greater Blue Mountains is anomalous and complicated. Valleys change from wide to narrow in puzzling ways, and old alluvium is found in strange positions. The Mountains have thus become a classic area for discussion about drainage pattern development, as well as landscape evolution generally.

Both early writers (Griffith Taylor, 1911) and modern ones (Ollier & Pain, 1994) believe that the major drainage pattern of the region was formed before warping of the old plateau, and that downwarping to the coast reversed the direction of previously inland-flowing rivers towards the coast. Other geomorphologists, such as Young (1978, 1989) and Bishop (1982, 1998), argue that drainage has remained essentially stable since Miocene times.
Waterfall, Govett’s Leap, Blue Mountains National Park. Photo I Brown
There is no longer any doubt that rivers were largely responsible for creating the valleys and gorges of the Greater Blue Mountains. How long the process took is still a matter of active debate. The presence of the Miocene basalts, mainly on the higher elevations, suggests that there may have been few valleys at the time of extrusion into which the basalt could flow. However, evidence from other areas suggests that erosion may have been well-advanced by the time the basalt was extruded. What is hard to dispute is the witness the Blue Mountains bear to the enormous impact that a combination of time, and relatively small river systems, together with other erosional forces such as wind and fire, can have on a landscape.

Features of note

The major valleys tend to have a characteristic profile: they are V-shaped or U-shaped and often capped with cliffs of orange sandstone in the main gorges and with a narrow V in the lower mountains. The sandstone of the cliffs is relatively resistant compared with the underlying shales, resulting in differential erosion. Thus, shallow plateau valleys may evolve into slot canyons, which in turn become the wide valleys of high relief once the overlying cap of sandstone has been cut through and the softer, faster-eroded shales exposed.

The cliffs and their waterfalls are the most spectacular features of the mountains. Most impressive is a line of cliffs, called the Cliff Wall by Cunningham (1996). This generally faces west, starting in the Broken Back Range of the Hunter Valley and running south, with many salients and rentrants, for about 280 kilometres. The Cliff Wall reaches its maximum sheer height at the edge of Kings Tableland just south of Wentworth Falls, where it is just less than 300 metres.
Mt Hay, Grose Valley. Photo I Brown
Other landscape features in the Greater Blue Mountains region are also of interest. Bottleneck valleys have a strange topography in which the walls and flanking cliffs are wide upstream and narrower downstream as the cliffs converge to form gorges. This is the reverse of normal valleys. The cause is downfolding of the resistant Hawkesbury Sandstone at the Lapstone Monocline. Upstream, the river has cut through the sandstone to the softer shale beneath, so erosion is great and a wide valley created. However, the descent of the river is not as steep as the dip of the Hawkesbury Sandstone, so that the river meets the sandstone walls downstream, resulting in the formation of gorges.

Still higher in the catchment, the headwaters of streams on the plateau have incised narrow slot canyons along joints in the Hawkesbury Sandstone. The slots, with their water-smoothed walls, can be hundreds of metres long but often only a few metres wide. They contain a micro-environment which stays cold, wet and dark during the hottest summer.

Jointing contributes to the formation of another landscape, popularly called pagoda country because of the shapes of the landforms. The pinnacles, slots, partly closed depressions, small caves and spectacular concretionary iron deposits of pagoda country are particularly well-developed in the Gardens of Stone National Park.

The hanging swamps are another unusual feature. The Hawkesbury Sandstone and sandstones of the Narrabeen Group have a relatively low permeability. As a consequence, shallow swamps frequently develop at seemingly anomalous locations on the plateau surface and provide a distinctive high altitude habitat. Veritable hanging gardens grow on some cliff ledges or almost vertical slopes. Also unexpected in this generally nutrient-poor area are the patches of rich soils associated with volcanic rock. Such surprising places greatly enhance the already diverse botanical and faunal composition of the Mountains.
Ironstone pagoda, Capertee Valley, Wollemi National Park. Photo I Brown
3.3 BIO-DIVERSITY

Biological diversity and ecological processes

Vegetation history of the Australian continent

The distinct modern flora of Australia, including that of the Greater Blue Mountains, evolved mainly during the Tertiary. This was when the Australasian plate finally separated from Antarctica and slowly drifted northward through a range of changing climatic belts. For about 30 million years the Australian biota evolved mostly in isolation from the biotas of other continental land masses.

The first records of Banksieae, Casuarinaceae-type and Xylomelum-type pollen occur during the Palaeocene (Martin, 1981), and these were possibly the ancestors of present-day xeromorphs. The first reliable fossil records of Myrtaceae from Australia also appear to be from the Palaeocene (Lange, 1982). Mesomorphic plant taxa that occupied the margins of rainforest, on the more nutrient-deficient soils, are believed to have given rise to scleromorphic forms (Johnson & Briggs, 1981).

The first reliable records of several characteristic Australian stocks in various families appeared in the Miocene. The family Myrtaceae was well represented at this stage of evolution, including the now widespread, dry-fruit ed genera Eucalyptus, Leptospermum, Baeckea and Darwinia. The Greater Blue Mountains area today contains 20 genera belonging to this family, comprising about 25% of the Australian total.

By the late Miocene, low-nutrient soils and drier climates over most of the continent would have favoured the spread of sclerophyll vegetation. During this time, the early Tertiary rainforest flora contracted to refuge areas such as the humid habitats in the eastern highlands. The dissected plateaus of the Sydney Basin, including the ranges of the Blue Mountains, would have provided topographic and climatic diversity.

The Pleistocene was characterised by relatively rapid oscillations in climate. During
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*Tea-tree and rough-barked apple, Wolgan Valley, Wollemi National Park. Photo I Brown*
the peaks of the glacial, vegetation formations were more typical of generally cooler and drier conditions than at present.

Many moisture-demanding species probably survived the last glacial maximum in protected environments within, or not far from, their present day ranges. With the amelioration in climate about 10,000 BP they would have expanded their ranges (Dodson, 1989). Because the Greater Blue Mountains would have provided refugia for plants during periods of extreme aridity and climatic stress, it was a likely centre of dispersal for some taxa (Beadle, 1981a, b).

During the Pleistocene, *Eucalyptus*, *Acacia* and other sclerophyll flora may have had increased opportunities for speciation due to periods of greater aridity, climatic seasonality and the impacts of increased fire frequency.

**Vegetation history of the Greater Blue Mountains**

The Greater Blue Mountains provide an outstanding example of the indigenous Australian flora and its Gondwanan origins. Taxa related to past Gondwanan connections include:

- the Wollemi pine (*Wollemia nobilis*), a genus in the Southern Hemisphere conifer family Araucariaceae
- the ancient plant groups *Lomatia*, *Dracophyllum* and *Podocarpus* the family Lauraceae, which is represented in the nominated area by the rainforest genera *Cinnamomum*, *Cryptocarya*, *Endiandra*, *Litsea* and *Neolitsea*, and the parasitic climber *Cassytha*
- the genus *Atkinsonia* in the Loranthaceae, the most primitive extant root parasitic genus in a family of great antiquity
- the Winteraceae, which is a very primitive angiosperm family, represented in the nominated area by species of *Tasmannia*. 
The flora

The eucalypts

Australia is the world’s most biologically unusual continent. Eucalypts are a major contributor to this uniqueness, with almost all the species being Australian endemics. Eucalypt-dominated forests, woodlands and heaths occupy most of the non-arid part of the continent. The group consists of more than 700 species, traditionally placed taxonomically in the genera *Angophora* (12 species) and *Eucalyptus* (the rest). The eucalypts as thus defined are thought to be a monophyletic group with two major evolutionary divisions (Ladiges, 1997). One of these lineages includes *Angophora* and a group of species that Hill and Johnson (1995) placed in a new genus, *Corymbia* (111 species). This new genus is yet to be widely accepted (Williams and Brooker, 1997). All species in *Eucalyptus*, *Angophora* and *Corymbia* are henceforth called eucalypts.

Eucalypts have many characteristics that make them the most globally unusual group of trees and shrubs (Kirkpatrick, 1987). These are briefly described below.

- The adult leaves of almost all eucalypts hang vertically and are arranged in clusters on the outside of the canopy. This geometry allows 40-60% of the incident solar radiation to penetrate the canopy (Nunez, 1985) and reach the understorey. Thus, in contrast to most trees in the world, eucalypts allow the development of a rich variety of understorey types, which can often respond to variations in climate and soils independently of the eucalypt species (Bowman and Kirkpatrick, 1984).

- Eucalypts have a remarkable array of characteristics connected with fire (Gill 1981, 1997). Adaptations that allow many eucalypts to survive fires include: the ability to re-sprout from buds held in a woody swelling (the lignotuber) in the ground; the ability to resprout from epicormic buds that lie quiescent...
Eucalypt flower. Photo AJ Morison
beneath the bark until exposed; the presence of bark that is thick and persistent, or deciduous and highly reflective, that protects adventitious buds from the heat of fire; the ability to root sucker. Most eucalypts are adapted to regenerate from seed after fire. Many species have woody capsules that remain on the tree for several years, protecting the seeds from death during fire, but which open, releasing seed, after fire. Adaptations that promote fire include: a high content of volatile oils in the leaves and litter; litter that breaks down extremely slowly; an open canopy; long strands of bark that hang from limbs after peeling and which can be carried alight for many kilometres to start new 'spot' fires well ahead of the fire front.

- Eucalypts flourish on a wide variety of soil types, including basaltic, calcareous and highly siliceous soils (Wardell-Johnson et al., 1997). They form forests of high biomass on soils of extreme nutritional poverty, often aided by mycorrhizal symbionts (Keith, 1997). This ability makes them globally unusual, as is the extreme nutritional poverty of most Australian soils.

- Eucalypts typically form monogeneric, but not monospecific, stands (Kirkpatrick, 1997). It is relatively common to find more than three eucalypt species in intimate mixture with no other genus sharing the dominant stratum. In some places more than ten eucalypt species share the forest canopy.

- Vegetation dominated by eucalypts, and eucalypts alone, extends over remarkable environmental gradients. For example, such vegetation extends from sea level into the lower alpine zone in southeastern Australia, involving a very large number of species. The phenomenon of monogeneric forests composed of large numbers of species in a single genus extending from the lowland tropics to the treeline is unique to Australia.
Left: Bushfire in sclerophyll forest, Yengo National Park. Photo I Brown
Right: Scribbly gum, Eucalyptus sclerophylla in snow. Photo I Brown
• The diversity of Eucalyptus is unrivalled in global genera consisting largely of trees. For example, Pinus contains only 210 species, compared to the more than 700 eucalypt species.

• Eucalypts are highly genetically flexible for a tree genus. The degree of expressed interlinking between species through hybridization and intergradation is globally outstanding. The high degree of density dependent mortality that occurs in eucalypt regeneration events leads to a fine adjustment of genotype to site. Combined with a high potential for gene exchange between sympatric species, the potential for evolutionary response to environmental change is extremely large. The fine adjustment of eucalypts to environment gives a large potential for allopatric speciation as distributions shift in response to environmental change.

• Thirty per cent of the 511 eucalypt species mapped by Chippendale and Wolf (1981) existed in widely separated patches (ie., had strongly disjunct distributions).

The Greater Blue Mountains offer the best single global example of the characteristics outlined above still existing in an extensive, natural landscape.

As a result of the diversity of geology and topography, the nominated area provides an exceptional range of habitats that is reflected in the diversity of eucalypt species and the communities they dominate. The eucalypts vary in morphology from small multi-stemmed shrubs (known as mallee) to towering single-stemmed trees. They have a wide diversity of understorey types, which are variably dominated by rainforest trees, scleromorphic trees, tall broad-leaved shrubs, tall scleromorphomorphic shrubs, heaths, sedges and grasses. The typical sequence from the shallow, nutrient-poor soils of the fire-prone sandstone plateaus to the deeper, more nutrient-rich soils of the less burned sheltered valleys is from heathy understoreys through shrubby understoreys to scleromorphic tree understoreys to rainforest understoreys.
Waratahs, Telopea speciosissima, Pierces Pass, Blue Mountains National Park. Photo I Brown
There are 90 taxa of eucalypts, comprising 13% of the global total. The Greater Blue Mountains have some of the highest local peaks in eucalypt species numbers anywhere. Indeed, the 65 eucalypt species recorded for the Katoomba 30’ x 30’ grid square is likely to be the highest in the world for an area of this size.

The Greater Blue Mountains are notable for their representation of all levels of eucalypt diversity. All three described genera (Eucalyptus, Angophora and Corymbia) are well represented. There are five species of Angophora occurring in the nominated area, comprising nearly 50% of described taxa. The genus Corymbia is represented by four out of seven sections with one species in each section. Eucalyptus subgenus Symphyomyrtus, particularly section Transversaria, is well represented in the nominated area. Eucalyptus subgenus Eucalyptus (‘Monocalyptus’) is represented by section Renantheria which includes the Stringybarks, Mahoganies, Peppermints, Ashes and Scribbly Gums. The Blue Mountains and surrounding plateaus are outstanding in their representation of this group.

The diverse representation of eucalypt genera can be related to both the geographical position and the diversity of habitats found within the nominated area. For example, past relationships and distributions can be inferred from the taxonomic affinities of local endemics. There are 12 taxa of Angophora, Eucalyptus and Corymbia considered to be endemic to the Blue Mountains and adjacent sandstone areas and occurring in the nominated area, eight of which are also rare or threatened. Eucalyptus squamosa, endemic to sandstone ridges in the Sydney district, is most closely related to an uncommon species in Queensland, and both share affinities with a large Western Australian group of Eucalyptus.

The sandstone plateau soils of the Greater Blue Mountains are some of the nutritionally poorest in the world. Their partial occupation by eucalypt forest is a good example of the ability of the genus to attain high biomass on poor soils.
Left: Bark of smooth – barked apple, Angophora costata. Photo I Brown
Right: Bark of scribbly gum, Eucalyptus sclerophylla. Photo I Brown
Some of the best examples of the process of allopatric speciation on continental land masses occur within the Blue Mountains and adjacent sandstone country. The species within Series Strictae (mallee ashes) and Haemastomae (scribbly gums) exemplify fine-scale allopatric speciation. Each essentially has mutually exclusive distributions in different parts of the area, apparently having differentiated morphologically in isolation from one another in response to the persistent habitat islands provided by sandstone plateaus isolated by deep valleys.

The Greater Blue Mountains are largely covered by communities dominated by eucalypts and are one of the most fire-prone areas in the world. It is therefore not surprising that, with the sole exception of root suckering, all the adaptations that eucalypts evidence in relation to fire are exceedingly well represented.

As a result of its outstanding diversity, the area exhibits the full range of dynamic interactions between eucalypts, understorey, environment and fire. These range from tall forests in which eucalypts form a dynamic boundary with co-existing rainforest, to communities in which shrub-sized mallee eucalypts co-exist with rich and equally flammable heaths on frequently-burned sandstone plateaus.

**Scleromorphic species**

Scleromorphic plants are those with a characteristic set of features: small, evergreen, tough leaves, thick cuticles, hairs, leaf rolling, succulent leaves and/or stems, sunken stomates and low transpiration rates. The leaves of scleromorphs are often stiff and pointed, containing a high proportion of sclerenchyma (increased fibre to protein ratio) and occasionally silica in the epidermal walls (Beadle, 1981a, b). Soft-leaved xeromorphs frequently grow with the sclerophylls. Their leaves are less hard, but they usually possess thick cuticles, hairs and ‘water storage’ tissue.
Regrowth after bushfire, Blue Mountains National Park. Photo I Brown
The evolution of scleromorphy is thought to have been in response to nutrient-poor soils. This is why scleromorphic plants feature so prominently in much of Australia’s vegetation and are said to attain their globally outstanding expression on this nutrient-poor continent. Beadle (1981b) recognised the Sydney-Blue Mountains district as one of two centres of scleromorphic diversification within Australia, the other being south-west Western Australia. Both centres exhibit long histories of independent evolution, although barriers to plant migration were more intermittent in the east. The floras of south-west Australia and south-east Australia have been separated by climatic and other environmental barriers since the late Tertiary.

The inherently infertile plateau soils of the Greater Blue Mountains have long been known to have a distinctive sclerophyllous vegetation (Hamilton, 1912, 1923, 1932; Osborn, 1930; Pidgeon, 1937). The theory that xeromorphy and scleromorphy evolved primarily in response to poor soil fertility, particularly low phosphorus concentrations, within rainforests (rather than as an adaptation to an arid climate) is supported by the widespread occurrence of scleromorphs in wetter areas, for example in the Sydney district on low-fertility sands. Maximum sclerophyll development is attained in soils that are sandy, with minimal clay content and of acid reaction (pH 4.5-6.5). The nutrient status of such soil is very low, with phosphorus values of 30-70 ppm recorded for the types of soils that are most common in the Blue Mountains (Beadle, 1981a). In comparison, phosphorus values for tall open-forest are 100-150 ppm and for rainforest 200-1000+ ppm.

Scleromorphy occurs in about 20 plant families, notably Myrtaceae, Proteaceae and Epacridaceae (Beadle, 1981b). Within the nominated area these families are all well represented, as well as the Fabaceae (including subfamilies Faboideae and Mimosoideae), Dilleniaceae (Hibbertia), Rutaceae (Boronia) and Euphorbiaceae (Tribe Stenolobeae).
The family Myrtaceae, particularly the dry-fruited capsular genera, is prominent in Australian sclerophyll vegetation. Within the Greater Blue Mountains the Myrtaceae contain the second highest number of species within a plant family (156). These largely belong to dry-fruited groups, including *Leptospermum*, *Baeckea*, *Darwinia* and *Eucalyptus*.

**Ant-adapted plants**

Nearly all genera of ant-dispersed plants are Australian endemics of dry sclerophyll eucalypt forest, woodland or heathland. While the seeds of eucalypts lack specialised structures for ant dispersal, ants transport and consume these in great numbers (O’Dowd & Gill, 1984; Wellington & Noble, 1985). The delayed release of eucalypt seeds undoubtedly contributes to a stable food supply for ants over many years.

The seeds of other genera within the eucalypt forests and associated heathlands display a unique combination of characteristics that suggest a long history of co-evolution of ant-plant interactions in Australia.

**Diversity and characteristics of the flora as a whole**

The flora of the nominated area is very diverse at all taxonomic levels with at least 152 families, 484 genera and some 1500 species.

The plant families with the highest number of species recorded from the nominated area are Fabaceae (149), Myrtaceae (150), Orchidaceae (77), Poaceae (57), Asteraceae (69), Proteaceae (77) and Cyperaceae (43). The largest genera in the nominated area are Eucalyptus and related genera (90 species) and Acacia (64 species).

The importance of the Greater Blue Mountains for the representation of eucalypts has been described above. They also have a high degree of significance for the representation of Australia’s other typical woody genus, *Acacia*. *Acacia* is the largest genus of vascular plant species in Australia, with over 900 species that are mostly
Clockwise from top left: Sawtooth banksia, Banksia serrata; Sunshine wattle, Acacia terminalis; Dagger hakea, Hakea teretifolia; Waratah, Telopea speciosissima. Photos I Brown
endemic to Australia, out of 1200 species world-wide. The majority of the species in Australia (c.99%) belong to subgenus *Phyllodineae* (syn. *Heterophyllum*) which is largely endemic to Australia (Ross, 1981, Maslin & Pedley, 1988).

The nominated area contains a total of 64 species, located within a centre of high Acacia species diversity. The two principal centres of species richness are south-west Western Australia and the Great Dividing Range south of the Tropic of Capricorn in eastern Australia (Maslin & Hnatiuk, 1987; Hnatiuk & Maslin, 1988). The node of highest diversity in eastern Australia (with over 50 species in a grid) encompasses the Greater Blue Mountains and adjacent sandstone plateaus.

The main area of *Acacia* species richness is described by Maslin & Pedley (1988) as the Central and South Coast area of New South Wales. This centre coincides largely with the Greater Blue Mountains area and of the 46 known taxa, 18 occur, representing 39% of the global total.

**Species diversity**

Some of the highest species-richness values in the world have been recorded from particular vegetation communities on sandstone country adjacent to the nominated area. (It is likely that similar values would exist within the area, but detailed research has not yet taken place.) In the upland swamps of the Woronora Plateau, species richness was compared within floristic groups at scales of 1m², 10m² and 15m². High values of species richness were recorded for open-forest, woodland and heathland with mean values of 57-66 for an area 400m² (Keith, 1994). A heath community occurring on relatively dry sites within the swamps recorded up to 70 vascular plant species in 15m², a significantly high value relative to other shrub and sedge communities in temperate latitudes, both within Australia and internationally (Keith & Myerscough, 1993). Species-richness values at the 1-15m² scales were higher than any other
published record, including data for Kwongan (in Western Australia) and Fynbos (in South Africa), which are renowned for their high species diversity (George et al., 1979; Cowling, 1983). Such high species richness values can be related to the low nutrient soils, the open vegetation structure and disturbance by fire.

There are insufficient data to assess the degree of species turnover along ecological and geographical gradients within the nominated area. However, observations and existing studies indicate that this is a significant component of the regional species diversity. Habitat diversity is a major factor determining the extent of species turnover (Cowling et al., 1992). The outstanding diversity of habitats and plant communities in sandstone areas adjacent to the nominated area is well documented (Keith & Myerscough, 1993; Keith, 1994). In studies on perched headwater valleys in the Blue Mountains, Holland et al. (1992) identified contrasting woodland, sedgeland and shrubby heath communities related to a drainage gradient within the valley.

Larger scale variations in plant species composition, along geographical gradients, have also been widely documented within the Greater Blue Mountains and adjacent sandstone areas (Benson & Keith, 1990; Burrough et al., 1977).

**Threatened species**

There are 127 plant taxa listed as rare or threatened (Briggs & Leigh, 1996) in the Blue Mountains. The majority of these taxa are associated with the sclerophyll communities of the plateaus with about 65% found in open-forest, woodland and heath. Many of the taxa recorded for these drier communities are restricted to sites with skeletal soils on steep, rocky cliffs or rock exposures. Heathland and mesa-tops are the most significant habitats locally for rare plant taxa. Moist habitats in rainforest or tall open-forest, including damp sandstone cliffs near waterfalls and swamps, are also important.
Warm temperate rainforest, Bell Creek, Blue Mountains National Park. Photo I Brown
Australia is recognised as a continental centre of plant endemism with a national level of 85% (Bond & Goldblatt, 1984). Within Australia, high levels of local endemism are normally associated with tropical rainforest systems (Wet Tropics of Queensland 37%, East Coast Rainforest Parks 12%). The predominantly sclerophyll communities of the nominated area, however, show a relatively high level of Australian endemism which compares well with other World Heritage areas on the Australian mainland.

A close relationship between plant endemism and rarity is evident within the nominated area. Over 50% of the plant taxa endemic to the Greater Blue Mountains are considered to be nationally rare or threatened. High levels of endemism are recognised at and below the species level with 114 taxa occurring exclusively or predominantly within the nominated area, comprising 8% of the total flora. The endemic taxa are predominantly associated with the fire-prone sclerophyll flora of the infertile sandstone plateaus. The well-defined plateaus of the Sydney Basin, with a unique combination of environmental conditions, may be viewed as ‘island’ habitats favourable to processes of speciation and endemism.

Several endemic and rare or threatened taxa in the upper Blue Mountains are restricted to the highly specialised habitat of damp crevices and wet rock faces, within the rainforest and tall open-forest. *Acrophyllum australe* belongs to a monotypic genus in the small Gondwanan rainforest family Cunoniaceae, and is restricted to sheltered gullies in the Greater Blue Mountains, growing below waterfalls and drip zones of rock overhangs and cliff faces. *Microstrobus fitzgeraldii* is only known from the Wentworth Falls-Katoomba district, restricted specifically to wet rocks on the eastern side of waterfalls within the range of spray carried by westerly winds. *Sprengelia monticola*, a diffuse or procumbent shrub, also grows here on wet rock faces and ledges or cliff bases on sandstone.
Clockwise from top left: Microstrobus fitzgeraldii, Wentworth Falls and Leura Cascades. Photos W Jones
Mesic sites of rainforest and tall open-forest also provide favourable conditions for non-vascular plants, particularly bryophytes (mosses and liverworts). The locally endemic liverwort *Haplomitrium intermedium*, for example, is also restricted to cliff faces with a constant supply of water. The discovery of this species comprised the first Australian record of a member of the Order Calobryales and filled a significant gap in its known global distribution (Berrie, 1962). There are 346 bryophyte taxa recorded for the Blue Mountains and adjacent areas.

Several endemic, rare and endangered taxa are restricted to upland swamps in the nominated area. For example, the rare grass species *Notochloe microdon* occurs in higher altitude swamps of the Greater Blue Mountains. Upland sites may represent important refugia during periods of climatic change (Benson & Keith, 1990).

Within the Greater Blue Mountains some 65% of rare and endangered taxa and a similarly high representation of endemic taxa occur in the fire-prone, dry sclerophyll communities. A high diversity of sclerophyll communities and habitats are found ranging from plateau tops, ridges, exposed rocks and cliffs to rocky slopes and more sheltered sites along gullies. Rocky habitats are often exposed to extreme climatic conditions on the infertile sandstone plateaus and are particularly significant for both endemic and rare, threatened and endangered species. A concentration of endemic and rare taxa are associated with dry, exposed cliffs and rock exposures. Species of conservation significance restricted to such sites include *Euphrasia bowdeniae*, *Leptospermum blakelyi*, *Eriostemon obovalis*, *Phebalium lachnaeoides* and *Parahebe lithophila*. Of the eight eucalypt taxa listed as rare and threatened within the nominated area, the majority are associated with dry sclerophyll communities. A significant number of locally endemic taxa are mallee species growing in skeletal soils on sandstone in exposed sites, including *Eucalyptus burgessiana*, *E. laophila* and *E. apiculata*.
Swamp near Point Pilcher, Blue Mountains National Park. Photo I Brown
The highest concentration of endemic and rare or threatened taxa is found in the upper Blue Mountains in the Katoomba area. Secondary concentrations are scattered throughout the nominated area in Wollemi and Yengo National Parks in the north. Within the Katoomba district the most significant area is along the escarpment from Kings Tableland, through Wentworth Falls, Leura and Katoomba to Narrowneck Peninsula.

**Plant communities**

Over 70 plant communities have been recorded for the nominated area ranging from rainforest, tall open-forest and swamps in wetter sites through a multitude of open-forest and woodland variants to scrub and heath in drier, exposed conditions. The most diverse vegetation types are the open-forest and woodland units, almost all dominated by eucalypts, with 56 communities. The mallee, scrub, heath and sedgeland communities, many of which are dominated by eucalypts, extensively intergrade within the area. In combination they total 13 communities, comprising a significant component of the vegetation. The eucalypt-free communities are usually embedded within a sea of eucalypt forest and woodland. Despite a distribution restricted to the most moist and fertile sites in the region, a diverse assemblage of 18 rainforest communities has been recorded (James, 1994), representing seven alliances and 14 suballiances of subtropical, dry, warm-temperate and cool-temperate rainforest. However, these rainforest communities are generally defined by the absences of species found more widely in the formation. Approximately half of the plant communities have restricted distributions and are unique to the region.

The distribution of rainforest and tall open-forest communities is particularly closely related to the occurrence of the more fertile soils, derived from igneous rock types. Patches of warm-temperate rainforest dominated by *Doryphora sassafras* and
Heathland and scribbly gums, Eucalyptus sclerophylla, Mt Hay Range, Blue Mountains National Park. Photo I Brown
Quintinia sieberi occur on high-altitude basalt caps. Subtropical rainforest occurs on basaltic remnants at Green Scrub (Wollemi National Park) with Doryphora sassafras, Ficus species and Toona ciliata as dominant species. On Mt Yengo, a drier form of subtropical rainforest is found with Dendrocnide excelsa, Toona ciliata and Claoxylon australis.

Sandstone communities with restricted distributions include Wingecarribee Woodland limited to the upper reaches of the Wingecarribee Valley, Wanganderry Ridgetop Woodland occurring between Nattai and Wanganderry Creek and Douglas Scarp Woodland restricted to outcropping Shoalhaven Group sandstones and siltstones in the Lake Burragorang district.

The main rivers in the western and central regions of the nominated area have cut through the Hawkesbury and Narrabeen sandstone to expose the softer Permian Illawarra Coal Measures, Shoalhaven and Devonian-Lambie Groups below. Many distinct poorly-reserved plant communities are associated with these different geological types.

On a larger scale the Bindook Porphyry complex supports a ‘Porphyry Woodland’ dominated by Eucalyptus albens, E. moluccana and E. melliodora. As a result of extensive past clearing and grazing, only minimal areas have survived, in various stages of regeneration. This community is conserved on the margins of Nattai National Park. The peak of Mt Jellore, in the Burragorang district, is of significance for its unusual low woodland of Allocasuarina verticillata and Eucalyptus blaxlandii which contains several species of botanical significance. This area is included within the Nattai National Park.

The extent of Wianamatta shale in the nominated area is limited to remnants on ridges in the lower Blue Mountains, in southern Wollemi National Park and in the Nattai area. Several distinct communities, contrasting with the surrounding sandstone
Red Cedar, Toona australis, Kanangra Gorge, Kanangra-Boyd National Park. Photo I Brown
vegetation, have developed on these shale remnants which weather to produce deep, well-drained clay soils.

There are several different communities recognised on alluvial soils within the region of the Greater Blue Mountains. Plant communities of particular conservation significance are the Camden White Gum Forest, the Coxs River Swamps and the Mellong Swamp Woodlands of Yengo and Wollemi National Parks.

The Fauna

Vertebrates
The Greater Blue Mountains and surrounding plateaus provide habitat for a wide variety of mammals, birds, amphibians and reptiles. The faunal diversity strongly reflects the floristic and structural diversity of the sclerophyll vegetation. Approximately 400 vertebrate species have been recorded, including one reptile endemic to the area.

Fifty-two native and 13 introduced species of mammals have been recorded from the area. All native species are endemic to Australia, and include such Australian ‘icons’ as koalas, kangaroos and wombats.

Birds are the most prominent and diverse component of the vertebrate fauna of the Greater Blue Mountains. Some 265 native and 10 introduced species of birds have been recorded in the nominated area, comprising approximately one third of the total number of species found in Australia. Ford (1985) noted that the highest concentration of honeyeaters in Australia is found on the east coast and tablelands of New South Wales. Twenty-five species of honeyeaters have been recorded within the nominated area, approximately one third of the Australian total.

Although the Greater Blue Mountains do not possess the reptile diversity characteristic of arid regions of Australia, a wide variety of reptiles has been recorded,
Clockwise from top left: Gang-gang cockatoo. Photo I Brown; Sulphur crested cockatoo. Photo D Watts/Nature Focus; Lyrebird. Photo D Watts/Nature Focus
including two tortoises and more than 60 lizard and snake species. One species is endemic and two are largely restricted to the area.

More than 30 species of frogs are found in the Greater Blue Mountains area. Relatively few species are found on the upper plateaus (Smith & Smith, 1990), with the majority occurring in the lower Blue Mountains. Frogs are predominantly found in the swamp communities. *Litoria littlejohni* and two other species have significant proportions of their known distributions occurring within the Greater Blue Mountains.

Changes in the vertebrate fauna of the area during the late Quaternary have been deduced from owl pellets deposited in Nettle Cave (Morris *et al.*, 1997). These include the apparent abrupt extinction of *Burramys parvus* between 15,000 and 14,000 BP.

**Invertebrates**

The taxonomy of invertebrates and knowledge of their distribution is limited and fragmentary within the Greater Blue Mountains area. Studies to date indicate that diversity is generally high in sclerophyll communities (Taylor *et al.*, 1993; New, 1988) and that the Blue Mountains contain a diverse and rich invertebrate fauna, much of which is undescribed. Surveys on the Boyd Plateau recorded a high diversity of invertebrates, including several new genera of Slater and the Hairy Cicada (*Tettigarcta crinita*) (Mosley, 1989).

The butterflies and moths (Order Lepidoptera) are a particularly diverse group within the nominated area. It is estimated that 110-120 species of butterflies and 4,000 species of moths are found in the Greater Blue Mountains (Edwards pers. comm.). Rodd (1987a, 1987b) provided the most detailed listing, recording 59 species of butterflies and 160 species of moths for the Mount Tomah area alone. There is also a diverse range of dragonflies and damselflies (Order Odonata) in the nominated area (Theischinger pers. comm.).
Bottom: Photo I Brown.
Rainforest communities are rich in invertebrates, often including many ‘primitive’ forms representative of the Gondwanan fauna, and of considerable scientific interest. The Phylum Onychophora, for example, is particularly significant because it is believed to represent the ‘missing link’ between annelids (earthworms, etc.) and arthropods (insects, etc.) and bears striking similarities, in external features, to fossil specimens. Tait (pers. comm.) notes that there are at least five species within the Blue Mountains out of less than two hundred found in the world. Also of evolutionary significance are the glowworms, particularly the primitive genus *Arachnocampa*. *A. richardsae* is a predator species which traps its prey in hanging mucilaginous threads and the larvae is ‘self-luminescent’. The type locality for this species is the Glowworm Tunnel, near Newnes (Harrison, 1966) which has become a tourist attraction within Wollemi National Park.

Also of significance within the area is the Family Gradunglidae (ground-dwelling spiders). A high proportion of this family is restricted to the east coast of Australia, and it is particularly well represented in the Greater Blue Mountains (Grey pers. comm.).

The invertebrate fauna of the Jenolan Caves is one of the richest in temperate Australia, its 67 taxa rivalling Exit Cave in Tasmania (73 taxa), and including syncarid and phreatoicidean ‘living fossils’ (Eberhard and Spate, 1995).

**Threatened animal species**

Of the species of vertebrates recorded for the nominated area, approximately 10% are listed as rare or threatened. These species of conservation significance are predominantly birds and mammals. There are six species which have been historically recorded within the nominated area, but for which no recent records exist. A further five species are considered extinct from the area, including three species of Bettong and the Eastern Quoll (*Dasyurus viverrinus*). There are 12 rare, vulnerable or
Cicadas. Photo I Brown
threatened mammals within the area. These include the Spotted-tailed Quoll (*Dasyurus maculatus*), Koala (*Phascolarctos cinereus*), Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*), Long-nosed Potoroo (*Potorous tridactylus*) and the Brush-tailed Rock Wallaby (*Petrogale penicillata*). Seven of the endangered mammals are bats. There are 15 species of birds found in the nominated area listed as rare or threatened. Three reptiles that occur in the Greater Blue Mountains are considered endangered.

The Blue Mountains Water Skink (*Eulamprus leuraensis*) is a rare, endemic species that is restricted to unprotected swamp communities of the Greater Blue Mountains. LeBreton (1992) recorded this species at Wentworth Falls, Leura and the Newnes Plateau. The Broad-headed Snake (*Hoplocephalus bungaroides*), is listed as threatened and is largely confined to the Hawkesbury Sandstone formation. Smith & Smith (1990) note a rare, undescribed species of tortoise, the Nepean River Tortoise (*Emydura* sp. nov.) which is only known from the Nepean River drainage basin (Cameron pers. comm.). Several species of amphibians found in the nominated area are listed as threatened, rare or vulnerable. These include the threatened Green & Golden Bell Frog (*Litoria aurea*) which has been recorded from the Upper Colo (Smith & Smith, 1990).

By contrast to the relatively detailed knowledge of threatened vertebrate species, documentation of the threatened, rare and vulnerable invertebrates of the nominated area is a difficult task. It is hampered by fragmented research, a large number of undescribed species and a lack of distributional and demographic information. Yen & Butcher (1994), in a preliminary listing, note 12 invertebrate species of conservation significance found in the Greater Blue Mountains. An additional 25 species have been considered significant by other researchers.
3. DESCRIPTION

Top: Brush-tailed rock-wallaby, Petrogale penicillata. Photo D Watts/Nature Focus
Bottom: Skink, Eulamprus leucaenas. Photo K Griffiths/Nature Focus
Conclusion

The area of the Greater Blue Mountains exhibits extremely high levels of plant biodiversity – it may well contain some of the highest values in the world – is an outstanding example of temperate eucalypt-dominated forest and woodland, contains many locally endemic as well as Australian endemic species, and is also rich in the invertebrate taxa that have been studied so far. Many species are significant in terms of the evolution of southern hemisphere plant taxa and communities. It amply fulfils the grounds for listing under Criteria 44 (a)(ii) and (iv).
Forest of Blue Mountains ash, *Eucalyptus ovata*, Mt Wilson, Blue Mountains National Park. Photo I Browam
3.4 NATURAL BEAUTY

The dissected sandstone plateaus known as the Greater Blue Mountains are, on the whole, well named. They are GREAT in their scale of a million hectares and in their presence, offering to the viewer a perception of massive vastness and, to the intrepid, the aesthetic qualities of wilderness and natural integrity. A more subtle form of GREAT is the sense of age that the worn landscape conveys.

...the mountain terminates in abrupt precipices of immense depth; at the bottom of which is seen a glen as romantically beautiful as can be imagined...
Macquarie, 1810-22

They are also evocatively BLUE, varying with time and season from pastels to indigo. The blue is not only the effect of distance but is also caused by the mountains’ characteristic blue haze. Their eucalypt-dominated vegetation disperses fine drops of volatile oil into the atmosphere. The oil drops increase the risk of fire, perfume the air and scatter, with great visual effect, the blue light rays of the spectrum.

Go inland from any part of the coast of New South Wales and it will not be long before the blue bulk of the eastern highlands stands up to bar your way... along the south-eastern edge where most of us live, we spend our days almost in sight of that great crescent of tableland, escarpment and gorge; it shapes our perceptions of the country...
Prineas, 1997
Grose Valley, western escarpment. Photo AJ Morison
The Greater Blue Mountains are, however, not exactly MOUNTAINS. They are essentially a series of deeply incised sandstone tablelands, rising above the coastal plain. This simple description fails to convey the qualities that have made the area exceptional. There are no lofty peaks in the alpine sense, but their grandeur arises from massive cliffs, valleys and gorges giving rise to spectacularly eroded landforms, simultaneously softened by its cover of rounded eucalypts.

...not in impressive heights, but in profound depths lies the chief claim of the Blue Mountains scenery. Magnificent canyons and precipitous ravines break the monotony of a summit but faintly relieved by solitary masses above the general level of erosion.

Carne, 1908

Diversity of country: Superlative natural phenomena

The Mountains cradle the city of Sydney on its western margin, and are a gentle, but defining, feature of the city limits. Distinguished by their horizontal form, physical expanse and atmospheric range of the colour blue, they form the backdrop to Sydney and were for a while a barrier to European colonisation of the inland.

In contrast to much of inland Australia, where landscape changes gradually over vast distances, the nominated landscape is highly diverse. Water and wind have sculpted the sandstone massif into dramatic features.

To the north, in Wollemi and Yengo National Parks, the plateau is dissected in a convoluted pattern to form a maze of ridges and valleys with sandy floors, modest gorges, canyons and grand sandstone cliffs. Part is relatively dry sandstone country, cut through by the Colo, Capertee, Wolgan, Wollemi and Macdonald rivers and their tributaries. Basalt caps form prominent mounts above the plateau horizon, while
Three Sisters, Blue Mountains National Park. Photo AJ Morison
volcanic cavities are scattered over the north-west quarter. The Gardens of Stone National Park displays the distinctive pagoda rock formations.

At the centre of the nominated area lie the upper and lower Blue Mountains, defined by the geological formations of the Narrabeen and Hawkesbury sandstone series respectively. The upper has a relatively large scale dissection, with wide bottlenecked valleys formed by the erosive force of the Grose and Coxs rivers. In the lower Blue Mountains there are undulating plateaus and platforms, dramatic waterfalls and cascades, cliffs, solitary rock outcrops, slot canyons, scree slopes, wet gullies, undulating valley floors, labyrinthine ridges and basalt caps. Accessible sentinel rocks have become physical and visual focal points for sightseers – the Three Sisters, Pulpit and Orphan Rocks and the Ruined Castle.

To the south, in the Kanangra-Boyd and Nattai National Parks, the plateau is also dissected by rivers and tributaries – the Nattai, Wollondilly and Coxs. Here there are deep gorges, broken quartzite ridges, upland peaks and sandstone plateaus with remnant basalt mounts. Limestone from coral laid down in the Silurian period has created a series of outstanding limestone caves, of which Jenolan Caves, in the nominated area, is the best known. The complexity, size and beauty of these caves were recognised early and protected by reservation, in 1866.

In the nineteenth century, underground caves were considered the most sublime of places because only there could Nature’s darkness be experienced utterly and completely. The caves at Jenolan provided a sublime experience as visitors considered the natural forces required to produce the unlimited variety of limestone formations, from the most delicate and intricate to the most overbearing and majestic.

Horne, 1994
Indian Canopy, Jenolan Caves. Photo E Holland. Jenolan Caves Reserve Trust
Water, atmosphere, plants and wildlife: Natural beauty

With rainfall levels higher than in surrounding areas, the Greater Blue Mountains abound in dramatic patterns of water flow, from rivers and creeks to waterfalls, hanging swamps, lakes and ponds. The scenery of deep, fern-lined waterfalls and cascades has always been popular, being noted by visitors and emphasised in early tourist literature. Waterfalls were often the destination of tracks – as a source of water for drinking, play and scenic appreciation. Commentators referred to the sounds of water. In the New South Wales Railway Guide of 1884, it was noted that:

...mountain rivulets dash themselves into a cylindrical abyss whose falling waters resound in your ears like an everlasting sigh...

More recently,

*The rock so sheer and high and mossed*
*seems a tundra turned on end,*
*a ribbon of silver water*
*blowing forever across its flank.*

‘Govett’s Leap Pass’, O’Connor, 1988

The appearance of landforms and water patterns changes constantly in the Greater Blue Mountains, as light, clouds and mist respond to sharp weather changes. The colour of rocks, trees and scrub is transformed in moments. As explained, the Mountains acquired their name from the blue haze that softens their layered silhouettes and defines their depths. The light-scattering eucalypt oils also create the
Govett’s Leap Falls, Grose Valley, Blue Mountains National Park. Photo I Brown
unique scents that pervade the Australian bush. The sense of space and wide, dramatic skies is emphasised by recurring mists and lightning, the layered horizon of hills, edged by sharply exposed rock strata, and the cries of parrots and currawongs flying across the great valleys.

Complementing the diverse landscape and its weather changes is the variety of vegetative response in trees, shrubs, flowers and grasses. These range from closed forests in moist gullies or valley floors to mosaics of heath, hanging swamps, mallee scrub, woodland and open forest on the undulating plateau. On the valley slopes, the flora responds differently to each aspect and soil type, with a correspondingly rich variety in texture, colour and perfume –

...the spectacular early spring flowers of the sclerophyll vegetation are comparable to the internationally recognised wildflower exhibitions of south-west Western Australia...

James, 1994

This fine-grained detail overlays the entire landscape, offering an extraordinary range of habitats for fauna, the most visible of which are the wealth of multi-coloured birds.

Aesthetic importance

Wilderness cannot be defined objectively.

Yi Fu Tuan, 1974, quoted in Primeas, 1997

Much of the nominated area is aptly described as wilderness. It includes a series of large natural areas, remote and hard of access, where the influence of modern,
industrial society is minimal and a sense of harmony with the environment may be achieved.

The aesthetic quality of wilderness is one of the most significant in the Greater Blue Mountains. It is sought for inherent spiritual satisfaction, much as is artistic beauty; in this case through isolation, solitude and appreciation of the integrity and enormity of nature and of its ability to protect, in its deepest recesses, ancient remnant species.

The natural beauty and aesthetic importance of the Greater Blue Mountains lie also in a multitude of ephemeral attributes – harmony, contrast and diversity; colour, changing light and shadow of sun, moon and stars; mist, cloud, snow, rain, lightning, thunder and wind; birdsong and flowing waters. These qualities extend the natural beauty as strongly as the underlying bio-physical forces. They are described –

*The shadows of the clouds creep in masses of indigo across the great gulfs and the sun lights up the bright cliffs, which are streaked red and yellow with stains of iron. Little niches in the walls are green with shrubs and ferns, and on the wider ledges are clumps of trees...cascades leap to the awful abyss in a veil of spray.*

Lawson, in Coghlan, 1903

The riot of colour is confirmed in Myles Dunphy’s description of his first bushwalking experience of the Blue Mountains, in 1910:

*The cliffs shone out in gold, reflecting the glory of the setting sun. They reached in the distance as far as the eye could see, gradually shading into all the different tones of violet and heliotrope. Down in the valley, 2000 feet below, everything was in shadow – that deep ultramarine hue from which the Blue Mountains derive their name.*
Artistic response

How indigenous Australians, who occupied the mountains for thousands of years, perceived them is not known in any detail, but clearly the area and its biota nourished and sustained their existence. They responded with images worked directly onto the surface features around them – in engravings, carvings, drawings, paintings and stencils. The known works are described at 3.5 Cultural associations.

The Greater Blue Mountains were depicted as early as the late 18th and early 19th centuries by European artists accompanying exploration parties and attempting to keep a topographic and botanical record of the land traversed. Most of these landscape paintings were horizontal compositions, emphasising the broad sweep of the terrain. The subject would often include a waterfall and suggest the depth and atmosphere of the adjacent valleys.

Wild places, as a sublime or romantic subject, were celebrated in the visual arts throughout the 19th century and the Greater Blue Mountains offered a splendid range of subjects. The recent exhibition of New Worlds From Old. 19th century Australian and American Landscapes (National Gallery of Australia, Canberra 1998) explored, through 100 of the best landscape paintings ever produced in Australia and America, how artists steeped in old world traditions reacted when confronted by landscapes of the new world. Prominently displayed was Eugene von Guerard’s Weatherboard [Wentworth] Falls, 1863.

In the later 19th century, photography was used to promote wilderness scenery, to stimulate tourism and to defend the unique character of the Australian bush. Towards the end of the century, photographed scenes appeared on postcards, with views from the most popular destinations. The recent novel The Service of Clouds by a prize winning young author, is based on the life of one such inspired photographer of the Blue
Weatherboard Falls, William Piguenit. Dixson Gallery, State Library of New South Wales
Mountains, Harry Phillips (Falconer, 1997). Now, in the latter half of this century, photographs depict the beauty of the wilderness landscape, out of reach of the visitor. Outstanding images of the extraordinary beauty of the Greater Blue Mountains have served to evoke and promote wilderness concepts.

The artistic response to the landscape has been prolific and has continued to be so throughout the 20th century. Works include drawings, paintings, etchings, woodcuts, ceramics, photography, verse, literature and music. Conrad Martens, Arthur Streeton, Margaret Preston are but three of the prominent national artists who have been inspired to interpret the qualities of the Greater Blue Mountains, while reflecting in their work the changing perceptions of a pioneering society adapting to a new environment.
Top: Jamieson Valley, NSW looking towards King’s Tableland, Conrad Martens. Private Collection. Middle: Blue Mountains Theme c1941, Margaret Preston. Shepparton Art Gallery. Bottom: Study no.1 from the ‘Rock’, 100m west towards Katoomba, Peter Cooley. Private Collection
3.5 CULTURAL ASSOCIATIONS

Cultural associations with the natural reserves of the Greater Blue Mountains are exceptionally strong and longstanding. The following description provides a brief social history of the area. It is not a formal history of the British colony but rather of this place itself, considering its occupation and custodianship by the first indigenous inhabitants, their cultural encounters with the colonists, the 19th century spread of settlement around the edges of the nominated area and the strong growth of concern to conserve the natural condition of the dissected plateaus and valleys of the Greater Blue Mountains.

Next, the wealth of Aboriginal rock art of the area is described in some detail. It derives from an archaeological assessment of pre-contact traditions and artistic works and an analysis of the art itself, with its exceptional juxtaposition of open engravings and sheltered art in a range of media, which may well be of semiotic significance. This is the first of the two tangible associations, which establish the direct link between culture and nature in this wild place.

The story of human attraction to, and relation with, the natural attributes of the upland area continues onto the conservation history of the 19th and early 20th century. This begins with the health-based movement, extends to the bushwalkers ‘caring for country’ and moves onto the effective conservation movement, from the 1960s, leading to statutory protection over large areas and the declaration of vast wilderness zones, capable of offering a sense of challenge and solitude to those venturing into them. The walking track network from these eras of concern for the landscape is the second identified tangible cultural association with the Greater Blue Mountains.
During the period 1900 to 1925 a number of photographers portrayed visitors at popular scenic spots along walking tracks.

Postcards from the J Smith Collection
Social history

First inhabitants

Despite the rugged terrain of the Greater Blue Mountains area, people have been in contact with the area for thousands of years, exploiting and caring for its natural resources and deriving spiritual sustenance from its landscape features and flora.

Gundungurra, Daruk and Darkinjung are languages originally spoken in the nominated area. Each group had stories to explain the creation of humanity, local flora and fauna and their country’s landscapes. Only the Gundungurra stories were recorded in any detail. The Gundungurra tale of the epic journey of Gurangatch (Rainbow Serpent) and Mirragan (a quoll) explains the origin of the great valleys of the Wollondilly and Coxs Rivers whose catchments form most of the southern portion of the nominated area.

Within each language group, Aboriginal people identified themselves as members of bands attached to a particular part of the land. The Wywandy, Therabulat, Bunally, Gingra, Burra Burra, Burratorang and Nattai bands, for example, occupied parts of the Coxs/Wollondilly catchment, in the south of the nominated area. Bands from the same, and from different, language groups met for social and ceremonial gatherings. Around the walls of the Kanangra plateau, rock galleries with dancing men painted in ochre are reminders of those events.

The Aborigines of the Blue Mountains and Wollemi areas moved about some of the most consistently rugged and precipitous country in the continent. These mountain people developed powerful physiques and fearsome reputations. In 1804, the explorer George Caley, travelling with Daruk guides from the coast, described how the Gundungurra man Cannabaygal and his men were
...much dreaded by the other tribes of natives...

*They were of gigantic stature in comparison with the rest; their hair being long, flowing upon the shoulders and their features in general gave them a frightful countenance.*

On the Coxs River, in 1819, Thomas Jones, also travelling with Daruk men, met another group of Gundungurra, who *ran up the Mountain like Kangaroo*.

Staple foods included the eels and mussels of the rivers and, in the small upland creeks, the crayfish. Seasonally, the nectar of the Banksia flowed with abundance in winter. In moving between valleys and ridge-tops, Aboriginal people found natural passes through the cliffs. Early European settlers referred to the few places where a negotiable gully or series of ledges met the top of the talus slope as ‘Blacks Ladders’.

**Cultural encounters**

From the British arrival and first colonisation in 1788, the meeting between the old and new cultures of Australia is one of drama, with conflicts over land and resource use making empathy hard to achieve. At the heart of many tragic events lay the difficulty of communication. This difficulty was experienced by the first European explorers of the Greater Blue Mountains – Wilson, Barrallier, Caley, Blaxland, Wentworth and Lawson, Evans and Jones in the south, and Parr, Singleton and Howe in the north.

In 1814, Evans surveyed a route for a road along the Aboriginal pathway on the ridge between the Grose and Coxs rivers, through the centre of the presently nominated area. No such continuous ridge was found for a road through the present-day Wollemi National Park to the north. Once the route was established, the European settlers crossed it with their horses, sheep and cattle. Aboriginal people had traditionally kept many areas of fertile soil clear of trees and shrubs with regular firing
to encourage grazing wallabies and kangaroos. The new settlers seized upon these fertile clearings for their stock and crops, disrupting a key element of Aboriginal food supply.

In 1832, surveyors Mitchell and Govett camped at the base of Mt Jellore alongside the camp of the Gundungurra man Myangarlie. Myangarlie, who carried his detailed map in his mind, watched the surveyors peer through theodolites to create their map on paper. The settlers who flowed along the roads to the west and south over the next few years continued to exert considerable pressure on Aboriginal communities. This was exacerbated by drought, when food became scarce for both hunter-gatherers and farmers. Conflicts between them led to a state of war to the east of the Greater Blue Mountains. Governor Macquarie’s punitive expedition of April 1816 resulted in a massacre of 14 Aborigines and among the dead was Cannabaygal. After this period of conflict, Aboriginal people adapted new strategies for survival, utilising resources from the settlers’ economy while maintaining, as far as possible, links with their traditional lands.

**Spread of settlement**

More accessible areas around the Greater Blue Mountains were settled from the 1820s by holders of ‘tickets of occupation’ or grants of land. Convicts, ex-convicts and free settlers often managed the herds for absentee owners. The system of squatting licences and land grants for the privileged was replaced in 1861 by the Crown Lands Alienation Act. Anyone was allowed to buy vacant Crown land with the lodgement of a deposit and the erection of a dwelling. The settlers built cottages of split stringy-bark with bark roofs and the land was cleared by ringbarking. Around the houses were fruit trees and fields of corn and potatoes. A small dairy herd was common. In coming to terms with the precipitous landscape, valley settlers developed a strong attachment to the land.
Moyengully, King of Nattai, Charles Rodius. National Library of New Zealand (Te Puna Mātauranga O Aotearoa)
and built relatively good relationships with local Aboriginal communities. Intermarriage was common and the descendants of the Gundungurra and their neighbours often bear the surnames of the earliest valley settlers.

The 1861 and subsequent Crown Lands Acts provided that land could be reserved from sale for various public purposes including public health, recreation, convenience or enjoyment. Numerous areas within the Greater Blue Mountains were reserved, under this provision, for public recreation, catchment protection or forest reserves.

Decades earlier, European explorers and travellers had described the emotional and scientific significance of the Blue Mountains for their colour, sublime scenery and distinctive topography and botany. The 1866 reservation of the Jenolan limestone caves gave government sanction to these values.

From the late 1850s, railway routes were surveyed in the Grose, Colo and Coxs River valleys of the nominated area. The route finally chosen followed the same ridge as that selected in 1814 for the westward road. The railway attracted a new type of resident. Professional men and their families, who did not need to make a living from the land, built country estates accessible from the railway. They often included carefully designed walking tracks into the nearby bushland, creating places where people from cities and towns could reflect on nature.

Early estate owners encouraged the development of public recreation reserves, of which they sometimes became trustees. The Jenolan Caves was the first government-owned tourist attraction in Australia. Townships competed for tourists wishing to follow local walking tracks. This led to the unique proliferation and concentration of tracks, some heroic in scale and descent. With the development of guesthouses, tourists from a variety of social classes would stay in the area for days at a time. Their accumulated experiences have reinforced the strong Australian cultural ties to the Greater Blue Mountains.
Early tourists in the Jamison Valley used the track established in 1878 by miners. Photo J Paine, 1880s. J Smith Collection.
Another impact came with mining. Aboriginal people had mined the cliffs’ friable chert layers for millennia to produce sharp edged tools. Non-Aboriginal miners were interested in the carbonaceous layers, the few exposures of which were soon exploited. Coal and shale mines, and a few for other minerals, proliferated in the region from the 1860s, but most of the rough settlements that grew up around the mines were soon abandoned. Remnants of ‘ghost towns’ and abandoned workings are found on the outskirts of the nominated area.

At the turn of this century, two elderly Gundungurra men, children of white fathers and Aboriginal mothers, were interviewed. Werriberrie (William Russell) and Maniade (William Lynch) embodied the dual cultural heritage of the region, speaking a local language at risk of extinction, as well as English. The interviews are moving personal testimonies of cultural and environmental change.

Conservation takes hold
While farming and urban development continued to increase in the surroundings of the Mountains throughout the early 20th century, so did the persistent efforts to conserve its wild attributes. In 1932, the Blue Gum Forest was added to the many reserves already proclaimed.

The late 1950s saw two remarkable events: the state government’s consolidation of the numerous reserves previously cared for by local communities into a Blue Mountains National Park, and one of the largest relocations of an Australian community, when Burragorang settlers were removed for the valley’s flooding to provide Sydney’s main water supply. The dam, adjacent to the nominated area, produced some environmental changes, vastly increasing waterfowl on the lake and macropods and rabbits grazing on abandoned farmlands.
3. DESCRIPTION

Top: Photo W Green, 1930s. J Smith Collection. Bottom: Photo W Green, 1940s. J Smith Collection
The 1960s and 1970s saw major conservation debates about the future of parts of the Greater Blue Mountains now in protected areas. From then into the current decade, new national parks have continued to be declared. Gundungurra and Daruk people have recently formed local Tribal Councils to reunite the descendants of the Aboriginal people of this region. Their traditional wisdom may help, through its holistic approach, to the ongoing ‘caring for country’. Aboriginal people and later settlers have exploited, respected and fostered the resources of the Greater Blue Mountains area. The extraordinary difficulties of access through most of it has spared it from unsustainable forms of development. The Greater Blue Mountains thus retain relatively unmodified ecosystems, as well as a rich mosaic of Aboriginal and European cultural associations. One of these is tangibly illustrated by the rock paintings and engravings scattered throughout the terrain.

**Rock Art**

*Aboiriginal traditions, beliefs and artistic works*

Archaeological research throughout the Sydney sandstone region has demonstrated not only the extensive and intensive Aboriginal occupation of the Greater Blue Mountains, but also the dynamic nature of life in this area. It is generally accepted that:

- Human occupation in this area extends back at least 14,000, and possibly 22,000, years BP.
- People adapted to a wide variety of climatic conditions during this time.
- Technology and material culture changed, as did preferred locations.
- Rock art in the region occurred in two distinct social contexts. Through stylistic behaviour, the people of the region, who were not in continual verbal contact with each other, were able to communicate important social messages and demonstrate both broad-scale group cohesion and within group distinctiveness.
Aboriginal rock art in the sandstone caves and platforms of Sydney’s highland reserves is extensive. Current knowledge stems from a variety of sources and is based on a broad understanding of the archaeology of the whole region. Detailed background to archaeological research in the region presents the context for the area’s art (Attenbrow, 1994). This document also summarises sources of information about the indigenous beliefs and traditions that were operating at the time of European contact.

The first major publication about rock art in the Sydney region was by WD Campbell (1899), who recorded a vast number of sites, mainly engravings, encountered during his duties as Government Surveyor. From the 1930s, there was an increase in rock art publication. Researchers gave many interpretations to the Sydney engravings, based on ethnographic material from this and other regions.

McMah (1965) undertook the first archaeological analysis of this body of art. Indeed, this was the first quantitative analysis of any body of art in Australia. Certain stylistic differences were identified within the art, some of which might be ascribed to cultural causes, while others were obviously the result of dramatically different environments. Since McMah’s seminal work, there has been a proliferation of more localised university research and doctoral projects. The art of the region has also been the specific subject of two large-scale management projects and of smaller environmental impact assessment projects.

**The art itself**

Art in the Greater Blue Mountains, as in the Sydney region generally, occurs in two contexts: in rock shelters and on open sandstone platforms. Site locus is the main criterion for dividing the art into components, since a strict division between pigment and engraved art is not possible. Both techniques are found in shelter sites.
Maynard (1976) has suggested a classification of rock art into three forms: a continent-wide, relatively homogenous engraving style – the Panaramitee – which is replaced in some locations by a series of regionally diverse but simple engraved and pigment art styles, the Simple-Figurative. Simple Figurative art is found in many parts of Australia (Port Hedland, the Cobar Pediplain, Laura, Groot Eylandt). The third category, Complex-Figurative, is really restricted to the north of Australia and comprises more complex engraving and pigment art bodies.

The art of the nominated area falls within the Simple Figurative group of styles, with some residual Panaramitee-style sites having been located. Tracks and figurative motifs dominate the art. Whether a motif is engraved, drawn or painted, in outline or solid form, it usually consists of a simple silhouette. Engravings are usually in outline, although some have infilled features. Pigment motifs range from outline to solid forms.

The schemata for both art components are very similar, in terms of Motif Range, Form, and Character, as defined by Maynard (1977). Motifs include anthropomorphic figures, terrestrial and marine animals, birds, material culture items and tracks of humans, birds and kangaroos. Most portrayals are strongly standardised. Many of the engraved motifs are life-size. However, very large and very small depictions also occur, such as 7 metre high anthropomorphic figures and 15 centimetre high kangaroos. The pigment art is generally smaller in scale – partly, it is thought, due to ‘canvas’ size.

A common technique in the rock shelter art is stencilling. Stencilled pictures are mostly of hands, but a variety of other cultural artefacts, such as hafted axes or boomerangs, have also been recorded. In both art components, there are spectacular examples of composition where it appears that a story is being told. In some cases there is a very complex use of design, whereby motifs share internal features.

Two techniques have been used to establish the age of shelter art in the Sydney sandstone region. In both instances, it was the first time that such attempts were made
Top: Large human figure. Photo J McDonald. Bottom: Pair of kangaroos, male and female. Photo J McDonald
in Australia. These techniques have involved the indirect dating of pigment art, through association with excavated and dated deposits, and the direct dating, using Accelerator Mass Spectrometry, of very small charcoal samples collected from drawings.

The most recent analysis, of 1994, suggests that most pigment art in the area dates to within the last 4,000 years, with the most intensive period of production being between 3,000 and 1,000 years ago. This art was still being produced at the time of European contact, in the late 18th century. Art of an earlier style – a regional variety of the Panaramitee – was produced in the area prior to 4,000 years BP, but its earliest date of production is unknown.

There is no known method for dating open horizontal engraving sites on rock platforms. It is however assumed that the open engraving art was being produced during the same time period as the shelter art. In 1994, an analysis of 717 engraving sites and 546 shelter art sites was undertaken as part of a study of art, in the context of the area’s prehistory (McDonald, 1994). This allowed its art to be characterised in terms of the size of the assemblage and the techniques used.

**Open engravings and sheltered art**

The largest recorded open engraving site in the whole sandstone region is named Burragurra and contains 174 motifs. It lies within the Greater Blue Mountains, to the north, in Yengo National Park, as does another of the very large assemblages, Frying Pan Rock. The majority of engraving sites has been created on relatively horizontal stone platforms, with a small number worked on the vertical faces of boulders adjacent to waterways. More than half the known engraving sites are located on ridgelines. Hill slope locations are also common but sites on valley floors are rare. The average engraving site contains more than ten motifs, while most have fewer than sixteen. About a fifth of sites contain one motif only and four sites have over a hundred.
Wallaby Rock. Photo J McDonald
On the other hand, the average rock shelter art site in the sandstone region contains many more motifs – some 25. The very largest recorded, Swinton’s, contains more than 850. Most sites have fewer than 30 motifs and some contain only a single motif. There are nonetheless eight sites which contain over 200 motifs. These large assemblages are located within the Darkinjung language area, north of the Hawkesbury River and west of the Mangrove Creek catchment, one lying on the foot slopes of Mt Yengo.

By definition, all of this art occurs within sandstone overhangs or shelters. None of the known deep limestone caves in the area, such as the Jenolan Caves, has been decorated. Within the shelters the art is commonly located on the back wall, but often occurs also on the ceiling and on the inside lip of the overhang.

Unlike the open engraving sites, most shelter sites are found on hill slopes, while the remainder are fairly evenly divided between ridge tops and valley floors. Most of the art is either drawn or painted in pigment on the rock surface. Stencilling is however also quite common, but engraving in sheltered formations is rare. The colour used in paintings and drawings is predominantly monochrome. Two coloured motifs are relatively rare and three or more colours is even rarer. When they occur, such motifs usually consist of red, black and white but several include yellow as a fourth colour. Black predominates, followed by white, red and yellow. Colour proportions have been found to vary significantly in localised areas. This is one of the elements creating stylistic variability.

Many of the decorated art shelters show evidence of human occupation, in both archaeological and midden deposits. It is probable that even more shelters with surface art contain deposits than has so far been recorded on register. This is because work in the area has revealed that most shelters with no surface evidence of habitation actually contain sub-surface deposits.
Trail of large mundoes (scale in foreground 10cm). Photo J McDonald
It is assumed that the Simple-Figurative art components in the Greater Blue Mountains are relatively recent and roughly contemporaneous. This allows for quite sophisticated analyses of the two art components of open platform engravings and rock shelter paintings and drawings, whereby recognisable patterns of stylistic differences and similarities may be attributed to spheres of mediation within the society that produced them. This is not to suggest that the original meaning of the art in the area can be identified: the opportunity to do so was lost with the disruption of prehistoric culture in the region caused by the arrival of British colonists some two centuries ago. A detailed picture of how the art may have functioned across the area has, however, emerged after analysis of the two components.

On average, sheltered art assemblages are far larger than open art assemblages. The largest shelter art site contains five times as many motifs as its engraved equal. An interesting similarity between the two is that each demonstrates a relative infrequency of very large assemblages but a proliferation of small, perhaps single episode, sites. This suggests that there are particular foci within the area for activities associated with art, and that the art in these focal places may represent a different type of activity from that in the sites with less intensive art production.

There are obvious similarities and differences between the surface engravings and the sheltered art in their motif assemblages. In both, tracks dominate the identifiable motifs. With the shelter art sites, this is due to the predominance of hand stencils; in the engravings it results from the predominance of human tracks (‘mundoes’ or footprints) and to a lesser extent, bird and macropod tracks. Given the possible interpretation of hand stencils as individual or personalised markers, and the fact that this type of motif places the artist very firmly amongst the art, the presence of human tracks in great numbers amongst the engravings is an intriguing similarity. The injection of a human element into both art assemblages suggests some semiotic significance.
Recognisable Motif Preferences for the Two Art Contexts

Engraving Sites (n=6,620 motifs)

Shelter Art Sites (n=8,263 motifs)
Despite the precipitous terrain and consequent difficulty of access, there are almost 700 recorded Aboriginal sites in the Greater Blue Mountains area (New South Wales National Parks and Wildlife Service Sites Register information). Of these, 40% have an art component. These sites are not evenly distributed throughout the national parks of the nominated area, because archaeological recording programs have been more intensive in some national parks than in others. The relative absence of sites from some parks should not be taken to indicate a lesser presence of Aboriginal sites, but rather a greater potential to contain as yet undiscovered sites.

Thus the nominated area can be said to reflect, through its rock art, strong cultural associations and patterns of communication across language groups, throughout the difficult terrain, and over millennia. Some time after the turmoil of the European arrival, the wild nature of the Greater Blue Mountains again inspired a spirit of custodianship in those who visited it.

**Conservation history**

Less than a century had elapsed since the first European occupation of eastern Australia, when a strong movement developed there to conserve natural areas, around the new coastal settlement. It was a phenomenon which had its counterpart in the New World of North America. The difference here was that the wildlands, which became the target of conservation efforts, were not in some remote mountain or desert but on the very doorstep of a rapidly growing city.

As already pointed out, from the earliest years of the New South Wales colony, natural features of importance for future public recreation were reserved from alienation. However, until the middle of the 19th century, each area was considered in isolation and there was no specific legislation for reserves and little supervision. All of this was to change for the natural lands around Sydney, as its inhabitants first sought
relief from the unhealthy conditions of the city and took on the role of protectors of their expanding recreation areas. The outcome was a living landscape, its character shaped by successive conservation efforts and its values cherished by many and enjoyed by all.

Today’s conserved environment in the Greater Blue Mountains records and commemorates the voluntary effort of many generations, all with a similar purpose but with different specific interests, each building on the achievements of those who went before. The best way to appreciate this landscape is to understand the aims and aspirations of each generation of players as they evolved.

**Health-based movement**
In the second half of the 19th century, the driving force for setting aside extensive systems of recreation reserves was the belief that these would counter the oppressive and polluted conditions of cities and towns. To the north and south of Sydney, the infertile sandstone bushlands offered attractive opportunities for recreation, whilst further afield to the west, the Blue Mountains offered a cooler summer climate and sublime scenery. The plateau country became an outlier of the Sydney-based reserve movement, then quickly developed as an independent centre for action.

Amongst the earliest public recreation reserves set aside under the *Crown Lands Alienation Act* of 1861 were the Fish River Caves (later Jenolan Caves) in 1866 and Grand Canyon (Bungonia) in 1872 – both within the Greater Blue Mountains nominated area. These and similar reserves in the southern Blue Mountains were in remote locations. In the central Blue Mountains, reserves were created and walking track systems developed to serve the growing number of people travelling the area to enjoy the spectacular scenery on either side of the east-west road and rail.

The first walking tracks of the 1830s and ‘40s were rough affairs linking the
roadside inns with nearby escarpments and major waterfalls. The opening of the Western Main Railway in 1867-68 enabled wealthy citizens to build summer houses with private tracks, as adjuncts to their landscaped gardens.

In the 1880s, cheap rail travel brought more and varied people to the Mountains for day visits and longer and more tracks were built above and below the nearby cliff lines. Rivalry between the hoteliers and resorts and community zeal stimulated the construction activity, simple spur tracks becoming loops and being so extended that eventually they merged. The agencies responsible for their construction, which quickly developed into an art form, included the trustees of reserves (especially in the period 1880 to 1910), community service associations, hotelkeepers and local authorities. The tracks were to play a key role in the recreation of resort visitors until the 1930s, with the growing use of motor vehicles.

The establishment of reserves for public recreation began in the upper Blue Mountains in 1867, with the gazettal of an 11,380 hectare reserve surveyed for public recreation, etc along the railway line between two stations. When this was revoked in 1870, smaller reserves (between Blackheath and Govetts Leap and in the Wentworth Falls area) were created to protect the land between railway and views. In the late 1870s and early ‘80s, reserves were established along the cliff lines with trustees appointed. Eventually, like the tracks, the reserves began to be linked. A petition presented to the New South Wales Legislative Assembly in 1880 by the ‘citizens of Sydney and others’ calling for a Katoomba Falls reserve (gazetted 1883) argued that it was for the health, morale and intellectual advancement of our daily increasing capital.

Collectively the string of reserves became known as the Blue Mountains Sights Reserves. They were consolidated in 1917, many passing into the control of the Blue Mountains City Council when it was established in 1947. In 1987, however, they were incorporated into the Blue Mountains National Park. Many resident volunteers helped to develop and maintain both the reserves and the tracks. This, along with a
commercial interest in the welfare of tourists, helped to engender an enduring sympathy for conservation principles, such as the undeveloped nature of the cliff tops.

In 1879, some 7,000 hectares of Hawkesbury sandstone country on the coast, just east of the Greater Blue Mountains, was dedicated as the first national park in the world – ‘The National Park’ (later the Royal National Park). This significant event followed the passage of several Legislative Assembly resolutions calling for recreation reserves for health reasons.

**Bushwalker conservation movement**

In the early part of this century, many people were introduced to the pleasures of walking in wild areas on the Blue Mountains bushland tracks. Amongst them were Myles Dunphy and friends who, starting from Katoomba in 1912, began to explore the remote country of the Greater Blue Mountains between Jenolan Caves and the Burragorang Valley. Out of these explorations developed a number of bushwalking clubs beginning with the Mountain Trails Club in 1914. The term ‘bushwalker’, for camping walkers, was not used until 1927 when the Sydney Bush Walkers Club was formed.

As described in 3.4 Natural beauty, the bushwalkers discovered the aesthetic quality of wilderness, in the joy of solitude, travelling through the country on its own terms, without the aid or confinement of roads, tracks or bridges and, in the process, rediscovering the spiritual nature of the land. Initially the clubs were concerned with the craft of walking in difficult terrains but, by the mid-1920s, they had added conservation to their objectives. Significantly, they soon applied this to remote natural areas.
The undoubted leader of this new breed of bushwalker conservationists was Myles Dunphy, a teacher of architecture. In 1931, a number of events converged to bring his ideas into the public domain. Working at the Lands Department on an official walkers’ map of the Southern Blue Mountains, he was encouraged to submit his proposals for a bold new Blue Mountains National Park scheme which he had been working on for eight years. Also encouraging was a successful public appeal to lease the floor of the Grose Valley, in order to prevent the ring-barking of the magnificent Blue Gum Forest.

In 1932, the Dunphy Park proposal was submitted to the Surveyor General and the Blue Mountains Shire Council. A Blue Mountains National Park Committee was formed to promote the park, and evolved the next year into the National Parks and Primitive Areas Council (NPPAC). The inclusion of ‘primitive areas’ reflected the Council’s interest in promoting a new category of wilderness reserve, either as zones within parks or as separate reserves.

What became known as the Greater Blue Mountains National Park proposal was in four sections and was quickly supported by the local authorities. Leaving nothing to chance, the NPPAC widely promoted it, most notably in a four-page supplement in the Katoomba Daily in 1934 with a text which was a veritable manifesto for the modern conservation movement. The primitive areas were seen as a means of defending bush conditions against the threat of motor road access. Four were proposed in the Blue Mountains Park.

Conservation movement from the 1960s
The long process of establishing the Greater Blue Mountains National Park began with the gazettal of a reserve in the Kanangra-Boyd area in 1937, and was followed in 1959 by the establishment of the Blue Mountains National Park. It required a third wave of action by conservation groups, from the late 1960s to the ‘90s, to have the other parts of the park scheme implemented.
BLUE MOUNTAINS NATIONAL PARK

3. DESCRIPTION

Proposed by
The National Parks & Primitive Areas
Council.

First brought under
notice of Authorities
June, 1932.

Scale of Miles

NORTHEN

CENTRAL

SOUTHERN

DIVISION

PROPOSED

NATIONAL PARK

Other areas worthy of protection

Almost expansion of settlement areas
in Central Division has been considered.
Alloated areas within the Divisions are
heavily settled. Amount of alloated
small portions are not shown.

Blue Mountains Gazette
Action was prompted by a series of threats to the natural landscapes of the area, notably limestone quarrying at Colong Caves (1967), pine planting on the Boyd Plateau (1970) and roads and dam proposals on the Colo (1974-1978). These spawned the formation of new conservation groups such as the Colong (1968) and the Colo (1974) Committees. Together with these, the National Parks Association, the Nature Conservation Council and the Australian Conservation Foundation, the conservationists succeeded in enlisting the support of the wider public. The creation of new parks became a major policy aim of government.

The Kanangra-Boyd National Park was established in 1969 and, in 1979, a much expanded area to the north was included in Wollemi National Park. Nattai National Park was established in 1991 and Gardens of Stone National Park in 1994, both after long struggles by the conservation groups against competing interests. By 1998, the area in the six parks related to the 1932 scheme had almost doubled the size of the original proposal.

Protection of specific areas of wilderness proceeded more slowly, but by the 1990s wilderness areas were gazetted at Nattai (1991), Kanangra-Boyd (1997) and Wollemi (1998). Two more proposals are currently being assessed. Wollemi is to be the largest, possibly the world’s largest wilderness reserve of open sclerophyll forest.

Current community conservation work is concerned with consolidation, through good management and restoration. After decades of partial neglect, much of the extensive walking track network has now been restored. Local authorities and community groups, along with the Colong Foundation, have played a major role in bringing the area’s World Heritage values to the notice of government.

The caring encounter of the people of the Sydney Basin with their sandstone bushlands – and, most directly, the Greater Blue Mountains – goes on, in a symbiotic relationship, which has produced a world class system of national parks and wilderness areas, adjacent to a major city. All evidence shows that it is as vital today as it was when it began some 130 years ago, following a tradition some 14,000 years old.
3. DESCRIPTION

Rock climber, Jamison Valley. Photo AJ Morisson
3.6 STATE OF CONSERVATION

Present state of conservation: Greater Blue Mountains area

The Greater Blue Mountains area is close to pristine. Developmental and environmental pressures and the protective conservation responses to them are described in detail at 5.1 Development and tourism and 5.2. Environmental pressures and natural disasters.

Most of the vast nominated area is eucalypt forest landscape, unmodified by European settlement. The low fertility soils and rugged nature of its sandstone landforms have precluded pastoral use and clearing, apart from a few minor inholdings of private land.

In the southern part of the Greater Blue Mountains, where soils are better, the catchment reservation for the Warragamba Dam has produced limited modification of the natural environment. Any pastoral use of land within the nominated area has now ended, apart from a single 4,000 ha portion of Yengo National Park. Remaining pockets of private land are being strategically acquired on a voluntarily basis, funded under the infill acquisitions budget and the generous Dunphy Wilderness Fund.

The rugged terrain was a significant barrier to expansion of the colony until a crossing of the mountains was achieved in 1813. Some environmental modification began soon afterwards in limited accessible areas. The known range of historic places in the present Blue Mountains National Park represents various historic themes including exploration, settlement, pastoralism and agriculture, mining, transport, water supply, conservation and recreation.

Modifications associated with urban settlement, resource exploitation and the road and railway links are confined by terrain to the central section of the Blue Mountains
Range, and are excluded from the nominated area. Water pollution arising from these settlements has been greatly reduced in recent years through major sewage transfer, improved treatment of remaining discharges and urban run-off controls.

The condition of the majority of the Greater Blue Mountains area is excellent. Fire and pest species are the greatest threats in the more remote bushland areas. Fires are managed co-operatively by the National Parks and Wildlife Service, State Bushfire Services, other fire fighting professionals and volunteers. Pest species are controlled by Service professionals, with growing support from the community.

Heavy visitor use is highly localised but minor erosion sometimes occurs on walking tracks, adventure tourism locations, such as slot canyons, and on some dirt roads. These problems are addressed through wilderness management, a walking track audit, management review processes and vehicle access maintenance.

There is no mining or timber extraction within the Greater Blue Mountains nominated area. Some coal mining operations occur nearby, but do not affect the water catchments that drain to the area. Potential impacts from mining include cliff collapses and alteration of surface drainage, however, all mining operations are subject to strict development control and pollution licensing by the New South Wales Environmental Protection Agency.

**Most recent records of the property**

The most recent records for the Greater Blue Mountains nominated area are contained within the plans of management for all its protected areas, except the recently created Gardens of Stone National Park. Plans of management and other relevant records are summarised below. (See 4.3 for a description of the plans).
**Jenolan Caves Karst Conservation Reserve**
A plan of management was adopted for the 2,422 ha Reserve in 1989 under the joint supervision of the NSW Department of Lands and the Tourism Commission of NSW. A Conservation Plan was prepared for the Caves House Precinct in 1988 consistent with the principles of the Burra Charter (Australia ICOMOS, 1988). A more recent account of the condition of the caves and the Reserve is provided in the 1997 State of the Environment Report for the Reserve.

**Blue Mountains National Park**
A plan of management was prepared for the 247,840 ha park in 1998. A further comprehensive description of the natural and cultural resources comprising the park is included in the NSW Royal Botanic Gardens’ report *An Assessment of the World Heritage Values of the Blue Mountains and Surrounding Plateaus* (James et al., 1994).

**Thirlmere Lakes National Park**
A plan of management was adopted for the 641 ha park in 1997.

**Nattai National Park**
A plan of management was prepared for the 47,855 ha park in 1997. The resources and history of the area now declared as the national park are described in *The Nattai National Park Proposal* (Colong Foundation, 1987). See also the report on the area’s World Heritage values by James et al., (1994).

**Kanangra-Boyd National Park**
A plan of management was prepared for the 65,379 ha park in 1998. See also the report on the area’s World Heritage values by James et al., (1994).
Jenolan River gorge, Kanangra-Boyd National Park. Photo I Brown
Wollemi National Park
A plan of management was prepared for the 499,879 ha park in 1996. See also the report on the area’s World Heritage values by James et al., (1994).

Yengo National Park
A plan of management was prepared for the 153,483 ha park in 1993. The park’s vegetation is described in detail in Preliminary report on the Vegetation of Yengo National Park and Parr State Recreation Area by Sanders et al., (1987). The park’s Aboriginal art sites are detailed in Sydney Basin Aboriginal Heritage Study: Rock engraving and shelter art sites (McDonald, 1985). See also the report on the area’s World Heritage values by James et al., (1994).

Gardens of Stone National Park
A plan of management is being prepared for this 15,150 ha park, which was declared in stages in 1994 and 1995. See also a report on the area’s World Heritage values by James et al., (1994) and The Gardens of Stone National Park Proposal (Colong Foundation, Colo Committee and Confederation of Bushwalking Clubs, 1985).

Present state of conservation: Individual reserves

The known state of conservation of each reserve in the nominated area is summarised below.

Jenolan Caves Karst Conservation Reserve
The state of conservation of the Jenolan Caves Reserve is the best understood of all the protected areas in the nominated area. It is the oldest reserve by many decades (originally established in 1866), has a long history of high visitation requiring intensive
management, has numerous unique natural features resulting in much research interest, and is small (only 2,400 ha).

The Jenolan Caves Reserve Trust produced its first State of the Environment Report in 1997, which analysed the condition of the caves’ features and threats to those features. (For details see 5.3 Monitoring).

Despite some modification to its natural environment for visitor facilities and infrastructure, most of the Reserve remains stable and its natural resources are well conserved. The principal impacts on the natural resources relate to the high number of visitors concentrated in a small section of the Reserve, and the ongoing provision and maintenance of infrastructure.

**Blue Mountains National Park**

The state of conservation of the Blue Mountains National Park is high and its overall integrity is ensured, above all, by its large size (248,000 ha) and rugged character. It contains an extensive variety of environments and natural communities and forms part of a network of connected protected lands totalling more than 1.2 million hectares. The park reserves natural environments over a wide altitudinal range from less than 20m on the Nepean River to 1,215m on Mount Werong in the southern Blue Mountains. This altitudinal change and the complex topographic features of the park create a great diversity of environmental conditions affecting the distribution of plants and animals across the park. At least 40 distinct vegetation communities have been recognised in the park, ranging from the windswept heaths on the high sandstone plateau, above approximately 600m, to rainforests in sheltered gullies and to open eucalypt woodlands in the drier, lower areas.

The park succeeds in conserving an unusually high diversity of plant communities and species, particularly within the Eucalyptus and Acacia genera, and a high concentration of threatened, rare and endemic plant species. (For detail, see 3.3 Bio-diversity).
The condition of the park is enhanced by the declared Kanangra-Boyd Wilderness, the identified Wollemi Wilderness, and the proposed Grose Wilderness. They emphasise the park’s relatively pristine condition and its size, which ensure maintenance of natural processes and long-term protection of its features.

Over 700 Aboriginal sites have been recorded in the park, witnessing human occupation of the area for at least 14,000 years. Those sites, in good condition, include rock art shelters, rock engravings, stone grinding grooves and stone arrangements. As only a small proportion of the park has been surveyed, many more sites are likely to exist, in the sandstone environments and relatively undisturbed park. Undisturbed sites are of particular scientific importance in contributing to the understanding of Aboriginal use of the area. Unlike Aboriginal sites, historic places in the park are often supported by documentary evidence. Although not systematically surveyed for historic places, the park includes 62 recorded historic complexes of buildings, mines, quarries, structures, roads and tracks.

The Grose Valley, and Blue Gum Forest within it, are historically important for their association with development of the early conservation movement in Australia and the Jamison and Grose Valleys are significant for their long association with tourism and recreation. These uses continue today, thus maintaining the authenticity of historic artefacts, such as the many lookouts and walking tracks in the upper Mountains constructed late last century and early this century.

**Wollemi National Park**

The state of conservation of Wollemi National Park is also excellent. It performs a similar conservation role to Blue Mountains National Park because of its size (500,000 ha) and relative freedom from human impacts, enabling the conservation of plant and animal communities in their natural state, the maintenance of natural ecological processes with little human interference, and the protection of many large,
3. DESCRIPTION

River oaks, Casuarina cunninghamiana, Murrin Ch, Blue Mountains National Park. Photo I Brown
pristine catchments. The Colo River valley is one of the largest sandstone canyon systems in Australia.

The range of topography, altitude, aspect, fire regime and microclimates has resulted in diversity of habitats for native plants and animals. In particular the vegetation exhibits an outstanding range in terms of its structure and composition. (For detail, see 3.3 Bio-diversity).

Although there has been no systematic survey of plant communities within the park, 25 rare or threatened plant species have been identified. The internationally significant Wollemi Pine was recently discovered in a remote section of the park. It is a significant remnant species from the pre-flowering Gondwanan era and is a new genus of conifer. Similarly, while there have been no major surveys of animals in Wollemi National Park, inventories for the Blue Mountains dissected plateau currently record 46 mammals, 235 birds, 55 butterflies, 58 reptiles and 32 amphibians as occurring within or in close proximity to the park. Eight threatened species of birds and mammals are recorded in the protected area.

One hundred and twenty Aboriginal sites have been identified in the park, only a very small proportion of those expected to be in the area. The cultural context of these sites is being developed to explain their contemporary significance and traditional functions. Archaeological evidence of 19th and early 20th century occupation of this area can be found on the edges of the park.

The protected ruins of oil shale refineries just within the boundaries of the park provide excellent evidence of early industrial and mining efforts. The Newnes/Glow Worm Tunnel precinct represents one of Australia’s largest self-contained shale oil production schemes and demonstrates the way of life of an isolated pioneering mining community of the early 20th century. The relics and their functions are well documented in an archaeological report of the site (Burke, 1991), which will guide future park and visitor management at the popular Newnes locality. The remains of the oil shale industry
have also been recorded, but it is not proposed to undertake any restoration work on the structures and artefacts, which will be kept in their present state.

**Gardens of Stone National Park**
The Gardens of Stone National Park was gazetted in two stages (12,000 ha, in 1994 and 3,150 ha, in 1995). Information on the natural and cultural resources conserved in Gardens of Stone National Park will be collected during the preparation of its plan of management. The National Parks and Wildlife Service commenced community consultation in early 1998 to gather information for the plan.

The state of conservation of the Gardens of Stone National Park is sufficient to protect the best expression of ‘rock pagodas’ (distinctive natural sandstone formations) in the region. This was a primary reason for its reservation in 1994. The park is known to contain eleven rare and threatened plants. Some unique plants occur commonly in this park, such as pagoda daisies, *Banksia penicilliata* and *Prostanthera hindii*. The vulnerable bird, the Glossy Black Cockatoo, is also commonly seen in the she-oak forests of the high plateaus (H. Washington, pers. comm., 1998).

**Kanangra-Boyd National Park**
Most of the park consists of the 125,000 hectare Kanangra-Boyd Wilderness (which spreads across into the Blue Mountains National Park), and therefore is afforded the highest level of protection for protected areas in New South Wales.

Kanangra-Boyd National Park conserves important geomorphological and geological features for the scientific investigation of the tectonic and geophysical development of the Australian continent. It also protects several karst areas (limestone caves) which are part of the nominated area’s geological history and have their own distinctive, endemic animals. The park protects relicts of Gondwanan and post-Gondwanan flora such as alpine/sub-alpine vegetation and rainforests, which
Heath above Kanangra Gorge, Kanangra-Boyd National Park. Photo I Brown
demonstrate stages in the geological, climatic and biological evolution of the continent.

The full diversity of plants and animals in the park has not yet been comprehensively studied. However, there are locations important for particular taxa or species, such as the tall wet forests on the Boyd plateau which provide good habitat for arboreal mammals including the threatened brush-tailed phascogale, and the karst areas with their distinctive invertebrates and large number of bat species.

Whilst the park has not been comprehensively surveyed for Aboriginal sites, it appears likely that Aboriginal occupation of the park dates back about 20,000 years. The park has strong associations with development of the conservation ethic and national park movement in Australia, featuring prominently in writings and national park proposals put forward by Myles Dunphy, Australia’s wilderness conservation pioneer. It was the scene of two landmark conservation disputes in the 1960s and ’70s: a proposal to clear much of the Boyd plateau for pine plantation, and proposed limestone quarrying near Mt Colong. Neither proposal went ahead. Both areas were subsequently added to the park and continue to be conserved.

**Nattai National Park**

Nattai National Park (48,000 ha) forms the core of adjoining protected areas on the south-eastern part of the Blue Mountains sandstone plateau. The state of conservation of the park is enhanced by these protected areas (four state recreation areas and one national park), and the Sydney Water Corporation’s Special Area conditions. The surrounding protected areas act as a buffer for the park and provide the principal recreational opportunities in natural settings in the region, thereby reducing recreational pressure on the park.

Nattai National Park and adjoining protected areas protect the catchments of tributaries of Lake Burratorang, created by the Warragamba Dam and now Sydney’s major water supply. The protection of this supply from potentially damaging
developments has maintained the park in a relatively unmodified condition.

The combination of the park’s deeply incised topography, climatic variations and several soil types has resulted in a diversity of vegetation and habitats. The park’s vegetation communities are dominated by dry sclerophyll forests, characterised by a large number of eucalypt species. Fifteen threatened plants and nine threatened animals have been recorded from the park.

In 1991, the area of greatest naturalness in Nattai National Park, approximately 30,000 ha, became the first declared wilderness area under Australia’s first Wilderness Act 1987. Wilderness management assists in protecting the inner catchment of the Lake Burragorang water supply, by restricting recreation to low impact uses, such as bushwalking.

The park conserves evidence of indigenous occupation and European settlement. The Nattai area was the traditional home of the D’harawal and Gundungurra Aboriginal people. The Wollondilly and Burragorang valleys made a boundary or transition zone between the two nations, which provided a corridor for peoples travelling northward from as far afield as Victoria to the major gathering and ceremonial grounds on D’harawal lands adjacent to the Nepean River. The Nattai area was also the scene of considerable exploration activity during the early history of European settlement. Some areas of the Burragorang Valley, just outside the nominated area, were occupied for grazing as early as 1824.

Due to management of the area as water catchment by Sydney Water Corporation since the 1960s, weed infestations and feral animal populations have been effectively controlled by the collaboration of the New South Wales National Parks and Wildlife Service and the Sydney Water Corporation.
**Thirlmere Lakes National Park**

Thirlmere Lakes National Park (640 ha) protects a small system of five perennial freshwater lakes of considerable geomorphological and biological significance. The park’s five lakes lie within a deeply entrenched valley meander, ‘perched’ above the Burragorang Valley to the west and the Cumberland Basin to the east. It is believed that the drainage pattern of the original river was disrupted through the downwarping of the surrounding countryside approximately 15 million years ago. The small size and configuration of the lakes’ catchment appears to have slowed the normal process of evolving towards dry land by infill with sediments.

Few lakes reach this age without undergoing evolution to dry land and terrestrial ecosystems. The great age and geomorphic stability of Thirlmere Lakes have enabled many aquatic organisms to evolve in isolation, restricted or almost restricted to this one lake system.

A freshwater sponge in the lakes is of particular ecological significance. It produces its own green pigment and is believed to be the only species of freshwater sponge in Australia which does not exhibit gemmulation, which is necessary for adapting to the changing conditions associated with the ageing process of lakes. This characteristic of the sponge is therefore an indicator of the very slow geomorphic and ecological development of the lakes.

The native vegetation includes many species of hydrophyte in the still water environment, a diverse array of littoral/riparian species on the lake margins and colluvial/alluvial flats, and eucalypt woodland on the ridge tops and slopes. Over 400 plant species from approximately 250 genera are known to occur within the park. The terrestrial and aquatic plant communities provide important habitats and breeding opportunities for a wide range of fauna.

The park conserves an historic railway pumphouse and associated facilities, constructed in 1867 to supply water from the lakes to the steam engines using the southern railway to Mittagong until 1964.
**Yengo National Park**

Yengo National Park (150,000 ha) provides the only protected natural east-west link between the coastal protected areas in the Hawkesbury Valley/Broken Bay region and those of the Central Tablelands. It lies within an area with lower rainfall than the higher tableland to the west in Wollemi National Park and the coastal range to the east. This ‘rainshadow’ effect, together with milder local climates and few areas of good quality soils has resulted in a range of habitats. There are large numbers of plant species at some sites, and different plant communities exist in close proximity.

Most of the ridge-tops and northwest-facing slopes consist of a low woodland with sclerophyllous shrubs underneath. There is considerable local variation, such as the occurrence of an open forest of ironbarks with an open grassy understorey, usually in dry habitats with a high clay content in the soil.

The wetter area closer to the coast in the south-east of the park supports small stands of tall eucalypt forest and warm temperate rainforest in sheltered gullies. The warm temperate rainforest in sheltered valleys and the dry rainforest on the basalt tops (such as Mt Yengo, Mt Wareng) reflect the climatic changes that occurred in eastern Australia during the late Tertiary and Quaternary periods. The drier north-western part of the park supports plant communities with species typical of the Western Slopes of New South Wales, such as ironbarks and cypress pines.

Twenty species of rare and threatened plants are known to occur in the park, and for most of these species, the park contains the major remaining populations. For example, the park protects three of the four known populations of *Olearia cordata* and most of the population of *Acacia fulva*, which is restricted to the basalt soils on Mt Yengo and Mt Wareng.

Although the fauna of the park has not been well studied, 19 species of threatened animals have been recorded, including koala, regent honeyeater, turquoise parrot, glossy black cockatoo and broad-headed snake. The park also provides specialised
habitat for species such as the threatened brush-tailed rock wallaby, which now occurs only in very small disjunct populations in New South Wales and Queensland and is vulnerable to predation by foxes.

Nineteen species of amphibians and 57 species of reptiles have been recorded in the park, which is an unusually high occurrence. This is probably related to the relative lack of disturbance and the extensive, topographically diverse areas of sandstone terrain. The richness of the amphibians and reptiles is comparable to that documented for Australia’s Central Eastern Rainforest Reserves World Heritage Area. The occasional illegal removal of rock cover is a threat to the conservation of amphibians and reptiles in the park. Such cover provides sanctuary from predation, fire and drought, and is a necessary part of the habitat of many species such as the threatened broad-headed snake.

Areas of Hawkesbury Sandstone are particularly rich in Aboriginal sites and Yengo National Park conserves an important sample of known sites. Because the remote and rugged terrain has not been systematically surveyed, it is most likely that more sites are present than those currently recorded. Of particular significance to Aboriginal people is the imposing Mt Yengo, an area of freehold land within the park. It is a sacred site of documented ethnographic and religious significance. It is believed that many other Aboriginal sites in the park and surroundings relate to this site.

The park contains historic relics relating to early attempts by British settlers to establish a transport route north to the Hunter Valley. The ‘Great North Road’, located along the eastern boundary of Yengo National Park, was built by convicts and demonstrates innovative engineering techniques in steep terrain. The ‘Old Settlers Road’ was built by early settlers from Howes Valley on the western boundary, to provide a transport route between their valley and the Wollombi district. Stone embankments and pavements demonstrate early engineering techniques along the road’s route, much of which remains intact.
Brush-tailed rock-wallaby, Petrogale penicillata. Photo D Watts/Nature Focus
3.7 INTERPRETING THE PLACE

Presentation and promotion of the natural and cultural values of the Greater Blue Mountains nominated area is undertaken by the NSW National Parks and Wildlife Service (The Service) and the Jenolan Caves Reserve Trust, in accordance with their statutory charters governing management of reserves under their control. Policies relating to interpretation, education, promotion and visitor awareness programs for individual reserves in the area are addressed in their various management plans (described at 4.3 Management documents).

The major facilities for interpreting the nominated national parks and karst reserve are the Service’s Heritage Centre at Blackheath, in the Blue Mountains National Park, and the visitor facilities and guided tours at Jenolan Caves. A wide range of books, posters, brochures and other media on the parks’ resources is available at the Centre. Visitor information on the area is also disseminated from nearby Service offices and tourist centres and facilities outside the park, particularly the three information centres managed by the Blue Mountains Tourism Authority. In addition, the Service has installed large interpretation panels and explanatory maps at popular visitor locations in Blue Mountains National Park.

The Service licences private companies providing commercial educational and recreational activities in Blue Mountains, Kanangra-Boyd and Wollemi National Parks. As part of the licensing process, the Service, must approve any interpretative content included on the natural and cultural values of the parks. Authors are encouraged to promote minimal impact recreation use in the parks.

The Service offers regular guided walks and tours by trained rangers to outstanding features in many parts of the nominated area. Additional staff are employed for interpretive work during school holiday periods.
3. DESCRIPTION

_Grose Valley, Blue Mountains National Park. Photo I Brown_
Adoption of the ‘City in a National Park’ theme for the chain of towns crossing the Blue Mountains highlights the liaison with tourism bodies, local schools and the broad community to protect cultural and natural heritage values. *The Edge*, a ‘wilderness destination’ wide-screen IMAX film shown in the town of Katoomba, has opened the public’s eyes to the wild beauty of the Greater Blue Mountains and to its sheltering of endangered species, experiencing the visual delights of gorges, canyons and caves, without trampling sensitive environments. A multi-lingual information brochure outlines the values of the Blue Mountains parklands depicted in the film.

The Australian government assists those State and Territory agencies responsible for the ongoing management of World Heritage listed sites with their interpretation, presentation and promotional programs and will do so, if the Greater Blue Mountains Area is inscribed on the World Heritage List. In addition, Environment Australia promotes public awareness of the 1972 World Heritage Convention generally, and of Australian World Heritage listed properties specifically, through widely distributed information material and education programs on the significance and consequences of listing.

Interpretation of the wide and complex range of values of the Greater Blue Mountains will be an important part of the Strategic Plan to be prepared for the area, if inscribed on the World Heritage List. The Plan will develop policies and programs to present and promote the exceptional attributes of the area, in an integrated and coordinated way, involving local governments and the concerned community.
4. LANDSAT LOCATION

0  50 kilometers
Satellite image of nominated area and surrounds
5. LANDSAT DETAIL – DISSECTED SANDSTONE PLATEAU
WOLLEMI NATIONAL PARK

0 2 kilometers
3. DESCRIPTION
6. LANDSAT DETAIL – DEEP GORGE, GROSE VALLEY
BLUE MOUNTAINS NATIONAL PARK
7. GEOLOGY OF THE NOMINATED AREA

- Devonian Porphyry
- Tertiary Basalt
- Carboniferous Granite
- Triassic Hawkesbury Sandstone and Triassic Narrabeen Group
- Quaternary Alluvium
- Triassic Narrabeen Group
- Devonian Lambie Group
- Permian Coal Measures and Berry Formation
- Serpentinite
- Tertiary Alluvium
- Limestone
## 8. GEOLOGICAL DETAIL OF THE CENTRAL BLUE MOUNTAINS

<table>
<thead>
<tr>
<th>Formation</th>
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<tbody>
<tr>
<td>Tertiary Basalt</td>
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<td>Tertiary Sediments</td>
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<tr>
<td>Carboniferous Granite</td>
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<tr>
<td>Carboniferous Diorite</td>
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<tr>
<td>Triassic Wianamatta Group</td>
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<td>Triassic Hawkesbury Sandstone</td>
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<td>Triassic Narrabeen Group</td>
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<tr>
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<td>Permian Coal Measures</td>
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<td>Permian Berry Formation</td>
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<td>Jurassic Breccia</td>
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9. CONTINENTAL EUCALYPTUS DIVERSITY

The specimen data used in the derivation of this map was extracted from the Specimen Database maintained at the Environmental Resources Information Network. It represents data held by many herbaria and institutions.
10. VEGETATION OF THE NOMINATED AREA
11. KNOWN ENDEMIC EUCALYPTS IN THE NOMINATED AREA

- E. bensonii
- E. burgessiana
- E. prominula
- E. cannonii
- E. cunninghamii
3. DESCRIPTION

Sydney

0 10 20 Kilometers
12. KNOWN ENDANGERED, VULNERABLE AND RARE PLANTS IN THE NOMINATED AREA
13. KNOWN ABORIGINAL OCCUPATION SITES

- Axe Grinding Groove
- Open Camp Site
- Stone Arrangement
- Shelter with Deposit
14. KNOWN ABORIGINAL ROCK ART SITES

- Shelter Art Site
- Open Engraving Site
Sydney
4 MANAGEMENT
4. MANAGEMENT

4.1 OWNERS AND MANAGING AGENCIES

All land within the Greater Blue Mountains nominated area is public land, vested in the State of New South Wales (NSW). With the exception of the Jenolan Caves Reserve, the area is entirely reserved as national parks under the care, control and management of the Director-General of the NSW National Parks and Wildlife Service. The Jenolan Caves are dedicated as a karst conservation reserve under the care, control and management of the Jenolan Caves Reserve Trust. Both the National Parks and Wildlife Service and the Trust report to the NSW Minister for the Environment.

Wollemi, Yengo, Blue Mountains, Kanangra-Boyd and Gardens of Stone National Parks are managed by the Central Region of the NSW National Parks and Wildlife Service. The person responsible for management of the Region is:

Mr R Conroy,
Regional Manager, Central Region
NSW National Parks and Wildlife Service
PO Box 95, Parramatta
New South Wales 2124, Australia
Telephone: +61 2 9895 7420

Jenolan Caves Karst Conservation Reserve is managed by the Jenolan Caves Reserve Trust, a statutory body responsible to the NSW Minister for the Environment. The person responsible for management of the Reserve is:

Mr T Reedy
General Manager,
Jenolan Caves Reserve Trust
PO Box 1495, Bathurst
New South Wales 2795, Australia
Telephone: +61 2 6332 5888

4.2 LEGAL STATUS AND PROTECTIVE MEASURES

New South Wales

The seven national parks comprising the nominated area are reserved under the National Parks and Wildlife Act 1974, a statute made by the Parliament of the State of New South Wales. In addition, the Jenolan Caves are dedicated as a karst conservation reserve under the same Act. The Act states that, in considering and investigating proposals for national parks and
karst protected areas:

The Director-General shall have regard to the principle [that] the areas to be reserved as national parks are spacious areas containing unique or outstanding scenery or natural phenomena; and the areas to be dedicated as karst protected areas are areas of scientific, recreational, aesthetic or historical value within karst regions.

Under the National Parks and Wildlife Act, national parks and karst protected areas cannot be revoked or lands within them cannot be appropriated or resumed except by an Act of the Parliament of the State of New South Wales. These statutory protected areas are established primarily to conserve natural and cultural features. Mining and timber extraction are prohibited in the nominated area. Under the Act, the Director-General of National Parks and Wildlife Service is responsible for the management of parks and reserves, consistent with the purposes of their reservation and dedication, including:

- promoting educational activities
- carrying out works necessary for the management and maintenance of national parks and karst protected areas and
- undertaking scientific research necessary for the preservation, protection, management and use of national parks and karst protected areas.

In managing national parks and implementing the National Parks and Wildlife Act, the National Parks and Wildlife Service adopts the following World Conservation Union (IUCN) (1994) definition of a national park:

A natural area of land and/or sea, designated to
(a) protect the ecological integrity of one or more ecosystems for present and future generations,
(b) exclude exploitation or occupation inimical to the purposes of designation of the area, and
(c) provide a foundation for spiritual, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Other measures under New South Wales legislation, relevant to protection of the nominated area, include:

1. Plans of Management for individual reserves
3. Wilderness Act 1987

Plans of management

The Director-General is required to prepare a plan of management for each national park and karst conservation reserve, which addresses, amongst other matters:

- the conservation of wildlife (plants and animals) and the preservation of historic and Aboriginal relics
• the appropriate use of a park or reserve
• protection of a park or reserve against fire or erosion
• prohibition of the carrying out of any works adversely affecting the natural condition or special features of a park or reserve.

Once a plan of management for a park or reserve has been adopted by the Minister responsible for administering the National Parks and Wildlife Act, operations within that park or reserve may only be undertaken in accordance with that plan.

The status of plans of management for the nominated area’s parks and reserves and the provisions of those plans is discussed in 4.3 Management documents.

Land and water catchment management regulations
The National Parks and Wildlife (Land Management) Regulation 1995 enables employees of the National Parks and Wildlife Service to enforce provisions of the Act and the Regulation so that the natural and cultural features within parks and reserves are adequately protected from overuse and damage. Similar powers in the Sydney Water Corporation Limited (Catchment Management) Regulation enable employees of the Sydney Water Corporation to control pest species and regulate visitor use near stored waters.

Worldwide, Sydney is exceptional as a large city, as it is surrounded by a belt of wilderness-quality national parks and reserves. Part of this outstanding heritage contains the water catchments, which supply the city’s drinking water. The Blue Mountains, Kanangra-Boyd, Nattai and Thirlmere National Parks lie largely within the Warragamba Special Area catchment, covering 2,511 sq.km. Warragamba Dam provides 70 per cent of Sydney’s water supply. The Water Board (Corporatisation) Act 1994 requires that a plan of management be prepared to protect the quality of stored waters and maintain the ecological integrity and other values of the area. The National Parks and Wildlife Service retains its responsibilities for native flora and fauna, threatened species and Aboriginal and historic sites and relics.

Reservation of the catchment enabled the then Water Board to acquire property in the 1950s, preventing land clearing and controlling bushwalking activities. The completion of the Warragamba Dam in 1960 led to the closure of the catchment to private vehicles. Wilderness management techniques of the inner catchment limit the use of the areas close to the stored waters, to minimise the risk of pollution from human waste and fire. Effective catchment management is achieved through both park and water catchment plans of management. The zoning regime within the Warragamba Special Area parallels that of the zoning of the parks found within it.

Joint management within the catchment provides additional funding for the environmental management of issues such as pest control and fire.
The protection of drinking water supplies was also critical in the development of the Blue Mountains waste transfer scheme.

*Wilderness Act*

The *Wilderness Act* 1987 enables the Director-General to identify wilderness areas and recommend that they be declared by the New South Wales Minister for the Environment. Under the *Wilderness Act*, wilderness areas are defined as:

- being in a substantially unmodified state
- being of sufficient size
- capable of offering opportunities for solitude and self-reliant recreation.

Once an area of land has been identified and recommended for declaration as wilderness, the land is acquired and reserved as national park or added to an existing national park. Hence all declared wilderness areas lie within national parks.

Under the NPWS Wilderness Conservation Policy, 1989, vehicle access and horse riding in declared wilderness areas are prohibited and personal transport must be manually powered, such as with bicycles, canoes or skis. The objectives for protecting and managing wilderness under that Policy include:

- conservation of the natural features and processes of wilderness areas as a primary consideration, with a minimum of human interference
- conservation of significant cultural resources

in wilderness areas in accordance with the Burra Charter (Australia ICOMOS, 1988)

- maintenance of opportunities for solitude and self-reliant recreation and exclusion of activities which conflict with or diminish those opportunities.

The nominated area already includes two declared wilderness areas:

- Nattai Wilderness, an area of 29,822 hectares within Nattai National Park, declared in 1991, and
- Kanangra-Boyd Wilderness, an area of 125,000 hectares within Kanangra-Boyd and Blue Mountains National Parks, declared in 1997.

It also includes some 290,000 hectares within Wollemi and Blue Mountains National Parks, identified as wilderness under the *Wilderness Act*, and proposed to be declared as the Wollemi Wilderness in 1998. A further area of about 50,000 hectares within Blue Mountains National Park has been proposed as the Grose Wilderness in 1998. An area of over 60,000 hectares in Yengo National Park has been recognised for its wilderness qualities. A detailed investigation of the area under the Wilderness Act is being undertaken in 1998.

Once the Wollemi Wilderness, the Grose Wilderness and the wilderness area in Yengo National Park are declared, over 500,000 of the nominated one million hectares will be subject to the most secure form of protection possible under State law.
Threatened Species Conservation Act
Under the *Threatened Species Conservation Act* 1995, the National Parks and Wildlife Service is required to prepare recovery plans for species listed as threatened in the Schedules to the Act. A recovery plan has been prepared for the Wollemi Pine, an extraordinary tree species of the Araucaria family occurring in just two small populations in a single gorge in Wollemi National Park, only discovered in 1994. The Wollemi Pine Recovery Plan is discussed in detail in 5.3 Monitoring processes.

Other threatened species in the nomination area for which recovery plans will be prepared include the dwarf mountain pine, restricted to a few locations around Katoomba, and the Blue Mountains water skink, found only in high altitude swamps in the central Blue Mountains.

Environmental Planning and Assessment Act
The *Environmental Planning and Assessment Act* 1979 is a comprehensive statute enabling the orderly planning of land use and the assessment of the environmental impacts of developments. Under that Act, national parks are zoned ‘National Parks, Nature Reserves, etc.’ by local government authorities. All development within them is prohibited except where approved by the Director-General of National Parks and Wildlife Service or permitted under the *National Parks and Wildlife Act* 1974.

The Act controls development on private and public lands adjoining the Greater Blue Mountains area to minimise the impact of adjoining uses on its identified outstanding values. Extensive areas of adjoining bushland, in the Blue Mountains City area, are zoned *Environmental Protection* by the City Council, to prohibit subdivision of land, clearing of vegetation, construction of houses and industrial development.

Commonwealth of Australia

Australian Heritage Commission Act 1975
The *Australian Heritage Commission Act* 1975 established a Commission, which has responsibility for the Register of the National Estate – a national inventory of significant natural and cultural places within the Australian environment. Listing on the Register acknowledges the significance of a place and requires Commonwealth Ministers and agencies not to take any action that would adversely affect it, unless there is no prudent and feasible alternative. Its statutory effect extends only to Commonwealth actions and property.

Within the Greater Blue Mountains nominated area, the Jenolan Caves, Blue Mountains and Kanangra-Boyd National Parks, Newnes historic oil shale mine (in Wollemi National Park), the ‘pagoda country’ in Gardens of Stone National Park, and Thirlmere Lakes National Park are all listed on the Register of the National Estate.

World Heritage Properties Conservation Act 1983
The *World Heritage Properties Conservation Act* currently authorises the Commonwealth to take
action to prevent damage to, or destruction of, a World Heritage property by prohibiting any action considered to threaten its World Heritage values.

Review of environmental roles and responsibilities 1997

A review of Commonwealth/State Roles and Responsibilities for the Environment was conducted for the Council of Australian Governments (COAG) in 1997. It recognised significant recent advances in knowledge of the environment and impacts upon it and the need for Commonwealth legislation to keep pace with these changes.

The COAG agreed that the Commonwealth government should focus on matters of national environmental significance, rather than State or local significance and defined matters of national environmental significance, including World Heritage properties.

Under the legislative reform new Biodiversity Conservation and Environmental Protection Acts are to be drafted, with heritage legislation to be reformed at a later date. The Biodiversity Conservation Act will replace some existing legislation and will provide for implementation of the World Heritage Convention through cooperative arrangements between the Commonwealth and the States and Territories. It will place greater focus on early strategic planning efforts with the States in key areas such as World Heritage.

While the Commonwealth will optimise its reliance on accredited State processes, any actions adversely affecting a World Heritage property and not in accord with a bilateral agreement, will be regulated under the new Biodiversity Act and will trigger the Environment Protection Act.

4.3 MANAGEMENT DOCUMENTS

Plans of management: National parks

The NSW National Parks and Wildlife Service has prepared plans of management for all national parks in the Greater Blue Mountains nominated area, except for the recent Gardens of Stone National Park. The National Parks and Wildlife Act 1974, requires that a plan of management be prepared for each national park. The procedure for adoption of a plan is specified in the Act as follows:

- the Director-General gives notice that a plan of management has been prepared
- the plan is placed on public exhibition for at least one month and any person may make representations about the plan
- the plan and copies of all representations are referred to the National Parks and Wildlife Advisory Council for consideration
- the Director-General submits the plan, together with any comments and suggestions of the Council, to the Minister
- the Minister may adopt the plan, after
considering the comment of the Advisory Council, or may refer the plan back to the Director-General and Council for further consideration.

Once the Minister has adopted a plan of management, operations undertaken within the national park must be in accordance with the plan. Whilst several national parks in the nomination do not yet have adopted plans of management, their current management is consistent with the World Conservation Union IUCN (1994) definition of a national park and with the following general principles for national parks under the National Parks and Wildlife Act 1974:

- promoting educational activities
- carrying out works necessary for the management and maintenance of national parks
- undertaking scientific research necessary for the preservation, protection, management and use of national parks.

All national parks, whether covered by an adopted plan of management or not, must be managed to be consistent with the National Parks and Wildlife Service’s Field Management Policies (NPWS, 1989). These policies provide park managers with detailed guidelines for managing issues common to most national parks, and also address nature conservation, Aboriginal sites conservation, historic resources conservation, recreation, research and communication. Policies relevant to protecting and managing values in the nominated area include wilderness conservation (see 4.2 Legal status and protective measures), bushfires, exotic plants and introduced animals, Aboriginal consultation, walking tracks, interpretation and environmental education.

The status and relevant dates of plans of management for the national parks within the nominated area is shown below:

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<thead>
<tr>
<th>National Park</th>
<th>Status of Plan of Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thirlmere Lakes</td>
<td>adopted 1998</td>
</tr>
<tr>
<td>Wollemi</td>
<td>prepared 1996; to be adopted 1998</td>
</tr>
<tr>
<td>Nattai</td>
<td>prepared 1997; to be adopted 1998</td>
</tr>
<tr>
<td>Blue Mountains</td>
<td>prepared 1998</td>
</tr>
<tr>
<td>Kanangra-Boyd</td>
<td>prepared 1998</td>
</tr>
<tr>
<td>Yengo</td>
<td>to be prepared 1998</td>
</tr>
<tr>
<td>Gardens of Stone</td>
<td>to be prepared 1998</td>
</tr>
</tbody>
</table>

The general management objectives for all these national parks are the same:

- protection and preservation of scenic and natural features
- conservation of wildlife (plants and animals)
- maintenance of natural processes as far as is possible
- preservation of Aboriginal sites and historic features
- provision of appropriate recreation opportunities
• encouragement of scientific and educational inquiry.

In addition, the plan of management for each park has specific management objectives. The Blue Mountains National Park plan, for example, includes the following long-term vision, which reflects an integrated approach to protecting the nomination’s principal World Heritage values:

A world quality national park in which human-caused environmental changes are excluded or effectively controlled, natural biodiversity is stable or increasing, significant cultural heritage is effectively protected, a range of high quality nature-based recreational experiences are available on an environmentally sustainable basis, and the maintenance of these conditions is strongly supported by the community.

Specific objectives in the various plans of management protect the World Heritage values identified in this nomination.

Criterion 44 (a)(ii): Outstanding examples representing significant on-going ecological processes in the evolution and development of terrestrial, fresh water…ecosystems and communities of plants and animals.

As discussed under 2. Justification and 3. Description, the nominated area’s continuing ecological and biological processes of adaptation are significant in the evolution of highly diverse ecosystems and communities of plants and animals. Biological evolutionary processes include a high level of hybridisation between eucalypt species and of endemism at species and genus levels. The vegetation of the Greater Blue Mountains area is believed to be an outstanding demonstration of the range of interactions between fire regimes and plant species.

Relevant objectives in plans of management include:

• protection of the diverse range of plant and animal communities within the park and
• management of wilderness areas to ensure the maintenance of natural processes (Blue Mountains National Park)
• maintainance of the park’s bio-diversity (Wollemi National Park)
• management of the park to conserve natural biodiversity and to maintain natural processes (Kanangra-Boyd National Park)
• protection of the lakes in a stable and unpolluted condition (Thirlmere National Park).

Criterion 44 (a)(iv): 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.

As discussed under 2. Justification and 3. Description, the nominated area provides significant habitats for the conservation of biological diversity, including threatened and ancient species of
outstanding value. Almost a tenth of Australian vascular plants occur in the Greater Blue Mountains. The exceptional richness at all taxonomic levels makes the area unique amongst temperate forest environments in Australia.

The nominated area has a high concentration of threatened plant taxa, which makes it one of the most important habitats for in situ conservation of threatened plants in the world. The outstanding example is the Wollemi pine, a mono-specific genus related to Gondwanan vegetation of 60-200 million years ago, discovered in 1994. There are also fourteen threatened animal species recorded.

Relevant objectives in plans of management include:

- protection of the diverse range of plant and animal communities within the park, with particular attention to threatened species, endangered populations and endangered ecological communities (Blue Mountains National Park)
- maintenance of the park’s bio-diversity with emphasis on the protection of threatened species (Wollemi National Park)
- protection of the relict warm temperate and dry rainforest communities (Yengo National Park)
- protection of the rainforest communities (Nattai National Park)
- protection of the sub-alpine and rainforest communities (Kanangra-Boyd National Park).

**Criterion 44 (a)(iii): Superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.**

As discussed under 2. **Justification** and 3. **Description**, the combination of dramatic landforms, complex patterns of water flow, highly variable atmospherics, diverse eucalypt-dominated vegetation, rich wildlife and extensive wilderness areas for the experience of solitude in the Greater Blue Mountains has created an area of exceptional natural beauty.

Relevant objectives in plans of management include:

- protection and promotion of the outstanding scenic values of the park including protection of viewscapes from within and from outside the park and
- control and elimination where possible of disturbances affecting: declared or potential wild and scenic rivers, pristine catchments...wilderness areas, recreational values (Blue Mountains National Park)
- maintenance of existing recreation opportunities for visitors to experience the outstanding scenic, natural and wilderness qualities of the park (Nattai National Park)
- protection of wild and scenic rivers (Kanangra Boyd National Park)
- protection and where necessary restoration of areas to a wilderness condition within the
proposed Wollemi Wilderness (Wollemi National Park).

Criterion 24 (a)(vi): Directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.

As discussed under 2. Justification and 3. Description the nominated area of upland sandstone country is tangibly associated with Aboriginal occupation over at least 14,000, and probably 22,000, years to today, through extensive archaeological evidence and vivid displays of rock paintings and engravings. Through its extraordinary network of walking tracks, the nominated area also presents direct evidence of its long association with the international evolution of conservation concepts and practice, focussed on respect, enjoyment and protection of the natural environment.

Relevant objectives in plans of management include:

- management of recreation and tourism within the park to minimise impacts on cultural features
- encouragement of public awareness and appreciation of the park’s outstanding features, with particular emphasis on its unique place in the history of settlement of New South Wales and the development of the bushwalking and conservation movement in Australia (Blue Mountains National Park)
- protection of all Aboriginal sites and places and provision of opportunities for the Aboriginal community to continue their traditional practices and maintain sites (Yengo National Park)
- protection of all Aboriginal sites and places in partnership with the local Aboriginal community (Nattai National Park).

Plan of management: Jenolan Caves Karst Conservation Reserve

In 1988, a plan of management for the Jenolan Caves Reserve (as it was known then) was prepared by the Tourism Commission of NSW and the NSW Department of Lands, which held joint responsibility for the Reserve. There was wide consultation with interested people and affected organisations. The plan was amended as a result of those consultations and was adopted in 1989, by the NSW Minister for Natural Resources, the State Minister responsible for Crown land reserves at that time.

The adopted plan for the Reserve includes a principal aim:

...to provide a reasonable and flexible framework for the practical management of Jenolan Caves Reserve commensurate with its natural and cultural resources and the terms of the Reserve notification (protection of the caves).

The following specific objectives are relevant to the protection of the values of the nominated area:
to recommend methods for the presentation of the karst system, cultural heritage and biophysical resources of the Reserve
• to align management of the Reserve on a total catchment approach and consider the impact of and on adjacent land uses
• to identify areas of existing and potential damage to the karst resource and make recommendations on its mitigation
• to develop a communications strategy involving information, interpretation and environmental education to effectively convey the themes of Jenolan to the public
• to facilitate liaison with adjoining land managers, statutory, and other bodies and make recommendations on continuous liaison and communication.

In 1997, the Jenolan Caves Reserve Trust produced a State of the Environment Report for the caves. This is discussed in detail in 5.3 Monitoring processes.

4.4 FUNDING, EXPERTISE, STAFF AND TRAINING

Funding

The management of the national parks in the nomination are largely funded by annual grants from the New South Wales government, with about 5% of funds coming from revenue directly earned by the NSW National Parks and Wildlife Service. The Jenolan Caves Karst Conservation Reserve Trust funds almost all its operations through revenue, with less than 10% of its costs being met by government grants.

In 1997, $7.4 million (Aus) was spent managing all the protected areas in the nomination, including staff salaries, but excluding extraordinary fire fighting costs. Some $4.3 million was spent managing national parks; $3.1 million was spent managing the Jenolan Caves.

The majority of funds spent in the management of the national parks and karst reserve are allocated to the maintenance of services and facilities for visitors (NPWS, 1997). Those services and facilities include walking tracks, signs, parking areas, lookouts, guided tours, information centres, camping areas, toilets, picnic areas and roads, and salaries for staff providing visitor services.

Extraordinary costs are sometimes incurred by the National Parks and Wildlife Service for managing major incidents in the nominated area such as wild fires, which must be controlled to minimise damage to property in adjoining towns and to protect natural and cultural resources in the protected areas. The cost of controlling wild fires varies from year to year depending on the severity of the fire season. Funds for controlling fires are provided by the State Government separately from the Service’s regular annual funding. In 1997-98, several hundred fires were recorded in protected areas in the nominated area over an eight month
period and cost the Service about $9 million to control. However the Service normally spends less than this on controlling fires. In 1994-95, for example, fire control costs were about $2.2 million, and in 1996-97, only some $0.5 million.

**Expertise, staff and training**

Within the Greater Blue Mountains nominated area, a total of 106 people are employed, of whom 33 are professional staff, 38 technical staff and 35 maintenance staff. The professional staff includes managers, rangers, tour guides and fire management officers. Technical staff includes pest species officers, administrative officers, visitor centre staff, infrastructure managers and interpretations staff. Maintenance staff is involved in on-ground maintenance of the facilities and natural and cultural features in the parks.

Professional and technical staff are trained in a range of specialisations, including natural and cultural resource management, financial and human resource management, business development, pest control, fire management, environmental impact assessment, ecology, archaeology, and community consultation and education. Maintenance staff are trained in a wide range of manual and technical skills, including many staff with trade qualifications in electrical work, carpentry, stone masonry, plumbing, automotive engineering, and building. Other maintenance skills include machinery driving, fire fighting, soil stabilisation and rehabilitation, pest control, and design and construction of specialised facilities such as walking tracks.

**Adequacy of staffing and funding**

The protected areas in the Greater Blue Mountains are managed and maintained by a professional, well trained and highly experienced work force, committed to the conservation objectives in the plans of management for the areas. Staff members are flexible in their approach to their duties and are prepared to respond quickly to changing requirements, such as increased visitor numbers at popular locations, concentrations of pests requiring rapid control or wild fires requiring immediate suppression. This flexibility of resource use means that staffing and funding remain adequate under variable circumstances.

Flexibility is also reflected in the ability to move staff between protected areas and to obtain additional funds to deal with threats to the integrity and values of the nominated area such as wild fires. To control wild fires the National Parks and Wildlife Service regularly supplements existing staff in the area with staff and equipment from elsewhere in the State. This enables it to control and quickly extinguish wild fires, which might otherwise develop into larger, more costly fires with greater impacts on the area’s values and on adjoining property.
Both the State and Commonwealth Governments are committed to continuing to protect and present the World Heritage values of the protected areas in this nomination. A range of specific programs will be developed in a strategic plan for the whole area, to include presentation of the area to visitors and bio-diversity and cultural resource surveys to enable long-term monitoring of the condition and integrity of the World Heritage values.

4.5 VISITATION

Visitor statistics

As explained in 2. Justification and 3. Description, the vast Greater Blue Mountains area is the nearest upland country to the major city of Sydney. It is a well recognised and much loved place, attracting many local, national and international visitors. In 1997, almost 2.5 million people visited the area.

Within the nominated area, it is the Blue Mountains National Park and Jenolan Caves Karst Conservation Reserve which receive by far the greatest number of visitors a year, many times more than the other parks, such as Gardens of Stone or Nattai. The high levels of visitation in these former areas, however, are environmentally sustainable, being generally confined to discrete developed areas such as lookouts and other visitor facilities, with little or no impact on outstanding natural heritage values.

In 1997, the estimated number of visitors to all the protected areas in the nominated area totalled 2,364,000 (A. Ramsay, pers. comm.). Visitors were distributed as follows:

<table>
<thead>
<tr>
<th>reserve</th>
<th>area (hectares)</th>
<th>visitors/ year</th>
<th>share of total visitation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Mountains NP</td>
<td>247,840 ha</td>
<td>1,935,000</td>
<td>82%</td>
</tr>
<tr>
<td>Jenolan Caves KCR</td>
<td>2,422 ha</td>
<td>264,000</td>
<td>11%</td>
</tr>
<tr>
<td>Wollemi NP</td>
<td>499,879 ha</td>
<td>80,000</td>
<td>3%</td>
</tr>
<tr>
<td>Kanangra-Boyd NP</td>
<td>65,379 ha</td>
<td>40,000</td>
<td>2%</td>
</tr>
<tr>
<td>Yengo NP</td>
<td>153,483 ha</td>
<td>24,000</td>
<td>1%</td>
</tr>
<tr>
<td>Thirlmere Lakes NP</td>
<td>641 ha</td>
<td>15,000</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Gardens of Stone NP</td>
<td>15,150 ha</td>
<td>5,000</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Nattai NP</td>
<td>47,855 ha</td>
<td>1,000</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,032,649 ha</td>
<td>2,364,000</td>
<td></td>
</tr>
</tbody>
</table>

Visitor facilities

As the nominated area consists largely of rugged bushland, most visitor facilities are concentrated in a few locations towards the edges of the parks and with good vehicle access. The principal visitor facilities of information centres, food outlets, picnic and camping areas, lookouts and walking tracks are, however, extensive. Their locations within each reserve are summarised below.
Wollemi National Park
There is a National Parks and Wildlife Service visitor information centre at Bulga. Overnight camping and picnicking areas are accessible by vehicle, and there are walking tracks at Dunns Swamp, Newnes-Glow Worm Tunnel, Wheeney Creek and Colo-Merou on the Colo River.

Yengo National Park
There is a picnic area and camping area at Mogo Creek in the south and a camping area and lookout at Finchley Trig in the centre of the park.

Gardens of Stone National Park
There are no visitor facilities, although fire trails provide easy access for walkers. Vehicular access is limited due to the environmental sensitivity of the area.

Blue Mountains National Park
Most visitor facilities are concentrated around the chain of towns on the Great Western Highway, which divides the park into northern and southern sections. As the park receives about two million visitors a year, there are numerous facilities of all types to cater for them, mostly situated along its edges. Facilities in the park and their principal locations include:

- walking tracks from Blackheath, Katoomba, Wentworth Falls and Glenbrook townships
- major lookouts at Glenbrook, Mt. Victoria, Blackheath, Katoomba, Wentworth Falls and along Bells Line of Road
- picnic and camping areas near Glenbrook, Woodford, Lawson and Blackheath, at Burralow Swamp and in several southern locations
- NPWS visitor information centre at Blackheath; also centres at Glenbrook, Echo Point and Wentworth Falls.

Kanangra-Boyd National Park
Walking tracks lead from the Boyd Plateau public road, as well as to Hollander’s and Kowmung Rivers. The well-known Six Foot Track from Jenolan Caves to Katoomba runs through the north of the Park. The Boyd River Crossing provides a car-based camping site and three more camping areas are accessible to four wheel drive vehicles. Kanangra Walls provides lookouts, picnic area, interpretation signs and walking tracks. Some of the several karst areas are popular recreational caving sites, but will not be developed.

Nattai National Park
Several walking tracks to the east are provided near the townships of Hilltop and Couridjah. An informal lookout to the south offers expansive views.

Thirlmere Lakes National Park
Picnic areas, with car parking, are provided on the shores of the lakes, with walking tracks and several public roads.

Jenolan Caves Karst Conservation Reserve
Due to its popularity and long history of public visitation (it was opened to the public in 1866),
Jenolan Caves Karst Conservation Reserve is the most intensively developed reserve in the nominated area, despite its relatively small size (2,422 hectares). This results partly from its isolation from urban tourist facilities, and partly from the tradition of managing public reserves, through the provision of accommodation and visitor facilities within the reserve. Caves House was built in the late 1890s to attract visitors and provide a high standard of accommodation close to the major attraction of the caves system.

The Reserve includes a comprehensive range of facilities for visitors and for management of the caves system, including Caves House, kiosks, parking areas, utilities, picnic areas, walking tracks, staff housing and workshops.
THE GREATER BLUE MOUNTAINS AREA

World Heritage Nomination
PRESSURES AND RESPONSE
5. PRESSURES AND RESPONSE

5.1 DEVELOPMENT AND TOURISM

By virtue of its size and the declared wilderness within it, the Greater Blue Mountains area is generally well protected from the impacts of development and tourism. (See 4.2 Legal status and protective measures, and the Wilderness Act). Wilderness declarations prohibit public vehicle access and commercial developments. More than 500,000 hectares out of the nominated area’s one million hectares will soon have enhanced even further its protection from development and tourism pressures.

Reserves outside declared wilderness are subject to development pressures to varying degrees. However, as mining, logging and grazing by domestic stock are prohibited within the Greater Blue Mountains area, these pressures are limited to impacts from adjoining areas.

The Sydney metropolitan area has some 3.7 million inhabitants. Its proximity, combined with the attractions of the Greater Blue Mountains, has increased the interest in the latter as a tourist destination. In addition, rapidly changing land use patterns nearby coupled with urban growth, lead to some development pressures discussed below.

Urban development: Pressure

The east-west chain of small towns of the Blue Mountains City Council divides the Blue Mountains National Park into two. Nineteen towns are linked across some 50 kilometres, some adjoining, others separated by several kilometres of undeveloped bushland. Whilst the combined population of these towns is not large (approximately 80,000 people in 1997), they are located on a series of ridge-tops which drain either north or south into the national park.

The City of the Blue Mountains with its series of townships, is attractive for urban growth because of its relative proximity to the employment centres in Sydney, good road and rail links and bushland setting. Whilst most natural bushland in the area is conserved in the Blue Mountains National Park, some areas close to existing urban areas remain in private ownership. Urban development on ridges tends to damage downstream areas of natural bushland by increasing:

- weed invasion
- soil fertility from garden fertilisers, urban run-off and in some places sewage effluent
- numbers of domestic and feral cats and dogs prying on native animals
- erosion of sandstone soils and sedimentation of streams
- the number of deliberate fires most of which are lit to reduce the risk of serious bushfires
Urban development: Response

Since the introduction of the New South Wales Environmental Planning and Assessment Act in 1979, development controls have evolved in sensitive areas, like the Blue Mountains, to address the needs of the community and competing interests, following careful consideration of the natural environment.

The Blue Mountains Council adopted a new local environmental plan in 1991, with the stated intention of providing positive guidelines for future development to protect the natural character of the Blue Mountains. The plan established bushland buffer zones separating the existing towns and the Blue Mountains National Park. Steep, erosion prone areas, significant vegetation communities such as hanging swamps, alluvial forests and rainforests, environmentally sensitive escarpment lines, large natural areas between towns, bushfire hazard and water catchment areas feeding creeks and waterfalls are all protected by this plan.

Areas significant to conservation have been preserved, by State and Local government-funded land acquisition programs. In 1997, the State Government provided $500,000 to acquire land that had been inappropriately subdivided in the past and to fund the purchase of environmentally sensitive land. Extensive areas of private land have been zoned for environmental protection, where only utilities, roads, walking tracks and bushfire management are allowed.

Through the Act, effective planning and land use management tools have curbed inappropriate urban growth. This avoids expensive extension of infrastructure through sandstone plateaus, protects drinking water catchments, minimises bushfire hazards, supports the strong community commitment to bio-diversity protection and prevents the environmental decline experienced by other scenic areas adjoining major capital cities.

Water Management: Pressure and response

Blue Mountains streams have been subject to contamination from poorly treated sewage for decades. In 1987, the Sydney Water Corporation, responsible for sewerage and water services, initiated a $250 million sewage transfer and treatment scheme to be implemented over 25 years. The scheme has the following features:

- decommissioning seven antiquated treatment plants.
- transferring the sewage from Blue Mountains urban areas to a modern treatment plant, by a 40km sewage transfer tunnel cut through sandstone. The sewage receives tertiary treatment, removing nutrients before discharge.
- connecting some 7,000 additional dwellings to the reticulated sewage network. In 1996, the government announced a further $20 million to connect a further 1,600 homes by 2001.
- the Corporation is transferring Mt Riverview flows to Penrith and considering options to improve treatment, or transfer, for Glenbrook.
• the Corporation is examining options to upgrade sewage treatment at Medlow Bath, Blackheath and Mount Victoria by 2008. The environmental impact report will be published in 1998.

The waste transfer scheme has achieved a four-fold improvement in water quality for previously polluted streams in the Blue Mountains. (The Wollemi wilderness is upstream from major settlements. Its streams do not suffer from sewage pollution.) A tertiary treatment plant for Southern Highlands residential areas will reduce sewage pollution discharged into the Nattai River. The environmental impact report for this work was completed early in 1998.

Gains in water quality and sediment control are being achieved through the $15 million 'Blue Mountains Urban Run-off Control Program'. Works include sealing roads to reduce stream sedimentation, restoring degraded sites, installing storm-water detention basins, weed control and bush regeneration.

**Coal mining: Pressure**

The nominated area is underlain by a series of coal seams. While mining is prohibited in all parts of the nominated area, some underground and open-cut mining continues outside the boundaries of the Nattai, Thirlmere Lakes, Blue Mountains and Wollemi National Parks. Further mines are planned for locations nearby.

The potential impact of coal mining includes altered hydrology and stream flows, sedimentation of streams, pollution by heavy metals in mine run-off, subsidence of land or collapse of cliffs close to or above mined coal seams. Cliff collapse is the most enduring impact of mining, of particular concern in areas of spectacular sandstone cliff faces or delicate rock structures such as the 'pagodas' north of Lithgow.

**Coal mining: Response**

Mining is prohibited in national parks under the *National Parks and Wildlife Act*. To facilitate negotiations on mining proposals and the management of protected areas, a Memorandum of Understanding has been agreed by the State’s National Parks and Wildlife Service and Department of Mineral Resources. It resolves issues of potential damage to natural values from mining activities close to the nominated protected areas.

Proposed mining operations must be assessed through an environmental impact statement and are subject to community consultation before any approval is granted. For mining proposals in the vicinity of the Greater Blue Mountains, this process includes assessment of impact on the hydrology of streams and underground water tables, pollution of streams from mine run-off and the impact of mine subsidence on the natural land surface and cliffs. If approved, stringent conditions are placed on the distance of extraction from escarpments, cliffs and geological formations such as 'rock pagodas' to prevent collapse or other damage.
Warragamba Dam: Pressure and response

Warragamba Dam supplies 70% of the Sydney metropolitan area's water supply. Its catchment lies within the southern part of the nominated area. The NSW government’s Dams Safety Committee has advised of the need to prevent a possible dam failure during a maximum possible flood event, which could affect the lives and property of up to 50,000 people downstream and cause major water restrictions for Sydney's population.

One option was to raise the dam wall for the temporary storage of floodwaters, until the flood subsided. This would inundate parts of the Kanangra-Boyd Wilderness and the Nattai Wilderness for up to five weeks in the event of the maximum possible flood.

The New South Wales government has decided not to proceed with this option, but instead to construct a second spillway to cope with a major flood event and protect the dam from failure. The government approved the findings of environmental studies for the spillway and will start construction of the spillway in 1998. This has removed the danger of irreversible damage to some 3,000 hectares of the nominated area, in the event of a major flood.

Tourism: Pressure

Possible inscription on the World Heritage List may increase visitor use of the Greater Blue Mountains national parks. Most of the nominated area consists of rugged, inaccessible lands with little vehicle access. As a consequence, there are fewer visitors and less tourism pressure on most of the area than in other national parks of the Sydney region. Royal National Park, a reserve of 15,000 hectares on the southern edge of Sydney, has good road and public transport access and receives about 2 million visitors a year. This is significantly more intense than in the protected areas of this nomination, with a total area of some million hectares and about 2.4 million visitors a year.

Visitors to the Greater Blue Mountains tend to congregate at a few accessible locations with good visitor facilities and nearby services. Tourists visit lookouts, picnic areas and walking tracks close to the townships, such as Echo Point and Govetts Leap (82% of all visitors to the nominated area). Intensive visitation also occurs at the outstanding karst formations at Jenolan Caves, with its road access and well developed facilities. Although Jenolan Caves Reserve receives fewer visitors than the Blue Mountains National Park, the visitation is very concentrated, in about 10 of the reserve's 2,400 hectares.
Tourism: Response

The current management of the nominated area ensures that core park areas are not degraded by over-use and that large-scale tourism is attracted to nearby areas that can absorb the increase with minimal environmental impact.

Wilderness management has developed since 1934 and continues to resolve many conflicts between park visitor use and conservation. At that early time, the Council stated:

...national parks should consist of both primitive areas (wilderness) and motor tourist areas. The primitive area portion should be compacted wherever possible, and the tourist open areas be more in the nature of access points to the perimeter of the whole national park. By this means, motor tourists may obtain a maximum number of avenues of approach, and maximum change of location without actual penetration into the wilderness heart of the region. Thus the requirements of the future are looked after... fire danger is lessened; no forest growth is destroyed by wholesale camping; the inner water supply rising from selected elevated areas is protected; and wildlife given a real chance to maintain itself.

In keeping with these initial concepts, roads and facilities for visitors are located toward the edges of national parks (as at Echo Point, Katoomba) and accommodation is provided in adjoining rural districts or the Blue Mountains towns. Regional tourism management minimises the environmental impact of commercial use on the natural qualities of the park estate. The Blue Mountains City planning controls ensure that nature-based tourism does not become commercial resort development of adjoining bushland areas. Key visitor use and tourism issues generated by a possible inscription of the nominated area on the World Heritage List are addressed by existing park plan of management processes (See 4.3 Plans of management). If listed, a joint, strategic plan for the whole area is to be prepared by the Commonwealth and State governments.

Management authorities are recognising the need for some limits to visits to the Blue Mountains National Park and Jenolan Caves Karst Conservation Reserve, to reduce impacts on the natural environment and improve the quality of visitors' experiences. In 1998, the National Parks and Wildlife Service and Blue Mountains Council prohibited rock climbing on the Three Sisters rock formation and restricted vehicle access to Echo Point, which overlooks it. The Jenolan Caves Reserve Trust now charges visitors for parking and is investigating alternative access, to limit vehicle arrivals at the caves precinct.

In 1995, the National Parks and Wildlife Service prohibited power boats in the Thirlmere Lakes, in order to protect the unique plants and animals in the lakes from petroleum-based pollutants and to avoid disturbance of other park visitors, by the noise of water skiing in a confined environment. This prohibition appears in the Park’s plan of management of 1997.
5.2 ENVIRONMENTAL PRESSURES AND NATURAL DISASTERS

Wild fire: Pressure

Fire is the major natural disaster to threaten the values of the nominated area. The temperate forests of south eastern Australia, which include the Greater Blue Mountains, lie in one of the most hazardous fire regions of the world, comparable with southern France and southern California, USA (Cunningham, 1984). This is because of the region’s highly flammable sclerophyll vegetation, exposure to strong, dry winds and rapid weather changes, the variability of rainfall, long droughts, topography conducive to unpredictable, catastrophic fire behaviour and uncontrollable causes of wild fires, such as lightning strikes or arson.

Fires have strongly influenced the composition and distribution of natural vegetation communities in the Greater Blue Mountains, through their frequency, season, extent and intensity. Little is known, however, about the history or prehistory of fire frequency and extent.

Fires started by humans, near roads and tracks, occur more frequently than fires naturally started. A non-variable fire regime, characterised by frequent fires, is damaging to the conservation of natural values, since some fire-dependent plants of the nominated area require a fire-free period of up to 20 years (Keith 1994).

Areas adjacent to the chain of towns experience more fires from human causes than remote areas. The Grose Valley, of some 60,000 hectares north of the townships of Springwood and Katoomba, has been burnt by major wild fires at least four times since the 1950s. Its most recent fire, in 1994, is believed to have been deliberately lit.

Other, more rugged, parts of the nominated area, – such as Kanangra-Boyd and Nattai National Parks – with strict controls on vehicle access, experience fewer human-caused fires but are susceptible to fires by lightning strike.

Fire management: Response

Fires in the nominated area are managed co-operatively by the National Parks and Wildlife Service and the Rural Fire Service, which co-ordinates the major contribution of personnel and equipment from volunteer fire brigades, under their respective Acts. The objects of the Rural Fires Act 1997 include:

- prevention, mitigation and suppression of bush fires
- protection of the environment by requiring that certain fire management activities are carried out in an ecologically sustainable way
- co-ordination of bush fire-fighting and bush fire prevention
• protection of persons from injury or death, and of property from damage, caused by fires.

The National Parks and Wildlife Service has responsibility for fire management within national parks. It must manage fire to reduce threats to life and property and to maintain bio-diversity. Plans for fuel reduction and wild fire suppression are formulated by local Bush Fire Management Committees, with representatives from the local Council, National Parks and Wildlife Service, local community, conservation groups, rural landholders, local bush fire brigades and local Aboriginal groups.

Fire management and emergency response are carried out by bushfire volunteers and professionals, coordinated by the National Parks and Rural Fire Services. Public participation is crucial for their success. Insurance companies support bushfire management through funding for infrastructure. Early protection is offered in the Greater Blue Mountains area through aerial surveillance in the fire season and helicopter-trained fire fighters identifying and extinguishing fires in remote areas before they become uncontrollable.

A strategic approach is adopted to managing wild fire risk to life and property and protecting natural and cultural values. Fire risk close to adjoining properties is minimised, while more ‘natural’ fire regimes are allowed in remote areas. The strategies also focus on protecting valued elements, such as the Wollemi Pine habitat, from human-caused fires.

Planned fires are initiated in infrequently burnt areas, to maintain patterns of vegetation communities and the diversity of fauna habitats, in accordance with plans of management and on the approval of the bush fire management committee. Restricted access in wilderness-declared areas reduces human-induced fires. Half the Greater Blue Mountains nominated area will soon be declared wilderness, thus significantly reducing the threat of unnatural fire regimes in the area. The National Parks and Wildlife Service holds fire insurance, which has enabled rehabilitation of wilderness values by removing temporary fire trails and installing vehicle controls over permanent tracks in wilderness areas.

Alien species: Pressure

Most of the Greater Blue Mountains area is free from high density weed occurrence. Localised problems are associated with disturbed sites, polluted watercourses, zones adjacent to urban and rural development, altered fire regimes and areas where introduced animals have contributed to the spread of introduced weeds.

Extensive, dense weeds have appeared at recently redundant sewage treatment plants in Katoomba and Wentworth Falls. These weed plumes extend directly into the park or threaten it. The Colo and Coxs Rivers are affected by willow and blackberry. Generally, weed plants of concern include prickly pear, serrated tussock, tree of heaven, scotch broom, gorse, privet and montbretia.
Introduced, now feral, animals within the nominated area include pig, rabbit, goat, horse, dog, cat, red fox and the European honey bee. These pests may cause significant impacts on native flora and fauna. Introduced predators such as fox and cat do the most harm to native animal populations, by preying on native fauna and competing with native predators. European bees compete with and displace many native pollinators and have been found to interfere with the reproductive processes of many native plants.

**Alien species management: Response**

Nutrient-poor sandstone soils and wild fires naturally limit most weed occurrences, provided water pollution and soil erosion are controlled. The Blue Mountains Bushcarer network and environmental weed control programs have ensured that weed dispersal into the central part of the nominated area is contained within manageable levels.

Many measures are taken within the nominated area to protect wilderness and bio-diversity from disruption by pest species, including the following:

- priority control of noxious weeds with a high spread potential
- co-operative work with Sydney Water Corporation to control weeds following decommissioning of sewage treatment plants
- eight separate collaborative programs targeting English/Scotch broom, gorse, lantana and mixed species in bush regeneration programs and bushwalker eradication of willows from 100 kms of the Kowmung River
- appointment of pest species managers to the Parks Service to upgrade park management in the proposed World Heritage area
- completion of a pest species management plan for the Blue Mountains
- implementation of pest management programs in the Wolgan Valley and elsewhere in the new Gardens of Stone National Park
- treating, in cooperation with local council officers, hundreds of hectares infested with Serrated Tussock
- final phasing out of domestic stock grazing under lease
- eradication of horses and cattle from the Grose wilderness and reduction within the Kanangra-Boyd and Nattai wilderness areas, as a result of pest species management
- an assessment of a significant rock wallaby habitat in the Wolgan Valley for future feral cat and fox control programs
- implementation of new pig control techniques for use in remote areas, such as the Kowmung valley, with the assistance of bushwalking clubs. (Pigs are a recent occurrence and control programs are proving successful.) Co-operative pig control programs with related departments. Feral pig programs targeting problem areas in Wollemi National Park
- the release of rabbit calicivirus, reducing rabbit populations in the nominated area and thereby reducing fox numbers
the ongoing project of the Friends of Blue Gum to control the spread of Scotch broom and gorse along the Grose River. The Friends, with Council and Parks Service support, are mapping and eradicating, with exceptional dedication, broom and gorse over 60 kms of river.

**Environmental pressure: an example of community response**

Support for nature conservation is reflected in all levels of Blue Mountains community endeavour. There are 27 active Bushcare groups in the Blue Mountains City Council area alone. These groups rehabilitate community-owned bushland at the urban interface. Through this program, the Council has expanded four-fold its bushland management program. These groups, by their work, broaden community awareness of environmental management issues associated with the Blue Mountains City within a National Park.

Over 75,000 hours of voluntary bushland protection were undertaken in the 1996/97 financial year, with the support of State and local governments. Bushcarers have, for example, abseiled to isolated pockets of the Blue Mountains dwarf pine habitat on cliff faces and waterfalls of the Blue Mountains National Park, to remove weeds that were crowding this critically threatened plant.

### 5.3 MONITORING PROCESSES

Recognising the World Heritage Committee’s requirement for systematic monitoring and reporting from States parties on a regular five yearly basis, an overall monitoring process will be established, on the inscription of the Greater Blue Mountains area, to ensure that the Committee’s reporting requirement is carried out.

Conservation management in the Greater Blue Mountains nominated area is currently considered to be effective. To confirm this, the National Parks and Wildlife Service will incorporate monitoring systems into plans of management, when they are reviewed. Pending this, a systematic monitoring process will be built into the proposal Strategic Plan for the Greater Blue Mountains area, discussed in 2.6.**Integrity and authenticity.** For example, the Montreal Process Indicators for ecologically sustainable forest management will be applied to management activities carried out in national parks. Several monitoring exercises have recently been undertaken for specific locations or features within the nominated area, such as:

- information on the occurrence of introduced species, compiled for all national parks in the area
- fire history records, maintained and updated annually for management planning
- the Wollemi Pine Recovery Plan
- the Blue Mountains bio-indicators survey and research project
• the Jenolan Caves Reserve social and environmental monitoring program. Valuable reactive monitoring on the condition of the nominated area continues to be undertaken by local citizens in bush care networks and environment groups. These volunteers assist in identifying threats to the area’s natural values and in controlling their impacts, such as weed eradication and feral animal control.

As a result of its Social and Environmental Monitoring program, the Jenolan Caves Reserve Trust produced its first State of the Environment Report in 1997, assessing all aspects of the caves, including:

• impacts of infrastructure and pollutants on the natural environment
• physical and chemical properties of the caves – sedimentation, water quality, air quality, speleotherm discoulouration and radon
• biology of the reserve and the caves – flora, fauna, endangered species, resource inventory and control of exotic species
• condition of the built environment – road access, visitor facilities and interpretation materials
• visitors to the caves – origins, experience and expectations.

The first State of the Environment Report found that –

• physical and biological resources need proper protection, in light of increasing visitor numbers
• several potential sources of pollutants from infrastructure should be carefully monitored
• water quality is acceptable, although increased sedimentation from hillsides, car park and road embankments is possible
• management should minimise erosion and disturbance to soils and karst features
• the major threat to cave fauna comes from organic matter carried in by visitors (67 species of cave invertebrates have been identified)
• feral pigs and foxes are the major exotic animals to be targeted for control and the control program of sycamore trees and blackberries should be continued.

Wollemi Pine Recovery Plan

The Wollemi Pine, (for description of this extraordinary plant, see 3.3 Bio-diversity) is the first species for which a recovery plan has been prepared under the provisions of the Threatened Species Conservation Act 1995. Under the Act the Director-General of the National Parks and Wildlife Service is required to prepare recovery plans for all threatened species listed in the Schedules to the Act and implement actions in those plans.

The overall objectives of the Recovery Plan for the Wollemi Pine are to protect the known populations from decline induced by non-natural sources and to ensure that the wild populations remain viable in the long term. Specific objectives are to:

• understand the ecology of the species
• determine the range of genetic variability of the known populations
• establish representative ex situ populations in botanic gardens
• determine if further wild populations exist
• protect any new populations and their habitat.

Bio-Indicators Survey and Research Project

In 1996, the National Parks and Wildlife Service researched the potential use of biological indicators to monitor the effect of disturbances, such as pollution and clearing, on the ecology of bushland close to the chain of towns in the Blue Mountains National Park. To determine suitable bio-indicators, the research study assessed the quality of fauna habitats; sampled water quality and invertebrates in streams; and assessed vegetation communities, terrestrial invertebrates and herpetofauna.

Stage 1 of the Bio-Indicators Project (AMBS Consulting 1997) included the following findings:

• streams in natural bushland catchments had higher water quality than those with largely urban catchments, although differences were not great
• signs of disturbance, such as rubbish or weeds, were generally absent from stream catchments less than 1km downstream from their source, although weed infestations were observed where urban development extended well into stream catchments
• weed abundance increased at high altitudes, possibly because of greater urban development, in the catchments of the central and upper mountains
• vertebrate fauna habitats were comparatively undisturbed less than 1km from the top of stream catchments, with habitats in the lower mountains less disturbed than habitats in the central and upper mountains
• in the lower mountains the proportion of weeds was higher in bushland than in urban catchments, perhaps due to a high fire frequency or to severe bushfires in the area in 1994
• three groups of terrestrial fauna were identified as potential bio-indicators of ecological degradation: amphipods (a crustacean family), collembolans (an insect family), and several species of small skinks (in the reptile family). No bio-indicators were determined for degradation in aquatic environments.

The National Parks and Wildlife Service has received additional funding from the Urban Runoff Control Program (see 5.1 Development and tourism) to undertake Stages 2 and 3 of the Bio-Indicators Project and to address the issues raised in the above findings.

Ecologically sustainable forest management

The Commonwealth and New South Wales Governments have agreed to undertake comprehensive regional assessments of the natural and cultural values of forests (the CRA process), to ensure that their conservation values are protected
and that they are managed using ecologically sustainable principles (ESFM). Primary goals of ESFM are defined as restoring, maintaining or enhancing:

- ecological processes within forests
- biological diversity of forests at the ecosystem, species and genetic levels
- natural and cultural heritage values of forests
- long term social and economic benefits on an economically sustainable basis, and
- intangible benefits of forests and maintenance of options for the future.

A meeting in 1995 between 12 major countries with temperate and boreal forests (known as the Montreal Process) defined several criteria for measuring ESFM, including:

- ecosystem diversity
- maintenance of ecosystem health and diversity
- conservation and maintenance of soil and water resources, and
- legal, institutional and economic framework for forest conservation and sustainable management.

The Montreal Process specified indicators for each criterion, and the National Parks and Wildlife Service is required to monitor and report on implementation of these indicators in protected areas. In the Greater Blue Mountains area, the Service will include a monitoring system for relevant indicators in plans of management for protected areas with a requirement that management of protected areas must ensure that the indicators are met.

The Service will use the data from natural resource surveys undertaken in the CRA process as the benchmark for determining compliance with the Montreal Process indicators, and for ensuring that its management of protected areas in the nominated area is consistent with the goals and criteria of ESFM.
5. PRESSURES AND RESPONSE
15. PROTECTED AREAS AND DEVELOPMENTAL PRESSURES

Goulburn River NP

Parr SRA

Dharug NP

Burrarorang SRA

Yerranderie SRA

Nattai SRA

Bargo SRA

Coal Mine

(not necessarily currently operating)
THE GREATER BLUE MOUNTAINS AREA

World Heritage Nomination

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APPENDICES
6. APPENDICES

6.1 ACKNOWLEDGMENTS

All the contributors to the preparation of this document are warmly thanked for their generosity of time and effort.

Steering Committee (and editorial comment):
New South Wales: National Parks and Wildlife Service:
(P Shadie), R Couch, T Hager
Commonwealth: Environment Australia:
D King, M Preece, I Mason

Project management:
Director(s): (P Shadie), R Couch
Liaison Officer: T Hager

Principal consultants:
Domicelj Consultants P/L
Assistant: B Mayerhofer

Editing:
Principal editor: Domicelj Consultants P/L
Text editing: R Beckmann
International review (and editorial advice): PHC Lucas

Contributed texts have been edited for the integrity and consistency of the document.

Experts who contributed written text, or comment, towards the final document:

- Statement of significance; Comparative analysis: Domicelj Consultants P/L
- Geo-diversity: C Ollier, A Osborne, C Killick, D Alder
- Bio-diversity: J Kirkpatrick, B Barlow (T James, P Kodela)
- Natural beauty: C Burton, R Lamb
- Cultural associations - Social History: J Smith, J Horne
- Cultural associations - Rock Art: J McDonald, V Attenbrow
- Cultural associations - Conservation History: G Mosley, R Lesslie
- Interpreting the place; Management; Integrity; Pressures and response: B Leahy, K Muir

Other expert advice:

Illustrations:
The generosity of authors and owners of illustrations used in this document is acknowledged separately under Section 6.6. List of maps and illustrations.

Publication production:
Art direction, design, illustration, production organisation: Wirth Visual Communications
Scanning and Pre-Press: Pure Colours Digital Imaging
Printing: Trendsetting

The Blue Mountains (World Heritage) Reference Committee met regularly with the Steering Committee and principal consultants during preparation of the nomination.

The following members were appointed by the NSW Minister for the Environment:
State: NSW National Parks and Wildlife Service (chair)
Commonwealth: World Heritage Unit, Environment Australia and the Blue Mountains City Council, Oberon Council, Greater Lithgow Council, Hawkesbury City Council, Deerubbin Local Aboriginal Land Council, Gundungurra Tribal Council, Daruk Tribal Aboriginal Corporation, Blue Mountains Conservation Society, Colong Foundation for Wilderness, New South Wales Minerals Council, Blue Mountains Regional Tourism Organisation, Confederation of Bushwalking Clubs, Jenolan Caves Reserve Trust, The Australian Committee for IUCN, G Mosley (individual member).

Specifically acknowledged:
The long and consistent endeavours of the Colong Foundation for Wilderness to achieve World Heritage listing for the Greater Blue Mountains area and the work of the Royal Botanic Gardens of Sydney in its Assessment of the World Heritage Values of the Blue Mountains and Surrounding Plateaus (1994).
## 6.2 SCHEDULES OF SPECIES

Eucalypt species present in the nominated area

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**Rare or threatened plant species in nominated area**

For the purposes of this table, the following definitions are adhered to (taken from Rare or Threatened Australian Plants by J.D. Briggs and J.H. Leigh)

**Rare**: Taxon which is rare in Australia (and hence usually in the world) but which currently does not have any identifiable threat. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wide range or some intermediate combination of distribution pattern.

**Vulnerable**: Taxon not presently endangered, but at risk over a longer period (20-50 years) of disappearing from the wild through continued depletion, or which occurs on land whose future use is likely to change and threaten its survival.

**Endangered**: Taxon is in serious risk of disappearing from the wild within 10-20 years if present land use and other threats continue to operate. This category includes taxa with populations possibly too small (usually less than 100 individuals) to ensure survival even if present in proclaimed reserves.

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### Vascular Plants Endemic to Study Area

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**THE GREATER BLUE MOUNTAINS AREA World Heritage Nomination**
### 6.3 SCHEDULE OF ART WORKS

Art works featuring or inspired by the Greater Blue Mountains from: James, T. (ed) (1994). *An assessment of the world heritage values of the Blue Mountains and surrounding plateaux*, Royal Botanical Gardens, Sydney, Table 21:


#### William Westall (1781-1850)
*Port Jackson, view westward toward the Blue Mountains*, 1802

#### John Eyre (1793-1838)
*Port Jackson Harbour, in New South Wales; with a distant View of the Blue Mountains. Taken from South Head*, c1810-12

#### John William Lewin (1770-1819) (botanical artist-recorder)
*Cox's Pass*, 1815
*Cox's River*, 1815
*Spring Wood*, 1815
*Evans Peak*, 1815
*Jamison’s Valley*

#### Joseph Lycett (1774-c1825)
*View on the Worrogoombu River [Warragamba]*, 1819-24

#### Anon.
*View in the Blue Mountains with Natives...*

#### Angusius Earle (1793-1838)
*King's Table Land, Blue Mountains, New South Wales, the appearance of the new road*, c1826
*Bougainville Falls, Prince Regent's Glen [Wentworth Falls]*, c1826
*A distant view of the Blue Mountains and Lapston Hill, New South Wales, taken from the Enu Plains Road*
*View from the summit of Mount York, looking towards Bathurst Plains, convicts breaking stones*, c1826

#### Thomas Livington Mitchell
*Victoria Pass; New line cleared of trees; Jul. 31, 1830*
*Victoria Pass*, c1831

#### William Romaine Govett (early surveyor)
*View of the Gullies of the Grose River from a cataract named Govett's Loop*, c1835
*Mount Victoria*
*Accident on the Road at Victoria Pass*, c1835
Conrad Martens (1801-1879)
Near Blackheath, Bathurst Road [Grose Valley], 1835
Fitzroy Falls, 1836 (also referred to as Fall of the Quarouilli and The Falls, Quarouilli)
Valley of the Grose, c1839
Cox’s River, late 1830s
Wombeyan Caves, 1872
(From) Mount Tomah, Blue Mountains, c1843
Govett’s Leap, Dec 16, 1874
The Zig-Zag, Lithgow, 1876
The Viaducts, Lithgow
View from Mt. Kg. George Nov. 30, 1876 [Mount Banks]
Jamieson Valley, N.S.W, looking towards King’s Tableland

Albert Tissandier
*Vue du 'Devil’s Couch house', La Remise du Diable, deconcerute en 1841* [Jenolan Caves]

Robert Marsh Westmacott
*Road from Emu Plains, over the Blue Mountains. First Stone Bridge built in New South Wales*, 1840s

John Skinner Prout (1806-1876)
Jamieson’s Valley
Fall of the Weatherboard, c1850
Mount Tomah
View from the top of Grose Head

Stanley Leighton
*The Weatherboard Waterfall [Wentworth Falls]*

Wm. (William) Leigh
*At Corbett’s Leap, Mt. Victoria Oct. 4, 1853 [Govett’s Leap]*
Waterfall at Corbett’s Leap, near Blackheath, Mt. Victoria Oct. 4, 1853
[Govett’s Leap]

John Aitken
Mount Victoria, 1854
Hassan’s Wall, 1854

W.G. Mason
*View of the Valley of the Waterfall, c1855*

Eugen von Guerand (1811-1901)
Mt. Victoria and Hartley Valley Dec 16, 1859
Blackheath Creek, View in the Cox’-river Valley Dec 18-20, 1859
Weatherboard Falls [Wentworth Falls], 1863
*Head of the Grose River, 1875*

Eliza Thurston
Caperter Valley taken from Crown Ridge, Sydney Road, 1868.

William Raworth (1904)
Govett’s Leap, 1874

John Barr Clarke Hoyte (1835-1913)
*Orphan Rock, Katoomba*

William Charles Piguenit (1836-1914)
Weatherboard Falls [Wentworth Falls], c1876
*The Upper Nepean, 1888*

Albert Henry Fullwood (1863-1930)
*Ladies on a Pathway Looking across the Blue Mountains, 1888*

G.A. de Tourcy Collingridge (1847-1929)
*At Orphan Rock*

George W. Lambert (1870-1930)
*Mountain Landscape*

John Peter Russell (1859-1930)
*Un Souvenier des Montagnes Bleues, 1882*

Lucien Henry (1850-1896)
*Devil’s couch-house, Fish River caves, 1883*

Gladstone Eyre (1863-1953)
*Orphan Rock*

Percy Clarke
*Govett’s Leap, c1886*

Danvin
*Vue du Torrent de Glenbrook creek*

F.B. de la Touanne
*Soumet de la Cataracte Bougainville, sur la route de Sidney a Bathurst dans les montagnes bleues (Nouvelles galles meridionale)* [Wentworth Falls]

Cde Amezaga
*Upper Points, Grande Zigzag - Colonia di N.S.W*

Il Grande Zigzag - vedulo dall’Ouest. Sydney - Australia

Arthur Streeton (1867-1943)
*Fire’s Out!, Lapstone Tunnel, 1891*
*Vale of Mittagong, N.S.W.*, 1892
*Grey day on the Hawkesbury, 1896*
*The land of the golden fleece, 1926*

Lorna Nimmo
*The Grey Gulch [leading to Megalong Valley]*

Dattilo Rubbo (1870-1955)
*Broken Rock, Burragorang*

Sydney Long (1871-1955)
*The Hawkesbury at Wiseman’s Point*
Jesse Jewhurst Hilder (1881-1916)  
*The Deviation Work [Glenbrook Tunnel], 1911*

Elioth Gruner (1882-1939)  
*Man and the Mountains*  
*Blue Landscape, The Megalong from Blackheath*

W. Lister Lister (1859-1943)  
*Jamieson Valley*

Stanley Mylius  
*Katoomba Feb. 27, 1896*

B. Schell  
*A Gully in the Blue Mountains*  
*Wentworth Falls*  
*Bushranger’s Cave, Mount Victoria*

Gerald Fitzgerald (1873-1935)  
*The Valley Beautiful, Leura, 1929*

Grace Cossington Smith (1892-1984)  
*From Blackheath, 1933*

William Rubery Bennett (1895-?)  
*The Burragorang Valley*

Theodore Penleigh Boyd (1890-1923)  
*In the Blue Mountains*

Margaret Preston (1875-1963)  
*Blue Mountains Theme, c1941*

Lloyd Rees (1895-1988)  
*A Quiet Morning at Kurrajong, 1941*

David Strachan (1919-1970)  
*Blackheath Creek Road*

Fred Williams (1927-1982)  
*On the Nattai River, c1959*

Shay Docking  
*Tier From in Ravine, 1961*  
*Thicket at Dusk [Blackheath], 1962*

Joy Roggenkamp  
*In the Blue Mountains*

Robert Campbell (1902-1972)  
*Cliffs from Inspiration Point*

Sally Robinson  
*Blue Mountains, 1977*
## 6.4 Schedule of Aboriginal Sites: Known Types in the National Parks within the Greater Blue Mountains Area

<table>
<thead>
<tr>
<th>Site Type/National Park</th>
<th>Blue Mtns</th>
<th>Gard. Stone</th>
<th>Kana</th>
<th>Nattai</th>
<th>Thirlmere</th>
<th>Wollemi</th>
<th>Yengo</th>
<th>Total</th>
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<tr>
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<td>37</td>
<td>6</td>
<td>68</td>
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<td>Shelter with art</td>
<td>54</td>
<td>10</td>
<td>4</td>
<td>50</td>
<td>82</td>
<td>181</td>
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<td>15</td>
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<td>3</td>
<td>6</td>
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<td>84</td>
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<td>4</td>
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<td>Abraded grooves</td>
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<td>Nat. Mythology/Ritual</td>
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<td></td>
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<td>1</td>
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<td><strong>253</strong></td>
<td><strong>691</strong></td>
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</table>
6.5 REFERENCES

Principal references are listed by topic, in the following sequence:

- Geo-diversity
- Bio-diversity
- Natural beauty
- Cultural associations

• Social history
  Rock Art
• Conservation history

• Integrity and management
• Comparative analysis

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**Integrity and management**


**Comparative analysis**


Authors of materials incorporated in this text have differed in their spelling of Aboriginal names. For the sake of consistency one spelling has been adopted throughout. Any discrepancy with other views is regretted.
## 6.6 LIST OF MAPS AND ILLUSTRATIONS

### List of Maps

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Continental biogeographic provinces</td>
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<tr>
<td>2</td>
<td>Greater Blue Mountains nominated area</td>
</tr>
<tr>
<td>3</td>
<td>Historic Map: 1932 proposal for Blue Mountains National Park</td>
</tr>
<tr>
<td>4</td>
<td>LANDSAT Location</td>
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<tr>
<td>5</td>
<td>LANDSAT detail: dissected sandstone plateau</td>
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<tr>
<td>6</td>
<td>LANDSAT detail: deep gorge, Grose Valley</td>
</tr>
<tr>
<td>7</td>
<td>Geology of the nominated area</td>
</tr>
<tr>
<td>8</td>
<td>Geological detail of the central Blue Mountains</td>
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<tr>
<td>9</td>
<td>Continental eucalyptus diversity</td>
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<tr>
<td>10</td>
<td>Vegetation of the nominated area</td>
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<td>11</td>
<td>Known endemic eucalypts in the nominated area</td>
</tr>
<tr>
<td>12</td>
<td>Known endangered, vulnerable and rare plants in the nominated area</td>
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<tr>
<td>13</td>
<td>Known Aboriginal occupation sites</td>
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<td>14</td>
<td>Known Aboriginal Rock Art sites</td>
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<td>15</td>
<td>Protected areas and developmental pressures</td>
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</table>

The above maps were designed and produced by Wirth Visual Communications.

### Illustrations

The author and source of each illustration appears in its caption. All are warmly thanked. Illustrations have kindly been provided by the following individuals and institutions:

- I Brown; W Jones; R Lembit; J Plaza; J McDonald; AJ Morison
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**Mapping Information**

National Parks and Wildlife Service: T Hager, M Koukoulas, R Haynes
Environment Australia (Heritage Information Team, ERIN): G Dunn
Signature on behalf of the State Party

June 1998

Senator The Hon Robert Hill

Minister for the Environment

Commonwealth of Australia