

The Ku-ring-gai GeoRegion

**A Community Initiated and Supported Project of
Potentially International Significance**



'A world-class wonderland of natural and cultural heritage'

July 2023

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'A world-class wonderland of natural and cultural heritage'

The Friends of Ku-ring-gai Environment Inc (FOKE), a community organisation, has initiated a project with the objective of making a positive contribution to conservation based in and around Ku-ring-gai Chase National Park, by seeking recognition of the very significant natural and cultural heritage values as exemplified by a wide range of geosites which exist in this area. This is not unprecedented as other geosites and geotrails have similarly been recognised at Port Macquarie, Newcastle, Warrumbungle National Park, Central Darling River region, and Mutawintji National Park.

Having conferred with a range of experts on the geology, geomorphology, and related natural and cultural heritage values of Ku-ring-Gai Chase National Park, it was decided to investigate further particularly the special geoheritage values which exist in the proximity to the Ku-ring-gai Chase National Park area.

These geoheritage values (both geomorphological and geological) form the platform for the development of the other natural heritage attributes as well as demonstrating the close relationship between landscape and human activity over many thousands of years.

Natural and Cultural Heritage of the Ku-ring-gai GeoRegion (KGR)

The special geosites chosen to profile exist in a broad area (with the working project name of 'Ku-ring-gai') and previously classified in 2002 as forming part of the Hornsby Plateau Landscape which includes:

- Cliffs, beaches, and lagoons from Long Reef to Barrenjoey.
- Ku-ring-gai Chase National Park.
- Muogamarra Nature Reserve.
- Northern Garigal National Park.
- Eastern Berowra Valley National Park.

This outstanding GeoRegion contains:

- Numerous geological sites, including several sites of international significance.
- Currently more than 50 key geosites have been identified across the area.
- Extensive rare and threatened flora and fauna relating to the geology (refer to Appendices 'A' and 'B' for a detailed list).

Ku-ring-gai Chase National Park was registered on the National Heritage List in 2006, with this assessment:

'Assessor's Summary of Significance: Ku-ring-gai Chase National Park and Long Island, Lion Island, and Spectacle Island Nature Reserves contain an exceptional representation of the Sydney region biota, a region which is recognised as a nationally outstanding centre of biodiversity. The place contains a complex pattern of 24 plant communities, including heathland, woodland, open forest, swamps, and warm temperate rainforest, with a high native

plant species richness of over 1,000 species and an outstanding diversity of bird and other animal species. This diversity includes an outstanding representation of the species that are unique to the Sydney region, particularly those restricted to the Hawkesbury Sandstone landform. The place is an outstanding example of a centre of biodiversity.'

- The area provides a vast array of Aboriginal heritage sites (refer to Appendix 'C') including rock engravings, cave art sites, grinding grooves, shell middens, occupational deposits, stone arrangements, and burials. The location, combination and distribution of these features provide an outstanding insight into the life of the First Peoples and their use of this land over at least the last 6,000 years, and perhaps extending back as far as 15,000-20,000 years.
- It is one of Australia's most dense areas for Aboriginal sites. Over 570 sites recorded, some with multiple site traits.
- The area provides a human history dictated by the nature of the landscape, extending inland from the Pacific Ocean.

Geological Heritage

Of international geological significance:

- The KGR reveals the best exposed geological section of early to mid-Triassic period (240 million years ago) sedimentary rocks in the Sydney Basin.
- The sediments were deposited in Gondwana adjacent to a high latitude coast under a cold climate in fluvial, lacustrine, and shallow marine environments. Various rock units contain a diversity of fossils that inform us of past environments over nearly 50 million years.
- The KGR includes eight volcanic diatremes (pipes) and associated dykes with the Hornsby diatreme having perhaps the best exposed geological section in the world.

Of particular interest, the geomorphology comprising deep valleys, extensive estuaries, pocket beaches, headland cliffs and coastal lagoons was formed by post-glacial sea level rise. Diverse rock types on the plateau and slopes have produced low nutrient soils which support an exceedingly high diversity of endemic flora and fauna.

This landscape has presented numerous challenges and opportunities for human occupation. The First Peoples exploited the resources of the bush and coast, and left a rich archaeological trace in rock engravings, occupation deposits and artwork in rock shelters, and extensive middens on the coast and along the Hawkesbury River.

Recent Cultural History

In 2018 FOKE proposed that Ku-ring-gai Chase National Park be World heritage-listed because of its geological connection to the UNESCO Greater Blue Mountains World Heritage Area that had been gazetted in 2000.

World heritage listing was also being advocated by the Sutherland Shire Environment Centre (SSEC) who had been campaigning, since 2013, for Royal National Park to be World Heritage listed. Royal National Park is one of the first national parks in the world. Some even claim it is the first national park in the world because when it was reserved in 1879 the term 'national park' was used for the first time to describe a 'protected park area'. The Yellowstone National Park in the USA that is

acclaimed as the world's first 'national park' in 1872 uses the term 'national park' to describe an area under federal government jurisdiction.

In 2017 the English Lake District's World Heritage status was changed to include the role it played in the development of the conservation movement. With this new precedent, SSEC felt it was another step closer in its advocacy for Royal National Park to be World Heritage listed because of its important contribution to the history of the conservation movement.

Ku-ring-gai Chase National Park has also made enormous contributions to the history of the conservation movement. The Park was the second national park to be established in NSW (1894) and among the first in the world. It was also significant because it was one of first parks to be recognised for its intrinsic value of nature. This was unlike Royal National Park that was established as 'pleasure grounds' for Sydney's working people to have a day's rest and relaxation away from the urban environment of Sydney and its suburbs.

Eccleston Du Faur (1832-1915) was the driving force behind the Ku-ring-gai Chase National Park. He was a 19th century patron of the arts, science, geology, geography, climate, and exploration. In December 1874, he was invited to be an observer of the transit of Venus at Woodford in the Blue Mountains. He was in awe of the Blue Mountains landscape and invited artist William Piguenit and the photographer Bischoff, to join him on excursions into the Gross Valley to paint and photograph this wild beauty that contributed to the protection of this Blue Mountains valley.

Moving to live in Turramurra he was again inspired by the sandstone landscape of the Ku-ring-gai Chase bushland. He believed it to be equal to Yellowstone National Park and was a driving force in it being dedicated as a national park in 1894 and then serving as its first managing trustee. He ensured future generations would have no doubts about the scientific and artistic beauty of Ku-ring-gai Chase National Park when he used these words for its seal that was later placed on the Park's entrance gates - *Natura Ars Dei* or 'Nature is the Art of God.'

One of the first things Eccleston Du Faur undertook as the Ku-ring-gai National Park Trustee was to make by-laws to protect the wildflowers in Ku-ring-gai Chase National Park. The Trustees of Ku-ring-gai Chase also made laws to prohibit the defacement or destruction of Aboriginal rock art sites and middens in the park.

Ku-ring-gai Chase National Park and its surrounds is not only an extraordinarily beautiful landscape. Its formation has also made a significant contribution to Australia's conservation and environment movement.

In 2018, after having been made aware of the UNESCO Global Geopark program <https://www.unesco.org/en/igpp/geoparks/about> which has a central focus on geological heritage, FOKE decided that a nomination made through this program was far more likely to progress to be considered for approval by the NSW State Government.

The KGR Project

This project aims to build on the existing recognised values of the area, its biodiversity, natural and cultural heritage, and highlight its foundation of nationally and internationally significant geology and geomorphology that has resulted in the development of these unique traits.

The plan is to re-invigorate and highlight the area's importance with the unifying aspects of a GeoRegion via the establishment of geosites and geotrails linking the various features and aspects of the area.

Many of the sites identified in the KGR possess values that have recently been identified as being not only of local and national significance, but also of international significance.

Subject to the success of gaining and maintaining stakeholder support for the establishment of geosites and geotrails within this area, there is the future possibility of proposing further heritage listings for the most significant of the geosites through local, state, and federal heritage legislation.

Once established and agreed by the various stakeholders an agreed area within the KGR could be proposed at some time in the future for submission as an aspiring UNESCO Global Geopark. This step would be highly beneficial in raising awareness of the area both nationally and internationally through geotourism, but this can only occur when both Australian and State/Territory governments are prepared to approve the concept of geopark development in Australia. Currently, as determined recently, this is not the case, although the Ku-ring-gai GeoRegion does enjoy 'in principle' endorsement of the Geological Survey of NSW (GSNW) for a potential nomination of the KGR for aspiring UNESCO Global Geopark development.

The KGR project is also supported by three local Councils (Hornsby, Ku-ring-gai, and Northern Beaches) and the National Parks and Wildlife Service, and local MPs.

The Economic and Social Benefits of Geotourism

The pursuit of geotourism offers the potential for new industries and employment opportunities through the development of major projects within Australia.

Tourism Industry development benefits in the context of addressing the ongoing COVID-19 pandemic can be realised through the holistic approach of geotourism which enhances the value of traditionally structured, nature-based tourism by generating new product development (i.e., including geology, landscape, flora and fauna, as well as cultural heritage attributes, both Aboriginal and post European settlement).

Employment benefits through the adoption of a strategy to support and promote geotourism have the potential to significantly improve Indigenous employment, and more broadly, regional employment.

In summary, geotourism in Australia can be readily delivered through the development of GeoRegions and geotrails, and where approved by governments, through geoparks.

Geotrail Development

As recommended by the GSNW, this first stage would see the establishment of linked geotrails to demonstrate the benefits of geotourism to the local community.

It is therefore proposed that the first stage has involved working with various stakeholders to identify and present proposed geosites linked by local geotrails which currently include the following.

- Thornleigh/Hornsby geotrail (Hornsby)
- Browns Field geotrail (Ku-ring-gai)
- Sheldon Forest geotrail (Ku-ring-gai)
- West Head geotrail (NPWS)
- Long Reef geotrail (Northern Beaches)
- Berowra Waters geotrail (Hornsby)

This work is being directed by the KGR Geotrail Development Group comprising representatives of the NPWS, the three Councils, and the project Steering Committee.

By way of example, Ku-ring-gai Council has developed and approved signage specifications for two geotrails as detailed at the following links.

https://www.leisuresolutions.com.au/wp-content/uploads/2023/06/KGR_signageformat.pdf

<https://www.leisuresolutions.com.au/wp-content/uploads/2023/06/KGR-Signage-Specs.pdf>

For any 'Aspiring' UNESCO Global Geopark (which extended beyond the national park boundaries into areas managed by the three LGAs), geotrail establishment costs as nominated above would need to have been incurred to establish credibility as a 'defacto Geopark.'

Sponsorship and grant funding will continue to be sought to help protect and present an agreed assortment of geosites which will serve to guide domestic and international visitors, students, and research workers through a collection of safe and easily accessible viewpoints.

These geosites will ideally allow for unobstructed and informative observation of the surrounding landscape and provide a superlative reference point for better understanding of Earth's evolution and human occupation of it as recorded in the rocks, geological structures, and landforms.

It is proposed that any geotrails and key geosites will be recorded into a national digital platform currently under construction by the Australian Geoscience Council Inc (AGC) as a pilot project of the National Geotourism Strategy. <https://bit.ly/3logPtS>

Development towards a UNESCO Global Geopark through Geotourism

Geoparks have been established world-wide to create enhanced opportunities for the people who live within their boundaries and foster economic benefits for them, usually through the development of sustainable tourism. Geoparks stimulate economic activity and sustainable development through **geotourism** (holistic, nature-based and cultural tourism that focuses on an area's geology and landscape as the platform for providing visitor engagement, learning and enjoyment) <https://bit.ly/3oTemHQ>

By attracting an increasing number of visitors, a geopark fosters local socio-economic development through the promotion of a quality brand linked with the local natural and cultural heritage. A geopark also encourages the creation of local, innovative enterprises and cottage industries involved in geotourism and geological inspired products.

Geoparks also focus on community engagement and ownership. In Australia, national parks focus generally only on biodiversity and often with insufficient attention given to geological heritage.

Unlike World Heritage Areas and national parks, Geoparks can comprise both protected and non-protected areas and enable and celebrate sustainable development.

Geoparks seek to conserve significant geological features and explore and demonstrate methods for excellence in conservation and geoscientific knowledge. This is accomplished through protected and interpreted geosites, museums, information centres, geotrails, guided tours, school class excursions, educational materials and displays as appropriate to the area.

Whilst a UNESCO Global Geopark must demonstrate geological heritage of international significance, the purpose of a Geopark (at all levels including national and local) is to explore, develop and celebrate the links between that geological heritage and all other aspects of the area's natural, cultural, and intangible heritages. These sites and landscapes of international geological significance are managed with **a holistic concept of protection, education, and sustainable development.**

Geoparks can choose to evolve through a series of levels from 'aspiring', 'national', 'state', 'regional' (e.g., or Asia-Pacific Regions) to 'global'. There are now hundreds of Geoparks around the world.

Whilst World Heritage Areas are created in perpetuity, the status of UNESCO Global Geoparks is reviewed and renewed by UNESCO every four years.

To succeed, a UNESCO Global Geopark nomination, lodged by an appropriately incorporated management body, must have the support of local communities.

A nomination area for a UNESCO Global Geopark has no stipulated size but its geographical boundaries must clearly embrace one contained area of land (both protected and non-protected). Hence with respect to any future 'Ku-ring-gai' UNESCO Global Geopark proposal, it would need to include the existing Ku-ring-gai Chase National Park, any other adjacent and relevant protected area (Muogamarra Nature Reserve, Garigal National Park), and other adjacent unprotected lands within which communities reside.

Support to individual UNESCO Global Geoparks is offered through the Global Geoparks Network Bureau which is currently representing 195 members from 48 countries.

In summary, the **over-riding socio-economic benefits of geotourism** include the following.

- Measurable economic benefits - additional visitors, direct and regional economic output, and local employment.
- Through establishment of a management entity, higher level of centralised coordination in areas of product development, travel and hospitality services, tourism promotion/branding.
- Maximisation of sustainable development and enhanced management of over tourism.
- A framework for focus on the 10 UNESCO Topics e.g., culture, education, climate change, geoconservation, sustainable development etc.
- Through its defined mission, community engagement is maximised and measured.

The AGC is currently implementing a National Geotourism Strategy (launched in April 2021) <https://bit.ly/3yyJpdy> designed to support the orderly development of major geotourism projects and activities in line with overseas trends and domestic regional development imperatives. The AGC has determined that the KGR project is one of three significant pilots for geotourism development in Australia, with the Glen Innes Highlands GeoRegion being also located within New South Wales. The Australian Government through the launch of its THRIVE 2030 National Visitor Economy Strategy has recognised the role of geotourism in combining natural and cultural heritage-based tourism <https://bit.ly/3DLwND9>

Requirements for a UNESCO Global Geopark submission

- That the geosites are of national and international significance
- The submission requires that the proposed area must be able to demonstrate that it has already been functioning as a 'de facto/National Geopark' for at least one year. This requires marked geotrails, signage, promotional material, management etc.
- The proposed Geopark area must have received awards or formal recognition for its activities in the field of geodiversity, conservation or sustainable geotourism during the last five years.
- One scientific/academic institution working in the Geopark, plus one PhD Geopark thesis and academic papers within the last three years.
- Strong community involvement and support for the project.

There are prescribed nomination and assessment costs to establish a UNESCO Global Geopark. There are no other payments required to be made to UNESCO during this period, although it is understood that the revalidation process will incur assessment fees at the end of each four-year period.

Current Progress of the KGR project

Earlier in 2020 a Steering Committee was established to determine the feasibility of this project.

The current participants of the Steering Committee are:

Ursula Bonzol and Janine Kitson (Friends of Ku-ring-gai Environment), **Angus M Robinson** (National Geotourism Strategy Coordinator for the AGC and Friends of Ku-ring-gai Environment Inc), **Bob Conroy** (former Executive Director, NSW National Parks and Wildlife Service), **Dr John Martyn** (Geologist and author), **Dr Peter Mitchell OAM** (Environmental scientist, former academic), **David Robson** (Retired Chief Geophysicist from the Geological Survey of NSW), **Rob Corkery** (Geological and Environmental Consultant], and **Jayden Walsh** (Ecologist).

To date the following work has been undertaken:

- A comprehensive account of the Natural Heritage of this GeoRegion (illustrating the rich and varied geology, scenery, and flora) has been prepared by Dr John Martyn. A sample of the 135 page book is available at <https://www.foke.org.au/projects-2/ku-ring-gai-georegion/ku-ring-gai-georegion-sample/>
- A peer-reviewed journal paper, *The Cultural and Natural History of the Ku-ring-gai GeoRegion*, has recently been published by the Linnean Society of NSW

<https://linneansocietynsw.org.au/wp-content/uploads/2022/12/Conroy-et-al..pdf>

- The GSNSW has reviewed the above-mentioned documentation and has formally advised that it has no objection to the concept of a UNESCO Global Geopark proposal embracing this GeoRegion. <https://bit.ly/3Mm9mTU>
- The group continues to add to the list of geologically significant sites in this GeoRegion, both of national and international importance.
- Indigenous site mapping is underway.
- Aggregation of rare and threatened flora and fauna lists.

Our Approach So Far

Stage One

- Identify and establish geosites/geotrails with the support of NPWS (within their updated management plan?), local Councils, Destination NSW, Aboriginal and community groups.
- Engage also with local school communities.

Stage Two

- At some time in the future and only with State Government and LGA approval and funding (and with community endorsement), seek Australian Government support for a nomination to UNESCO of a designated area as a potential Aspiring Global Geopark.

Stakeholder Benefits of Establishing Geotourism within the KGR

• Destination NSW

NSW is offered the downstream potential of adding to its destination attraction listing a potential UNESCO Global Geopark to complement the Blue Mountains WHA and Australia's first National Park, the National heritage listed Royal National Park – together these three outstanding landscapes showcase for the world, Sydney's unique natural and cultural heritage.

• Local Communities

Local communities including bushwalkers, school groups, bush regeneration groups, environmental interest associations (e.g., FOKE, STEP, Hornsby Conservation Society, Australian Association of Bush Regenerators (AABR), National Trust of Australia, National Trust of Australia (NSW), National Parks Association of NSW, Pittwater/Northern Beaches groups etc), and those with youth and seniors' interests would benefit.

• First Peoples Groups

A substantial opportunity will be created to enable Aboriginal groups to celebrate their culture in so many ways e.g., contribute totem imagery and review and approve as appropriate the proposed name of any proposed geopark. New employment and business opportunities, particularly for Aboriginal tourism will be created.

- **National Parks and Wildlife Service**

In respect of any future proposal to establish formalised geotrails in the first instance, it is reasonable to assume that the National Parks and Wildlife Service (NPWS) would want to be satisfied that the proposal added value to their existing management plan and that any additional 'out of state' visitors could be reasonably managed with existing funding resources.

Should a UNESCO Global Geopark be eventually established, the NPWS would be able to participate in the benefit of engaging in the Global and Asia Pacific Geopark networks with its inherent knowledge exchange programs.

- **Geological Survey of NSW**

Participation in the development of geotrails and geotourism generally.

- **Geoscience and Natural Heritage Professional Societies** (e.g., Australian Geoscience Council, Geological Society of Australia, Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists, Sydney Mineral Exploration Discussion Group etc.), Linnean Society of NSW, other professional groupings.

Provide an opportunity for engagement by society members in geopark organised activities and as instrument for promoting careers for young people in the geoscience, environmental sciences, and the natural resources industries.

Angus M Robinson FAusIMM (CP)

A/Chair, KGR Steering Committee

Coordinator, National Geotourism Strategy, Australian Geoscience Council Inc

5 July 2023

Appendix A

Schedule of Endemic, threatened and rare Fauna

Listing	Species	Notes
Critically Endangered	Curlew Sandpiper, Great Knot, Eastern Curlew, Swift Parrot, Regent Honeyeater	1,2 and 3 are Migratory shorebirds found primarily at Long Reef Aquatic Reserve and Careel Bay. Species 4 and 5 are reliant upon Woodland environments particularly Warriewood, Valley, KCNP and Bayview.
Endangered	Red Knot, Lesser Sand-plover, Eastern Bristlebird, Australasian Bittern, Australian Painted-snipe, Spot-tailed Quoll, Southern Brown Bandicoot	1 & 2 are Migratory shorebirds found primarily at Long Reef Aquatic Reserve. Eastern Bristlebird is a fascinating species with the last recorded individual in Sydney being from near Mt Ku-ring-gai. Aus Bittern and Painted Snipe reliant upon Wetlands. Spot-tailed Quoll recorded from Deep Creek catchment and KCNP. SBB primary area of occurrence in NSW is within KCNP and GNP.
Vulnerable	Greater Sand-plover, White-throated Needle-tail, Bar-tailed Godwit, Hooded Plover, Blue Petrel, Giant Burrowing Frog, Red-crowned Toadlet, Large-eared Pied Bat, Koala, New Holland Mouse, Grey Headed Flying Fox	1,3,4. are Migratory shorebirds found primarily at Long Reef Aquatic Reserve. 6,7,8,10 all reliant upon Sydney Sandstone.
Sydney Endemic	Rockwarbler, <i>Saitis virgatus</i> , Giant Burrowing Frog, Broad-tailed Gecko, Red-crowned Toadlet, Three-toed Skink	1, 2 have core or sole populations in KCNP, Muogamarra, GNP. All restricted to Geology that is unique to Sydney Basin.
CAMBA, JAMBA & ROKAMBA Species	Common Noddy, Fork-tailed Swift, Ruddy Turnstone, Sooty Shearwater, Wedge-tailed Shearwater, Short-tailed Shearwater, Sharp-tailed Sandpiper, Sanderling, Red Knot, Curlew Sandpiper, Pectoral Sandpiper, Red-necked Stint, Great Knot, Double-banded Plover, Greater Sand Plover, Lesser Sand Plover, Oriental Plover, White-winged Black Tern, Oriental Cuckoo, Latham's Snipe, Lesser Frigatebird, White-throated Needle-tail, Caspian Tern, Bar-tailed Godwit, Black-tailed Godwit, Black-faced Monarch, Eastern Curlew, Little Curlew, Whimbrel, Osprey, Ruff, Glossy Ibis, Pacific Golden Plover, Grey Plover, Rufous Fantail, Common Tern, Little Tern, Crested Tern, Grey-tailed Tattler, Wandering Tattler, Terek Sandpiper, Common Greenhank and Marsh Sandpiper	Migratory birds endemic to Sydney, predominantly coastal and waterways. International agreements for the protection of migratory species.

Appendix B

Extract from the Ku-ring-gai Chase National Park Plan of Management 2014

Native Plants

Ku-ring-gai Chase National Park, located within the Pittwater Sub-region of the Sydney Basin Bioregion, is particularly important in conserving a large area of relatively undisturbed vegetation of the type which gives the Sydney bushland its distinctive character. It is also important for conserving vegetation types which are significant in a local and regional context. These tend to be of limited size and are associated with unusual or remnant geological and topographical features.

Several surveys of plant communities within the national park have been undertaken, including a major survey by the Royal Botanic Gardens Sydney (Benson & Thomas 1985). A total of 24 plant communities were identified in this survey, comprising over 1,000 plant species. Vegetation surveys have also been undertaken of Lion Island (Benson 1981), Spectacle Island (Webb 1981) and Long Island (Benson & Howell 1994). Lion Island, Long Island and Spectacle Island Nature Reserves support a similar range of vegetation to the national park, but the diversity is more remarkable because of their small size.

Threatened and Uncommon Species

Several plant species found within the park are listed as either endangered or vulnerable under the Threatened Species Conservation Act 1995. Recorded species currently known to occur in the park are listed in the table below.

<i>Acacia bynoeana</i>	Vulnerable species found on sandy soils in gullies.
<i>Ancistrachne maidenii</i>	Vulnerable species.
<i>Cryptostylis hunteriana</i>	Vulnerable species, last seen in the park in 1974.
<i>Darwinia biflora</i>	Vulnerable species found on the clay/sandstone interface.
<i>Eucalyptus camfieldii</i>	Vulnerable species found on ridge tops.
<i>Grevillea caleyi</i>	Endangered species which is found in four small locations in the park.
<i>Haloragodendron lucasii</i>	Endangered species, found in wet mid-slope areas.
<i>Kunzea rupestris</i>	Endangered species which is found on one sandstone ridge in the park.
<i>Lasiopetalum joyaceae</i>	Vulnerable species found only in heath on ridges in the Sydney area.
<i>Melaleuca deanei</i>	Vulnerable species found in marshy heath areas.
<i>Micromyrtus blakelyi</i>	Vulnerable species found on rocky outcrops.

<i>Microtis angusii</i>	Vulnerable species.
<i>Persoonia mollis</i> ssp. <i>maxima</i>	Endangered species found in three locations in the park. It is normally within 10-15m of creeks in steep gullies.
<i>Tetratheca glandulosa</i>	Vulnerable species found near its southern most limit in the park, mainly along ridges.

Regionally rare or uncommon species found in the park include *Allocasuarina verticillata*, *Amperea xiphioclada*, *Angophora crassifolia*, *Blechnum ambiguum*, *Boronia fraseri*, *Boronia serrulata*, *Boronia mollis*, *Callistemon linearifolius*, *Darwinia procera*, *Eucalyptus capitellata*, *Eucalyptus leuhmanniana*, *Eucalyptus squamosa*, *Genoplesium baueri*, *Hibbertia nitida*, *Leucopogon amplexicaulis*, *Lomandra brevis*, *Persoonia isophylla*, *Persoonia mollis* ssp. *maxima*, *Pimelea curviflora* ssp. *curviflora*, *Pimelea latifolia* ssp. *hirsuta*, *Platysace stephensonii*, *Rulingia hermanniifolia*, *Tetratheca neglecta* and *Xanthorrhoea macronema*. It is important that these plants are also protected.

In addition to individual species of importance, there are several community types of importance within the park, including:

- * The Duffys Forest vegetation community being an open forest dominated by *Eucalyptus capitellata*/*Eucalyptus sieberi*/*Eucalyptus haemastoma*/*Eucalyptus oblonga*/*Corymbia gummifera*/*Angophora costata* associations found on lateritic and shale derived soils on ridge tops in the Duffys Forest/Terrey Hills/St Ives area (this community has been listed as an endangered ecological community under the *Threatened Species Conservation Act*);
- * The Pittwater Spotted Gum Forest being an open forest of spotted gum *Eucalyptus maculata* and grey ironbark *Eucalyptus paniculata* found on Narrabeen shales on western edge of Pittwater from Towlers Bay to Elvina Bay (the spotted gum community on the shores of Pittwater has been listed as an endangered ecological community under the *Threatened Species Conservation Act*);
- * Sydney Coastal Riverflat Forest dominated by *Eucalyptus saligna*, a small patch of which has been located on Cowan Creek upstream of Bobbin Head (this community has been listed as an endangered ecological community under the *Threatened Species Conservation Act*);
- * Low woodland (*Eucalyptus camfieldii*/*Eucalyptus haemastoma* association) found near the start of the Elvina Trail on the Lambert Peninsula;
- * Diatrema vegetation communities at Campbells Crater and Smiths Crater, which includes rough barked apple *Angophora floribunda*, cabbage tree palms *Livistona australis*, blue stringybark *Eucalyptus agglomerata* and a few remnant red cedars *Toona ciliata*;
- * Dyke vegetation communities, particularly at West Head, comprising species

such as bastard mahogany *Eucalyptus umbra*, broad-fruited red mahogany *Eucalyptus scias*, cabbage tree palms *Livistona australis*, cycads *Macrozamia communis* and grass trees *Xanthorrhoea arborea*;

- * Open forest on Wianamatta shale along Cockle Creek upstream of Gibberagong Waterholes on Cockle Creek (contains a number of uncommon species or species which do not occur elsewhere in the park);
- * Vegetation communities containing rainforest species along creek lines and the western edge of Pittwater; and
- * Hanging swamp communities, particularly on the Lambert Peninsula, and associated seepage zones which include the yellow-top mallee ash *Eucalyptus leuhmanniana*.

Most of the above threatened or uncommon plants and communities are found on the ridge tops where shale or lateritic soils occur. They are particularly vulnerable because these soils are highly erodible.

When the vegetation of the park was mapped in 1985, six permanent scientific reference sites were established and described in detail. The sites are located near Towlers Bay, at Smiths Crater, at the start of the Ryland Trail near Mona Vale Road, near the start of the Elvina Trail, above Flint and Steel, and at Campbells Crater.

Appendix C

Aboriginal Cultural Heritage

The cultural history of the GeoRegion is described in detail in the Linnean Society of NSW journal review paper <https://linneansocietynsw.org.au/wp-content/uploads/2022/12/Conroy-et-al..pdf>

The Sydney Region is well known for the richness of its Aboriginal heritage. This is no better exemplified than on that part of the Hornsby Plateau near Ku-ring-gai Chase, where a large expanse of the natural landscape has been conserved in national parks and reserves providing both evidence and opportunities for Aboriginal peoples ongoing connection with and use of this area.

Ku-ring-gai Chase National Park, Garigal National Park, and Muogamarra Nature Reserve, as well as other bushland reserves on the Plateau, sample a vast array of Aboriginal heritage sites including rock engravings, cave art sites, grinding grooves, shell middens, occupational deposits, stone arrangements, and burials. The location, combination and distribution of these features give us an outstanding insight into the life of Aboriginal people and their use of this land over at least the last 6,000 years and perhaps extending back as far as 15,000-20,000 years. Within the national parks and reserves in this area alone there are more 570 recorded sites, many with multiple site traits (e.g., a shell midden or occupational deposit within a rock shelter with art). Additional sites are regularly found within this area and are recorded in the NSW Aboriginal Heritage Information Management System (AHIMS) each year.

The close association of these sites with the geology and geomorphology of the Hornsby Plateau is also strong and obvious. The spatial patterning of site traits appears to reflect travel and trade routes which were often followed by early explorers and present-day roads, they also reflect hunting and gathering areas, special ceremonial and spiritual sites, storytelling sites and perhaps base camps for family groups and clans.

Sites and site traits are often associated with ridge lines, upper slopes, and saddles often with commanding views of the surrounding sandstone landscape and also along shorelines and lower slope terraces. The accounts of early settlers and explorers confirm a particularly strong association with the Aboriginal use of waterways including estuaries, creek lines and the shores of drowned river valleys and beaches for fishing and gathering of shellfish, and the use of open areas in valleys and on plateaus for hunting and gathering, and for occasional assembly in large corroborees, particularly where permanent fresh water could be easily sourced.

Shelters with Art and Occupational Deposits

A particularly substantial number of Aboriginal sites and site traits are associated with particular types of Hawkesbury sandstone landform. These include sandstone rock shelters which often contain evidence of Aboriginal occupation including shell middens and occupational deposits, as well as images in the form of red and yellow ochre and white pipeclay stencils and prints and charcoal and ochre drawings. Occasionally burials, engravings and grinding grooves are also present in or near the shelter.

Large shelters located near rocky shorelines and freshwater often contain stratified deposits of shell, charcoal, artefacts, bone, and plant material. Artefacts can take the form of shell, bone or stone which have been modified into scrapers, woodworking adzes, barbs, fishhooks, spear points, grinding stones, hammerstones or grinding or sharpening instruments. Stone artefacts are primarily composed of locally sourced quartz which has eroded as pebbles and cobbles from the Hawkesbury Sandstone, as well as indurated mudstone, quartzite, chert, silcrete, volcanic rock and granite which was either sourced from locally eroded volcanic diatremes and dykes or otherwise traded from more remote areas in the upper Hawkesbury-Nepean catchment and beyond.

Rock Engravings

The rock platforms, cliff faces and rock shelves in the area are common on the upper slopes, saddles and ridges of the Plateau and typically consist of massive quartz sandstone. They served as a perfect canvas for literally thousands of images presented as outline rock engravings and usually prepared as conjoined or partially conjoined puncture marks. It is likely that an outline was scratched on the rock surface, perhaps using either a shadow or a tracing of the figure to be drawn, and holes were then punctured along the scratched lines which were subsequently joined to form a continuous groove.

These engravings reflect a vast array of animals including birds such as emus, penguins, and brush turkeys; marsupials such as wallabies, kangaroos, koalas, and wombats; reptiles such as snakes and goannas; and often large numbers of marine animals such as fish, sharks, whales, jellyfish, and dolphins. People are also engraved often with genitals, eyes, arms raised and legs astride, fingers and toes and bodies with horizontal or sometimes vertical bands, perhaps indicative of body decoration

and/or joints. These figures are usually in front view, but occasionally are shown in profile and suggestive of dancing or singing.

Large mythical or anthropomorphic figures representing ancestral beings are also drawn on rock platforms and in rock shelters. Anthropomorphic figures are sometimes engraved along with their tools and weapons such as clubs, boomerangs, spears, dilly bags, and hatchets and sometimes in association with large numbers of footprints also known as *mundoes*, engraved across the rock platform suggesting a route or path to follow.

Many of these sites have either panoramic views or unusual or significant features associated with them. Images of mythical figures such as Biami and Daramulan and possible totems such as large whales are often associated with these sites. Good examples are found on the unusual, tessellated pavements that are common in the area, on the slopes of prominent geological features such as those carrying trigonometric survey stations and on unusual sandstone formations including large rock platforms, raised sandstone wells or pedestals, on tessellated pavement and near sandstone *gnammas* (i.e., large sandstone potholes).

Grinding Grooves

Grinding grooves are also common in the area. These are sites where tools such as stone axes and spear points may have manufactured and sharpened, or sometimes where seed grinding and food preparation occurred. Quartz sandstone with uniform grain size and slight friability was an ideal surface for this to occur particularly when immediately adjacent to a water source such as seepage from a hanging swamp, a *gnamma* or rockpool or creek bed. Occasionally in association with grinding grooves, water management constructions such as wells, weirs, *gnamma* holes, or drains were constructed or modified by Aboriginal people to exploit groundwater, or to divert or conserve water.

Stone Arrangements

Aboriginal stone arrangements, although relatively uncommon in the area, are often found in association with tessellated pavements, or on saddles and ridgelines. The stone arrangements often consist of small heaps of sandstone rocks perhaps arranged for ceremonial or story telling purposes and often found adjoining spectacular rock engraving sites. Arrangements of stone also occur near, or on route to, shelter sites perhaps indicating a safe path of entry or directional beacon to these sites.

Open Occupational Deposits

Open occupational deposits which are often found on alluvial flats and lower slope terraces on Narrabeen shales and Quaternary alluvium contain evidence of shell middens, occupational deposits and burials and are strongly associated with estuarine and ocean shorelines and beaches. Some of these deposits are quite shallow while some are large and deep and quite stratified, indicating long term and regular use over the last 6,000 years (since the last sea level rise). Many are found on favourable sites and often co-located with European settlement and use.

It is highly likely that given the strong association with Aboriginal use of ocean and estuarine shorelines and evidence that Aboriginal people occupied the Sydney Region for at least the last

15,000-20,000 years, that much of the evidence of Aboriginal use of this area has been hidden with rising sea levels over that period (i.e., since the last major glaciation 18,000 years ago).

Ongoing Connection with Country

Aboriginal people maintain a strong ongoing connection with this Country and a close association with its geology and geomorphology. The strong connection is maintained in the use of Aboriginal clan names and words for many of our place names, as well as ongoing partnerships between the Metropolitan Local Aboriginal Land Council and traditional owner groups with land management authorities such as the NSW National Parks and Wildlife Service and local councils.

Joint management activities include the identification, protection, conservation and interpretation of Aboriginal sites, the maintenance of site records, the protection and management of three Aboriginal Areas within the Ku-ring-gai area (Mt Ku-ring-gai AA, Bujwa Bay Resting Place AA, and Towlers Bay Resting Place AA), the ongoing repatriation of Aboriginal skeletal collections from museums back to Country and the revitalisation of language, stories, and cultural activities.