The Bum Tree

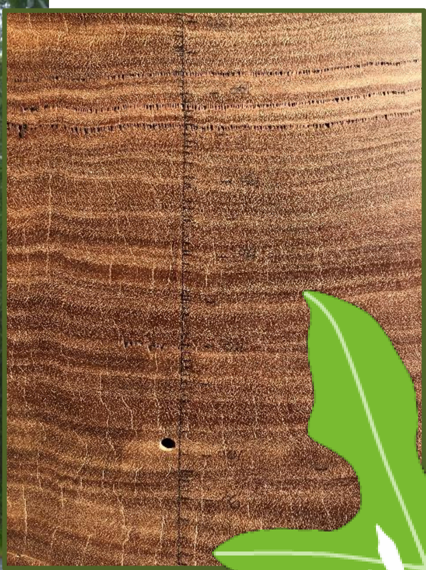
Berry NSW

A Salvaged Legacy

Kelvin Officer

including a specialist report by
Matthew Brookhouse

April 2020



a report by
Berry Landcare Inc.

Berry Landcare

Berry Corridor

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Figure 1 *Placards and demonstrators at the Bum Tree vigil prior to the felling of the Bum Tree*

Project supporters

The following organisations, institutions, government authorities, and private companies supported this project.

Berry Landcare

Project management and direction, sample preparation, administration and report preparation

Shoalhaven City Council

Provision of project funding, support for sample recovery

Fenner School of Environment and Society
Australian National University

Dendrochronological and radiocarbon analysis

Dr Matthew Brookhouse

NSW Office of Environment and Heritage

Supported and recommended sample recovery initiative to SCC

National Parks and Wildlife Service

Supported the initiative and funding application

Berry Museum

Curation and permanent display of polished sample, archiving of documentation and public interpretation and education

Navin Officer Heritage Consultants

Logistical support, sample preparation and storage, and report preparation

Bamboo South Coast

Chainsaw removal of a narrow disk from the larger sample

Danny Kennaway

Engaged to complete fine sanding of sample down to 1200 grit surface

R&K Stone Mobile Welding

Engaged to construct frame for the display of the polished sample in the Berry Museum

School of Earth, Atmospheric and Life Sciences
University of Wollongong

Curation of second (unpolished trunk sample) for further research, education and display

Thankyou

Berry Landcare would like to thank Shoalhaven City Council for funding this project, and Council staff and contractors (A & D Tree Services) for providing logistical support during sample recovery.

We would also like to sincerely thank all those individuals who assisted in this project and donated their time and resources.

Clinton Bramston, Matthew Brookhouse, John Clark, Valda Corrigan, Chris Currey, Diane Garrood, Sam Hathaway, Keith Houston, Danny Kennaway, Kerry Navin, Kelvin Officer, Chris Page, Rob Stone, Philip Thorniley, Penny Williamson, Julia and Bill Woinarski, Geoff Young and Jo Winkler.

Figure 2 *The polished Bum Tree trunk sample in the Berry Museum*

Summary

To travellers along the Gerroa Road (between Shoalhaven Heads and Gerroa, NSW), it could have been a blur, a loved local icon, a traffic hazard or a graffiti blight. To the local Greater Gliders it was a home.

Known to some as the Bum Tree, its age and the origin of its posterial burl was the realm of folklore. The tree was easily the largest along that road, the maximum diameter of the trunk at breast height was 1.7 metres (the viewer's not the tree's), and its canopy arched gracefully above the road and the forest opposite.

In 2014, the Shoalhaven City Council determined that this tree on the road verge impeded road safety and should be removed. The decision prompted considerable opposition and debate. Despite its recognised ecological value, roadside vigils, and public discussion of alternatives, the felling of the tree proceeded on 14 March, 2014.

In the midst of conflicting claims about the age and value of the tree, Berry Landcare began a project to salvage a sample 'slice' of the trunk and accurately determine the tree's age. The objective was to provide a record for future research, and reference data to assist future decisions in managing old-growth trees. The Shoalhaven City Council agreed to fund project costs.

After felling, close inspection of the stump revealed the tree originally had two trunks, and at some time in its early life one of these had fallen and the resulting scar overgrowth had formed the infamous burl.

Hundreds of volunteer hours then followed in preparing the sample and sanding the surface to a fine burnish to reveal its record of tree rings. An analysis of the rings, combined with radiocarbon dating, was then conducted by Dr Matthew Brookhouse at the Fenner School of Environment and Society, Australian National University.

The analysis concluded that the Bum Tree probably germinated sometime between 1626 and 1680 CE (Common Era), that is, between 334 and 388 years before it was felled in 2014. This places the tree well before European knowledge of the Australian continent and makes it a contemporary of the British monarch Charles II.

The polished trunk sample is on permanent display at the Berry Museum. The salvaged burl can be seen at the Shoalhaven Heads pool complex.

The legacy of the Bum Tree is the knowledge that these large old-growth trees, in inconvenient places, are indeed ancient and more importantly, irreplaceable.

This is underlined by the scientific contribution this analysis has provided, and the potential for future research which resides in its curated samples.

It is hoped that the telling of the Bum Tree story, will provide a legacy of education and a greater awareness to ensure we conserve our ancient trees – alive.

Figure 3 *The Bum Tree (right) and another old growth Blackbutt tree with protestors' signs, just prior to felling in March 2014*

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1. Introduction

1.1 The Bum Tree

To many it was a loved local icon, a visual pun half-way along the 'sand track' and a natural wonder, to others a graffiti blight or a traffic hazard. To the endangered population of Greater Gliders in the Seven Mile Beach National Park, it was a home.

Affectionately known as the Bum Tree, its age was the subject of both wild and learned debate, and the origin of its posterial burl the realm of folklore.

The Bum Tree was a large, old growth Blackbutt tree (*Eucalyptus pilularis*), situated on the road verge of Crooked River Road (also known as the Gerroa Road), just north of its intersection with Beach Road, Gerroa, NSW (GDA map grid reference: 296458.6148019). Refer **Figure 9** and **Figure 10**. The tree became a well-known local landmark due to its large size, majestic crown, and an unusual prominent growth near the base of its trunk which resembled buttocks. Known locally as the Bum Tree its full-time 'mooning' of the passing traffic generated a spectrum of responses ranging from mirth, pride, graffiti, disgust and dubious origin-stories.

The height of the Bum Tree was approximately 35 m. At 'breast height', (defined as 1.37 m above ground level), the diameter of the tree was 1.7 m, and the circumference 5.34 m. At ground level, the trunk had a maximum diameter of 2.20 m (minimum diameter was 2.00 m) and a circumference of 6.75 m.

Like the forest opposite, the Bum Tree grew on a wave-washed and wind-blown sand deposit laid down between seven and three thousand years ago. The tree was situated 8 m above sea level and 600 m from Seven Mile Beach. The climate is warm and temperate, with an average annual temperature of 16.9 °C and rainfall of 1492 mm.

In March 2014 the Bum Tree was removed by the Shoalhaven City Council (SCC) as part of a program of vegetation clearance works with the objective of increasing the safety of the Gerroa and Crooked River Roads. This work involved the construction of wider road shoulders and was funded by the Nation Building Black Spot Program administered by the NSW Roads and Maritime Services.

Figure 4 *Two views of the old-growth Blackbutt trees felled by the SCC in 2014, formerly situated just east of the Crooked River and Beach Road T-intersection. The Bum Tree was the eastern (right hand side) and largest of the pair. Top – looking east, bottom – looking northeast.*

The proposal to remove the tree promoted considerable community debate, and a wide range of opinions were expressed in local, State and National media. The debate revolved around the values of habitat conservation and road safety, mostly as polemic opposites. Potential compromise positions such as: clearing undergrowth to improve visibility, lowering the speed limit from 100 to 80 km/h, and redesign of the intersection appear not to have been pursued as alternatives and were not openly investigated with community consultation. Undergrowth clearing and a lower speed limit were later adopted by Council. Widely reported age estimates for the tree ranged between 200 and 400 years, however, there was no hard factual data to support these claims or an assessment of the tree's rarity.

The Bum Tree was situated within the Berry Wildlife Corridor ('the Berry Corridor'), and adjacent to the Seven Mile Beach National Park. It was considered to be one of the largest surviving native trees on this section of the Illawarra coastal plain[1] and an important habitat tree for local arboreal mammal populations. Specifically, the listed endangered local population of tree-hollow dependant Greater Gliders (*Petauroides volans*) within the park, for which the Corridor is the only means of connection with the hinterland and other remnant forest habitat.

When it became clear that the Shoalhaven City Council was going to proceed with the felling, Berry Landcare approached the Council with a proposal to salvage a section of the trunk. The aim was to salvage scientific information by conducting an analysis of tree ring data (dendrochronology) and to conserve a trunk sample as a reference for future research. The proposal recognised that the Bum Tree had the potential to conserve a long record of tree-ring growth from a land zone with an important future role in the management of habitat and ecological values,

A proposal to salvage a full disk sample of the trunk during felling was supported by Mr Geoff Young, SCC project manager of the works program. Mr Young directed the Council's sub-contractor, A and D Tree Services, to assist Berry Landcare in the recovery. This was completed on the 14 March 2014, under the direction of a Berry Landcare representative, Kelvin Officer.

A detailed project proposal and grant application to support sample preparation, dendrochronological analysis and museum presentation was subsequently prepared by Berry Landcare and submitted to SCC in May 2014. The proposal was supported by: Dr Matthew Brookhouse, a dendrochronologist at the Fenner School of Environment and Society, Australian National University; the NSW Office of Environment and Heritage; and the Berry and District Historical Society which undertook to include the trunk sample in its permanent Berry Museum collection.

The SCC approved the proposal on 11 June 2014 and provided a grant of $4070.00 to conduct the project.

1.2 Project Objectives

The objectives of the project were to salvage scientific information and educational value by:

1. Determining the age and growth rate(s) of the Bum Tree through dendrochronological analysis and radiocarbon dating;

2. Long term conservation management of the sample as a resource and reference for future scientific research; and

3. Providing for the public display and interpretation of the sample and the results of the dendro-chronological investigation.

1.3 Why was this project important?

The Bum Tree's position within the Berry Corridor provides relevance and an important context for the analysis of its record of growth. The Berry Corridor is a patchwork of remnant native vegetation spread between the Barren Grounds Nature Reserve on the Cambewarra Range and the Seven Mile Beach National Park along the coast. The habitat values and interconnectivity of this patchwork have been recognised as vital to

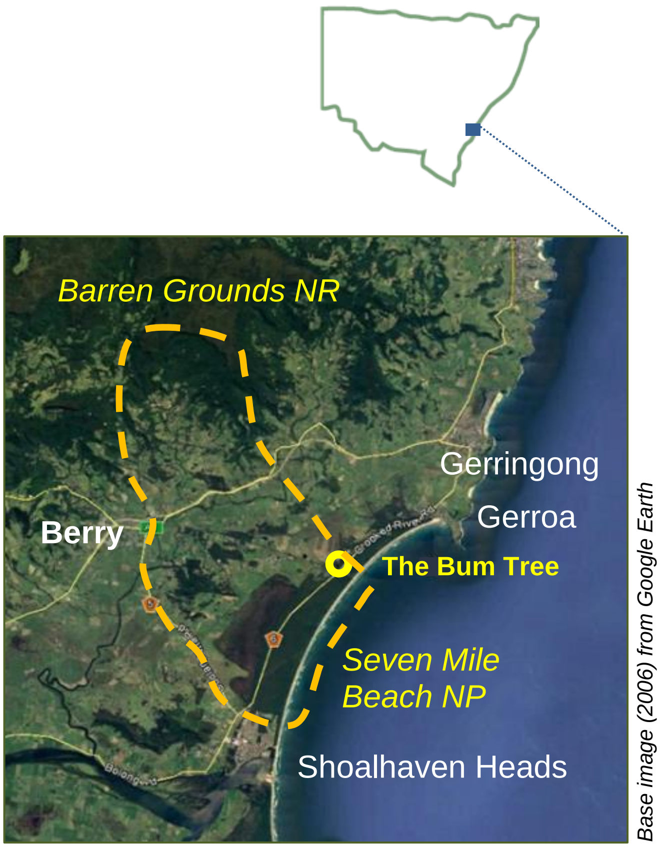


Figure 5 *The location of the Bum Tree and the Berry Corridor (orange boundary)*

the area's role as a wildlife corridor between the coast and the hinterland rangelands. The future viability of flora and fauna populations, and particularly their ability to respond to extreme events and adapt to changing climate and sea levels will depend on such corridors. The Berry Corridor is recognised in the South Coast Regional Conservation Plan 2010, the Shoalhaven – Illawarra Regional Plan 2015, and the Southern Rivers Catchment Action Plan 2013-2033, and forms part of the South Coast Regional Strategy 2006-2031. It is one of ten priority biodiversity focus corridors identified in the Illawarra Shoalhaven region of the Great Eastern Ranges Initiative.

Figure 6 *Upward view of the Bum Tree canopy (July 2004)*

The Bum Tree was one of the largest native trees on this section of the Illawarra coastal plain. As such it was a rare old-growth example of its species. Blackbutts were favoured by timber-getters in the past and were the principle species sawn in coastal NSW and Southeast QLD[2]. Typically those felled were the larger and older hollow-bearing trees, and their removal impacted upon animals dependant on tree hollows. The Bum Tree was therefore a rare habitat tree.

The tree-ring record preserved in the Bum Tree trunk provides a rare, and potentially unique record of tree growth across an extended time depth, into pre-history, and across the impacts of European landuse. As such, this record, will be a valuable addition to the understanding and management of existing local vegetation communities, their age, and ecology. The future management and understanding of the Berry Corridor is particularly advantaged by this data.

Despite the caution required when comparing the age and growth rates of trees across different environments, determining the age and growth rate of the Bum Tree provides the first reliable baseline for estimating old-growth tree age on the Coastal Plain of the Southern Illawarra and Shoalhaven regions. This will benefit a number of research fields and management objectives including:

- The biology and ecology of forests and forest remnants;
- The assessment and conservation management of significant trees;
- The significance assessment and management of human modified trees (such as Aboriginal scarred trees); and
- The future assessment and management of native road side vegetation.

Figure 7 *The Bum Tree looking west, in the days prior to felling (March 2014)*

The Bum Tree analysis provides a valuable baseline for evaluating and managing other old growth trees and forest structures across the NSW South Coast. Many of this region's forests and old growth trees survive on comparable landforms and micro-climates such as the ancient dune field on which the adjacent Seven Mile Beach National Park is situated.

The Bum Tree analysis will add to a slowly growing body of information about the age and growth rates of old growth trees across the temperate and eastern seaboard of Australia. This data will increasingly inform conservation management and the interpretation of cultural landscapes and features.

A tree-dating project conducted in the ACT in 2006-7[3] involved the dendrochronological analysis of eight samples from six old-growth trees removed during the construction of a northerly extension of the Gungahlin Drive. This project aimed to provide comparative information for the evaluation of scars on nearby trees which may have had an Aboriginal origin. The project found that growth rates across the *Eucalyptus rossii* samples ranged between 1.7 and 2.6 mm per year, and that the age of the sampled trees ranged between 120 and 260 years.

Concerning the age of scars, it was found that the rate of radial outgrowth (*i.e.* the depth of the original scar from the modern trunk surface) was a more reliable indicator of age than the extent of lateral overgrowth across the scar (*i.e.* the way the tree 'heals' the scar by growing across from either side). A conclusion of the research was that many scars previously identified as Aboriginal, may be too young to have a traditional Aboriginal origin.

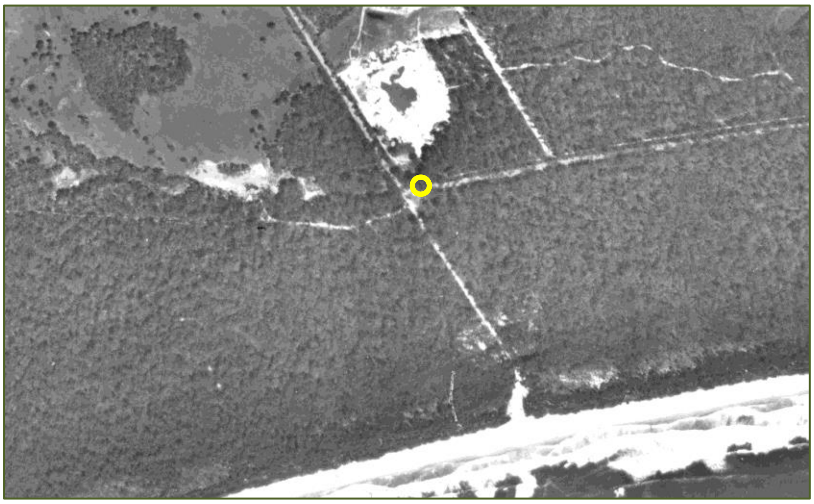
The Bum Tree record includes a natural scarring event and its analysis contributes valuable comparative information on local scar-regrowth rates. This provides a piece towards a larger jigsaw puzzle which, with further future determinations may provide a baseline for the identification of culturally significant tree scars in the Shoalhaven and Southern Illawarra.

The future assessment and conservation management of roadside vegetation across the Shoalhaven could also benefit from the Bum Tree analysis. At the time of this project there was no reliable or readily available comparative data for the age estimation of local and regional old-growth trees. This constrains an effective evaluation of individual trees and harbours the misuse of age estimates within community debate.

Figure 8 *Basic graffiti ID on the Bum Tree in July 2004, looking north*

The proposed long term conservation of the Bum Tree sample as a reference and as a potential resource for future research is a necessary and justifiable action to allow the salvage of scientific information now and in the future. The conduct of a dendrochronological analysis and radiocarbon dating employs current technologies and serves contemporary scientific objectives. However, the research questions and technological abilities of the future remain unknown and it is important that samples, such as those from the Bum Tree, are preserved and remain available for future inquiry. Possible future research may involve fields such as climate change, biodiversity, genetics and forest productivity. The analysis and conservation of the Bum Tree sample would, to some degree, mitigate the loss of natural and scientific values that has resulted from the death and removal of the tree. It would also recognise the rarity of both the record contained in the tree, and the opportunity to conserve such a record.

The conservation of a reference sample and the determination of baseline age and growth rate data would provide an opportunity for public interpretation and education. The Berry Museum has provided a commitment to conserve the sample as a scientific reference item, and to display the sample as an exhibit that interprets the findings of the dendrochronological analysis. This provides an opportunity to mitigate the loss of the educational value of the tree as a live and highly visible old-growth native tree and local landmark. Such a display would have strong significance to the Shoalhaven district, given the historical importance of its original forest resources, and the continuing importance of trees, forest remnants and nature reserves to the ecological health and character of the Shoalhaven.



1972
Extract from aerial photo: 1972 NSW 1760 Nowra to Jervis Bay Run OJ2 5097 (NSW Dept of Lands)

2012
Extract from: Google Earth Pro (capture: 2014, image:2012)

***Figure 9** Aerial views of the location of the Bum Tree from 1972 (top) and 2012 (bottom).*

***Figure 10** Looking northeast along Gerroa Road at its cross intersection with Beach Road (July 2004). The Bum Tree can be seen past the intersection on the left road verge.*

2. The Project Method

2.1 Program

This project involved the following program:

1. Recovery of trunk sample during felling operation;
2. Cutting of the salvaged trunk into two complete disk samples;
3. Preparation of one sample for tree-ring and radiocarbon analysis;
4. Delivery of prepared sample to Fenner School of Environment and Society, Australian National University, Canberra for analysis;
5. Conduct of dendrochronological analysis;
6. Preparation of samples for radiocarbon dating;
7. Conduct of radiocarbon determinations;
8. Preparation of specialist report on dendrochronological analysis;
9. Delivery and accession of prepared sample to the Berry Museum permanent collection;
10. Delivery of remaining unprocessed sample to School of Earth, Atmospheric and Life Sciences, University of Wollongong; and
11. Publication and interpretation of analysis results.

Figure 11 *The sample after completion of the 80 grit sanding. Note the belt sander and use of a vacuum to capture the dust.*

Figure 12 *The sample after completion of the 240 grit sanding*

Figure 13 *Danny Kennaway finishing the 1200 grit polish*

2.2 Grit and Polish

The section of trunk recovered during the tree felling was thick enough to allow for the creation of two complete disk samples. One, approximately 50 mm thick, was used to create a flat polished surface for analysis of tree-rings and recovery of samples for radiocarbon dating. The remaining disk, with a thickness of up to 200 mm, remained unprocessed with the intention that it would be reserved for future research.

The preparation of the 50 mm sample involved:

- Use of a chainsaw to remove an approximately 50 mm thick, full disk slice from the larger trunk sample, for the preparation of a polished surface for tree-ring and radiocarbon analysis;
- Controlled drying (in a well ventilated undercover space) in order to harden the wood for surface sanding, and to minimise cracking; and
- Sequential sanding of the whole of one side to a very fine finish, in order to reveal tree-rings and fine grain detail.

  The following sequence of papers were used with a mechanical belt sander: 40/60, 120, 240, 480, 600/800 grit, and finally by-hand application of 1200 grit.

The direction of sanding was kept consistent with each sanding grade and changed by 90 degrees for the following grade. This made it possible to identify and remove all surfaces created by the previous grade (evident as texture orientated at cross sections to the current sanding direction).

The sample was secured to a wooden pallet mounted on casters during sanding,

2.3 Reading the Rings

The identification and interpretation of tree rings is a skilled visual exercise, conducted with the aid of visual light magnification (such as a microscope) and is based on identifying concentric bands of latewood fibres and variation in vessel characteristics.

__Figure 14__ Dr Matthew Brookhouse with the Bum Tree sample prior to his analysis at the Australian National University.

The analysis of tree-rings (also known as dendrochronology) is based on a starting premise that fibre growth within a tree trunk consistently varies in colour and density over the seasonal course of a year and that consequently, a year of growth is evident in cross section as a light to dark ring. Theoretically it follows that counting the rings will provide the number of years of growth.

In reality, the time represented by a single tree ring, and the growth between rings, may vary considerably, depending on the species, seasonal conditions, and individual genetic variation. Some Eucalyptus species may not create a ring during a particular year (or years), and in other cases, multiple rings may be formed. For this reason, a tree-ring sequence requires cross-referencing with an independent measure of time. This measure is typically provided by radiocarbon dating, which provides a 'radiocarbon age' by measuring the decay of Carbon isotopes within the fibre of individual rings (see following section).

By combining a sequence of tree rings, with a spread of radiocarbon ages across that sequence, a reliable estimate of age and growth rates can be gained.

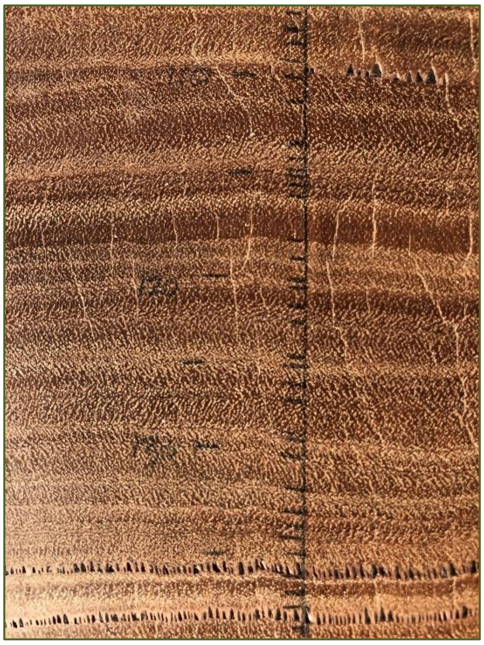


__Figure 15__ A section of the Bum Tree tree-ring sequence, showing the analyst's interpretation of tree rings (indicated by the pencil increments). Note the numbered decadal increments on the left.

In addition to the issue of interpreting ring chronology there can be problems in the interpretation of indistinct tree-ring boundaries. Consistent with the observations of Banks in 1997[4] the clarity of tree-ring boundaries can vary significantly between species. Consequently a number of methods are used to assist in verifying ring counts, controlling for irregular growth, and method biases. These include: the use of decadal increments; the use of segmented radii; and standardising decadal measurements by dividing them by the ratio of the measured radii to the mean sample radius.

Like many old-growth tree trunks in Australian trees, the earliest core wood was missing due to rot and borer attack. In such cases the number of rings lost due to the bio deterioration of the innermost section of the trunk is estimated using the average ring width and the radial distance to projected position of the pith (the latter is estimated using tree ring geometry). For more detail on the method of tree ring analysis see Section 5 and Attachment B.

2.4 Radiocarbon Dating

An important component of the tree-ring analysis was gaining radiocarbon age determinations from a series of samples taken from the tree ring sequence. Given the small quantity of material available from any single ring, a specialised technique using an Accelerator Mass Spectrometer (AMS) was employed. Five samples were recovered by drilling holes into the face of the sample using a Dremel tool (refer **Figure 35**).

Radiocarbon dating is based on the principle that all living things contain Carbon in a consistent ratio of three isotopes. This ratio gradually changes after death according to a known rate of radioactive decay in one of those isotopes, Carbon 14. By measuring the remaining Carbon 14 in a sample, an estimate of age since the death of the organism can be made. See Inset below for more detail on radiocarbon dating and AMS.

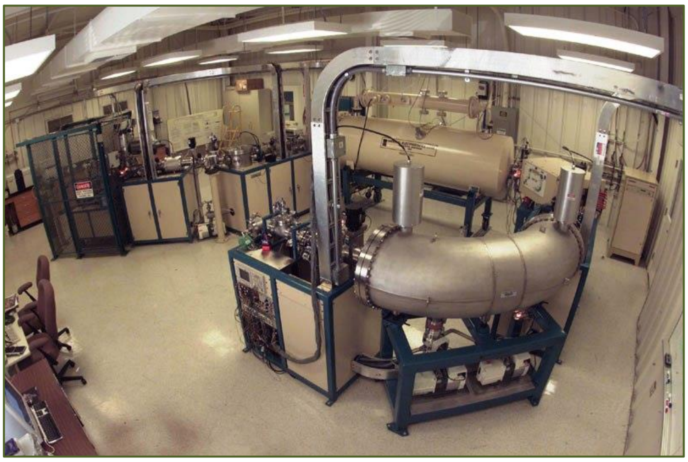


Figure 16 *An example of an accelerator mass spectrometer of the type employed for this project (Lawrence Livermore National Laboratory, US Dept of Energy, public domain image)*

The AMS determinations were conducted using a single stage accelerator mass spectrometer at the Research School of Earth Sciences, Australian National University, in close co-operation with Dr Matthew Brookhouse who prepared the samples.

2.5 Display and Curation

The following conditions for the curation of the sample were outlined at the commencement of the project:

- It must be managed, and made available for future scientific research and reference (according to an assessment protocol to be established, such as for example, approval by the committee of the custodial institution);
- It must be stored in conditions conducive to long term preservation;
- It must not be contaminated with chemicals or materials which may reduce its research and reference value (for example, it should not be varnished or painted), and any future treatments (such as for borer), would need to be assessed by an appropriate specialist prior to any application). This condition is meant to conserve its value for future research, such as for radiocarbon dating or future techniques not yet known or developed); and
- Where feasible, the educational value of the sample should be realised with periodic public display and interpretation.

Figure 17 *Julia Woinarski and Keith Houston from the Berry and District Historical Society review the new home of the sanded disk in the Berry Museum*

Following completion of analysis, the salvage Bum Tree sample consisted of two parts: the finely sanded disk (approx. 50 mm thick) which was used in the tree-ring and radiocarbon analysis; and the thicker unprocessed portion from which the 50 mm disk was removed.

The Principles of Radiocarbon Dating

- The element Carbon is made up of three isotopes Carbon 12, Carbon 13 and Carbon 14. An isotope is a variant of any given element according to the number of neutrons in its atomic nucleus. All atoms of a given element have the same number of protons (twelve in the case of Carbon) but different numbers of neutrons in each atom.
- Carbon 14 (also known as radiocarbon) is an isotope of Carbon that is unstable and weakly radioactive. The period of time after which half of any sample of Carbon 14 will have decayed is about 5,730 years, a further half of the remaining Carbon 14 will have decayed in the following 5,730 years, and so on. In very old samples, the amount of remaining Carbon 14 becomes extremely small and the limits of reliable measurement are reached in samples around 50,000 years old.
- Carbon 14 is continually being formed in the upper atmosphere by the effect of cosmic ray neutrons on nitrogen 14 atoms. It is rapidly oxidized in air to form carbon dioxide and enters the global carbon cycle. Plants and animals assimilate Carbon 14 from carbon dioxide throughout their lifetimes. When they die, they stop exchanging carbon with the biosphere and their Carbon 14 content then starts to decrease at a rate determined by the law of radioactive decay. By measuring the Carbon 14 in a sample, an estimate of age since the death of an organism can be calculated.
- A radiocarbon determination on wood, provides an age for when the wood was formed by the tree, not the death of the tree, which may be much later. This is because the wood is only 'alive' when it is being formed at the cambium layer (the live part of the tree between the bark and the wood), after this, although functioning as part of a live tree, the wood cells are dead.
- Radiocarbon determinations must be calibrated to take into account changes over time in the ratio of Carbon 14 with Carbon 12 and 13 within the biosphere. These have been caused by fluctuations in the intensity of cosmic rays, different uptake of carbon in different types of organisms and habitats, and the burning of fossil fuels from the late nineteenth century.
- The detonation of atomic bombs in the atmosphere since the middle of the twentieth century has altered the ratio of Carbon isotopes within the biosphere to such an extent that it is impossible to calculate age by the measurement of radiocarbon in samples post-dating this period.
- There are two basic ways of measuring the Carbon 14 content of a sample: 1) radiometric dating by counting the number of Carbon 14 decay events in a given period of time, and 2) using an accelerator mass spectrometer to measuring the actual number of Carbon atoms present and the proportion of isotopes.
- Two radiometric techniques have been developed for detecting the Carbon 14 decay events: gas proportional counting and liquid scintillation counting. Both techniques detect the release of beta particles which are produced during a decay event. These techniques require a substantial sample size (counted in grams) to produce reasonable accuracy.
- The use of accelerator mass spectrometry has the advantage that very small samples (counted in milligrams) can be processed with reasonable accuracy. Radiocarbon dating through accelerator mass spectrometry involves accelerating Carbon ions to extraordinary high kinetic energies and passing them through various focusing devices and charged states before counting and measuring their mass as they pass through a strong magnetic field. The magnetic field causes the moving charged particles to deflect according to their mass, allowing differentiation of the different isotopes.

Sources

https://www.radiocarbon.com/about-carbon-dating.htm

https://en.wikipedia.org/wiki/Radiocarbon_dating

The finely sanded disk, was accepted as part of the permanent collection of the Berry Museum where it is publicly exhibited and interpreted.

The unprocessed disk was accepted by the School of Earth, Atmospheric and Life Sciences, University of Wollongong, for use in education, interpretation and as a reference and resource for future research.

2.6 Archival

In keeping with the project's aims of public interpretation, access, and providing for future research, project documentation has been archived with the Berry and District Historical Society, and hard copies of this report have been deposited with the following institutions:

- National Library of Australia (Australian Government)
- State Library of NSW (NSW Government)
- Hancock Library (Australian National University)
- Fenner School of Environment and Society (Australian National University)
- University of Wollongong Library (University of Wollongong)
- School of Earth, Atmospheric and Life Sciences (University of Wollongong)
- National Parks and Wildlife Service, South Coast Branch (NSW Government)
- Shoalhaven City Council
- Shoalhaven Libraries – Nowra (Shoalhaven City Council)
- Kiama Library – (Kiama Municipal Council)
- Berry Community Library (Berry Uniting Church)
- Berry Museum (Berry and District Historical Society)
- Gerringong Museum (Gerringong and District Historical Society)
- Nowra Museum (Shoalhaven Historical Society)

Figure 18 *The Bum Tree with detailed graffiti highlights 19 February 2014. Note the blacked out 'Save Me' underlying the heart motif.*

3. Salvage of a Sample

The Bum Tree was felled on March 14, 2014, by A & D Tree Services contracted to the Shoalhaven City Council.

The event was witnessed by separated gatherings, those in hard hats and reflective tops operated behind an arc of safety cones; those with placards mourned behind checkered tape barriers; and in between, police, and a single line of traffic taking turns to shuffle north or south (**Figure 23**).

The felling involved the removal of the canopy branches, followed by the incremental removal of sections of the trunk, and finally the detachment of the basal trunk portion with a horizontal chainsaw cut close to ground level.

The basal section of the trunk which contained the burl, was intentionally cut in a section approximately 3.5 m long with the aim of reserving the trunk for future public display at a location to be determined (refer Section 8).

The sample disk was recovered from the base of the cut trunk section immediately above the reserved trunk section containing the burl. The sample disk was 23 cm thick and was situated approximately 3 m above ground level. The maximum diameter of the sample disk was 1.48 m (minimum diameter was 1.26 m). The disk circumference was 4.44 m.

***Figure 19** A 'cherry picker' and crane used in the incremental removal of canopy branches and trunk sections*

***Figure 20** Removal of a hollow canopy branch, stopped at both ends to contain any potential residents for later release*

***Figure 21** Cutting the basal section of the trunk close to the ground with the intention to retain the section for future public display. The sample disk came from immediately above the top of this trunk section.*

***Figure 22** Preparing to cut the sample disk from the trunk section felled from above the basal portion of the trunk, still in situ in this picture*

Figure 23 *The felling was witnessed by locals, protestors and passing motorists, each group tightly controlled by cones and tape*

Figure 26 *The salvaged disk was 230 mm thick…*

Figure 25 *…and probably pushing the weight limit of the trailer.*

Figure 24 *Cutting a 50 mm slice from the sample for tree-ring analysis (Clint Bramston left, and Jo Winkler right)*

4. The Stump's Story

The origin of the burl which looked like a bum was a favourite source of oral tradition and local conjecture.

In the 20 January, 2014, issue of the Illawarra Mercury an article proudly claimed 'We get to the bottom of the Bum Tree story'. It reported a widely held story recounted by 'a local Berry man' that the burl was the result of a vehicle impact.

> 'In 1966 a 13-year-old boy who lived in Berry hit upon the idea of visiting some mates in Gerroa. He borrowed a car that belonged to his sister's boyfriend.
>
> 'His driving skills were not up to task. He took the corner of Beach and Gerroa roads a mite too quickly and slammed into a young gum tree, not much more than a sapling.
>
> 'The boy ended up in Wollongong Hospital with several injuries, but survived the experience.
>
> 'The tree was severely damaged, but over time new growth covered the scarring done to the sapwood in the accident.
>
> 'Over the following decades, the new growth developed into the round, well-formed and cheeky feature that has made the tree famous all over the land.'

Figure 27 *Multiple views of the Bum Tree stump, looking south (top) and north (bottom)*

After the felling, a detailed inspection of the stump revealed a much older and convincing story. Instead of the usual single set of concentric tree-ring circles, the cut face clearly showed a pair of circles, indicating that the tree originally had two trunks.

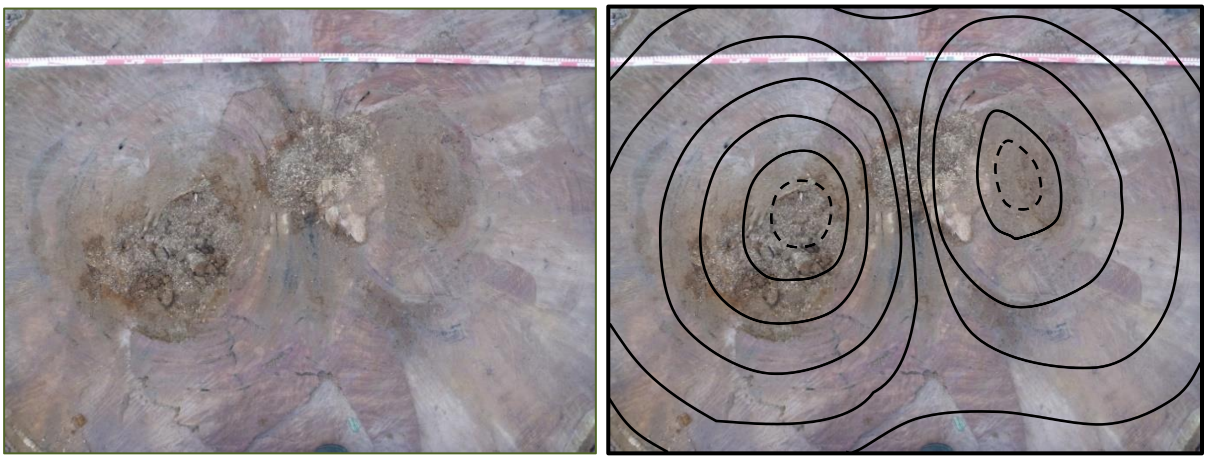


Figure 28 *Detail view of the central portion of the chainsaw cut across the Bum Tree stump, showing a pair of concentric tree-rings (interpreted on right), providing clear evidence that the tree once had two trunks (stems).*

Two other observations are relevant to the origin of the 'bum' burl. The first is that the surviving tree's trunk was slightly inclined to the north, the other is that the burl was located low down on the southern side of the trunk.

In combination, these tell us that the burl is the result of regrowth over a scar caused when the southern of two original tree trunks broke and became detached. The northern trunk remained, slightly inclined to the north, and away from its former twin. The burl's two 'cheeks' were formed by regrowth extending from each side of the scar, and joining along a centreline.

The growth story of the Bum Tree is shown in **Figure 29**.

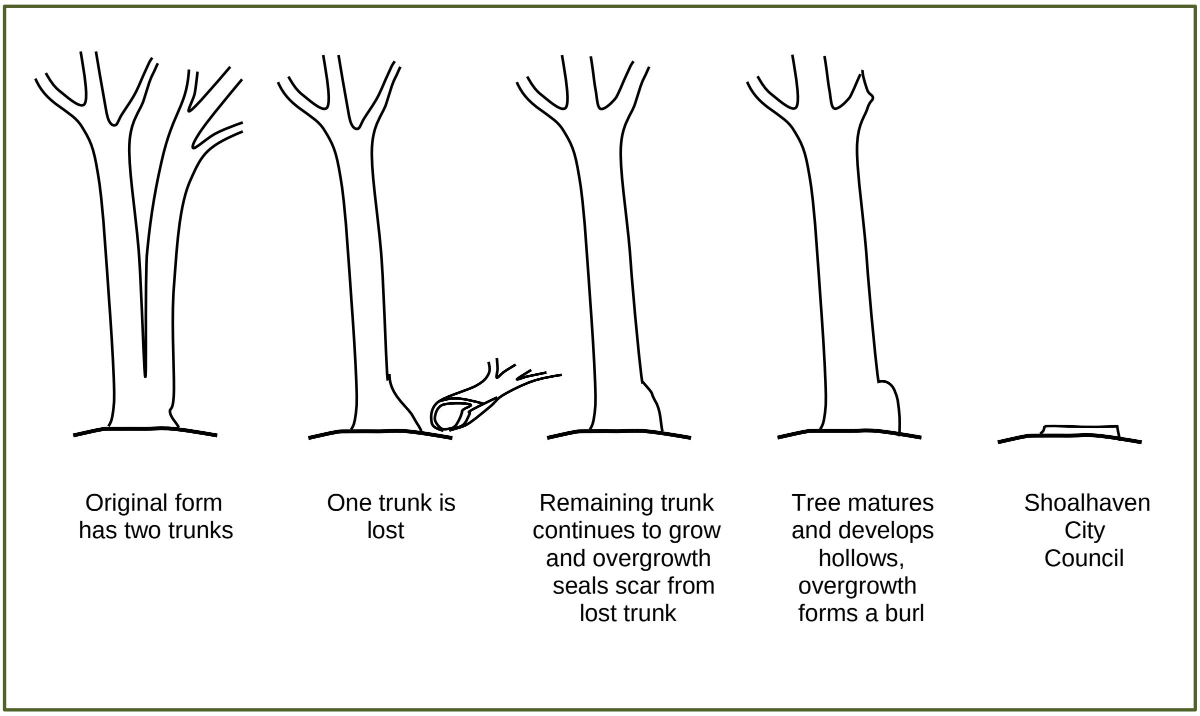


Figure 29 *The growth story of the Bum Tree*

Figure 30 *Signs of the times*

5. The Age of the Bum Tree

5.1 The Analysis

Figure 31 Marking time

The analysis of the tree-ring record was conducted by Dr Matthew Brookhouse at the Fenner School of Environment and Society, Australian National University, Canberra. His report is presented in full in Attachment B. This section presents a simplified and plain English version of that report. For an exact understanding please refer to the original report.

The analysis had three stages:

(a) interpretation of tree-ring structure and measurement of tree-ring widths;

(b) radiocarbon-based age estimation; and

(c) non-linear estimation of the origin data based upon radiocarbon dates and diameter increment data derived from tree-ring widths.

Tree-ring structure and width measurement

Tree rings are a response to different periods of activity of the cambium. In eucalypts, this is generally due to temperature variation during winter. In cool climates, this variation gives rise to an annual couplet of thin-walled cells formed during the early part of the growing season (earlywood), and thick-walled cells during the latter part of the growing season (latewood).

Rings may also form due to variation in the concentration of water conducting cells (tracheids) which can reflect annual variability in climatic conditions. In south-east Australian eucalypts, high concentrations of vessels commonly correspond with periods of high evaporative demand and relatively rapid growth[5]. For this reason, dense arrangements of vessels are typically present in wood formed during late spring and summer, whereas sparse arrangements of relatively small vessels are formed during autumn to early spring.

Examination of the Bum Tree sample revealed that, consistent with the low elevation at which the tree grew, the specimen exhibited indistinct earlywood/latewood couplets. However, banding of vessel tracheids was evident, permitting identification of growth zones.

Once identification was complete, tree-ring positions were recorded on transparent film. This film was then scanned on a flatbed scanner at high resolution (1200dpi) and tree-ring widths were measured to the nearest 0.001 mm using a program called WinDendro Density©.

Radiocarbon-based age estimation

While rings formed by alternating low and high vessel concentration provide a reasonable basis for conducting ring counts in trees at low elevation, this becomes unreliable where the ring series includes periods of slow growth. With an aging canopy, diameter growth can be imperceptible preventing age determination in the outermost sections of old-growth eucalypts[6]. In these circumstances radiocarbon dating from wood formed during periods of relatively fast growth may be used to provide anchor points for undated ring-width sequences[7].

Samples were removed from the Bum Tree disk sample for radiocarbon dating at five positions. Refer **Figure 35**. Sample powder was extracted using a 5 mm drill bit. Radiocarbon dating was performed using the single-stage accelerator mass spectrometer (AMS) at the Research School of Earth Sciences, ANU[8]. Radiocarbon ages were reported with conventional radiocarbon age expressed in years prior to CE 1950 (Common Era), using the Libby half-life of 5568 years[9]. Values for the Carbon-13 isotope ($\delta 13C$) were measured on the AMS and used to correct for plant-level isotopic fractionation.

(This correction is needed to allow for the slower diffusion of Carbon-13 in plant tissue and thus a different ratio of stable and radioactive Carbon isotopes).

How do you date the missing bit in the middle of the sample disk?

Internal trunk hollows present an obvious limitation for age determination. Nevertheless, estimating the age of the missing bit is possible by modelling the early tree-ring growth pattern of the tree. This is done on a basis called 'inverted non-linear increment modelling'.

This analysis was conducted in two steps:

(a) applying an appropriate model which describes trends in cumulative tree-ring increments (typically this includes slowing growth rates as the tree gets older), and

(b) estimating age by counting towards the centre, as if the tree diameter is equivalent to zero.

These steps require conversion of ring-width data to cumulative diameter increments, including an estimation of the distance to the assumed position of the pith, or biological centre of the trunk. In addition, estimating the origin year relies upon correct dating. Cumulative increments must be calibrated against radiocarbon dates.

A preliminary examination of the data indicated that the pattern of growth was not typical and growth increased in the latter part of the tree-ring series. Since this growth acceleration was likely to impact upon inverse estimation of the origin year, analysis was restricted to the innermost 150 rings.

5.2 The Results

Ring Width

A total of 238 rings were identified along a 47.9 cm radial path. Although highly variable on a yearly timescale, ring width across each decade is relatively stable throughout the earliest third of the measured time series (**Figure 32**). A long-term upward trend in ring width is evident, however, during the central portion of the series following a short-term growth depression approximately 150 rings before the tree was felled. The upward trend reaches a maximum approximately 80 rings before felling and ring width then declines gradually thereafter. A period of consistently narrow rings widths are evident in the final 50 years of the series. While this growth depression is typical of old-growth forest trees a slight upward trend in ring width is evident in the final 15 rings.

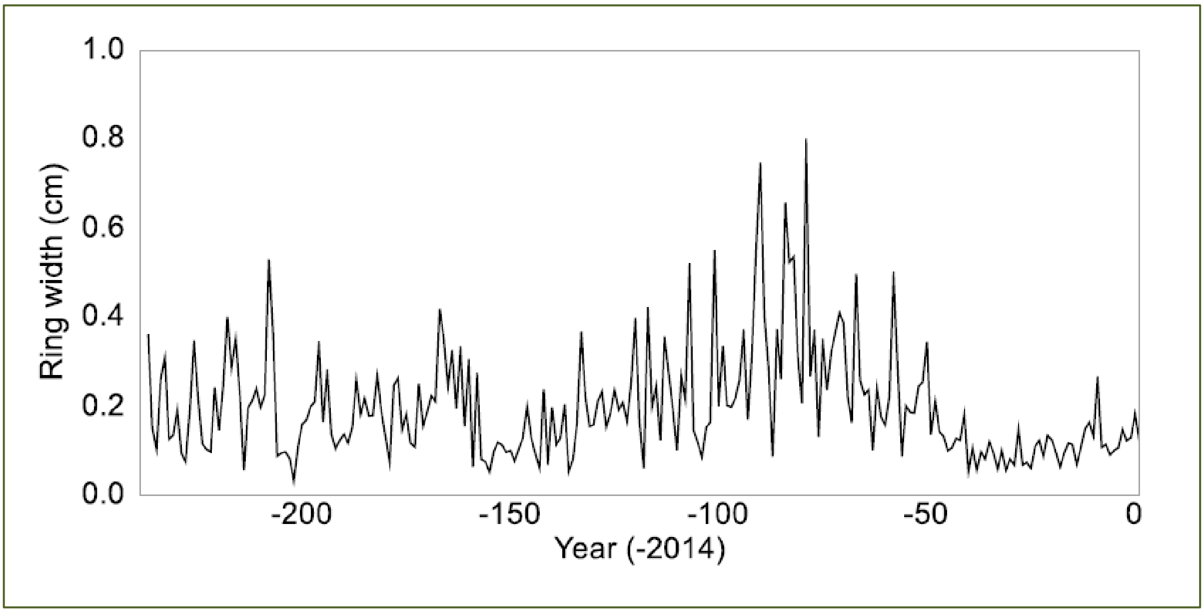


Figure 32 *Measured ring-width series for the Bum Tree. Years denote assumed years prior to felling based upon tree-ring counts*

Application of the tree-ring growth pattern model (refer outline and detail in Attachment B) suggests an origin year of 1697 CE – 317 rings prior (± 6 rings) to felling – at the sample height.

Radiocarbon dating

Radiocarbon dates are available for only three of the five analysed samples. Samples 1 and 5 (the outer most samples – closest to the trunk circumference, refer **Figure 35**) contained concentrations of Carbon-14 which exceeded expected calibration values. This means that both are likely to post-date 1950 CE and the conduct of atmospheric nuclear testing. This outcome is consistent with ring counts for both sample positions (ring -15, 1999 CE; and ring -50, 1964 CE).

Sample ID	Conventional ^{14}C age (CI)	Estimated ^{14}C ring year	Ring-counted year
003	155 (± 38)	-219 (± 38)	-100
002	213 (± 27)	-277 (± 27)	-238
004	183 (± 29)	-247 (± 29)	-150

Figure 33 *Bum Tree radiocarbon and CI reported to α=0.05. Estimated 14C ring years include minimum ring count between felling year and benchmark year (CE 1950). The comparative ring-counted year for each sample position is also reported.*

Less consistency occurs between ring count and radiocarbon dates for the samples that pre-date the modern era. The most recent of the dated samples (Sample 3) exceeds the ring-counted age by 81-157 years. Calendar dates for the next oldest (Sample 4) exceeds the ring counted age by 61-126 years and the oldest sample (Sample 2) by 12 to 66 years. When applied to the modelled estimation of tree age, these error estimates increase the date of origin. Addition of the error range for the oldest of the radiocarbon samples pushes the year of origin to between 1631 and 1685 CE.

Figure 34 *Danny Kennaway completing the final 1200 grit polish*

Figure 35 *The Bum Tree tree-ring sequence showing the location of the radiocarbon samples and estimated ring ages (length of radial path is 479 mm)*

About the origin date and the difference between radiocarbon and ring-counted dates

Although much is known about the structure and yearly growth of tree rings in eucalypts, forest-based studies haven't considered the Blackbutt species (*E. pilularus)*. As a result, very little is known of this species' ring structure. This analysis uses inferences based upon the tree rings observed in the Bum Tree sample which reflect observations of eucalypt species grown elsewhere at low elevation locations.

The Bum Tree sample exhibits the same variability in vessel arrangement (which is responsible for forming the tree ring) observed in Messmate Stringbark (*E. obliqua*) and Silvertop Ash (*E. sieberi*) grown at low-elevation[10]. This feature has been shown to be laid down each year in locations where moisture availability varies according to the seasons. This variation is due to both rainfall and temperature[11]. This is true even in locations where temperature does not independently limit growth.

Despite the reliability of variation in vessel arrangement elsewhere, ring-counted dating does not correspond with radiocarbon-derived dating. In the Bum Tree sample, the most recent radiocarbon date pre-dates the ring counts by 81 years. Although the earlier radiocarbon dates are closer to the ring counted estimates, both pre-date the ring counted estimates.

This result is consistent with previous studies for old-growth eucalypts[12]. Substantial reduction in diameter growth rates is due to the degradation of the tree's canopy in the latter stages of eucalypt life. This reduction can often be sudden as a result of major branch loss from the canopy. Substantial under-estimation of tree age can result if tree-ring counts have not been cross-dated against younger specimens. Indeed, it has been reported[13] that several decades of growth may be excluded from ring counts based upon the outermost segments of old-growth eucalypts.

The dramatic reduction in the later stages of the Bum Tree's growth and the subsequent error in ring counts is a likely explanation for the mismatch between radiocarbon and ring-count based estimates in this analysis. Indeed the relative consistency in the error between radiocarbon and ring-estimates in the earlier samples suggests that ring counts and measurements on the inner wood represent annual formations.

With that in mind, modelling of the origin date based upon the innermost rings appears valid. That is, the estimated the year of origin to between CE 1631-1685 appears to be an appropriate estimate of the age of the *sample*. However, considering that the sample was taken at a position approximately 3.0 metres above ground level, there is a time-lag for the tree to grow to this height. This estimate should therefore be considered as the latest possible range for the origin year. It is reasonable, based upon assumed height growth rates for forest-grown Blackbutt trees, to subtract a further five years from this range. This leaves a probable range of CE 1626-1680 for the germination of the seed from which The Bum tree emerged.

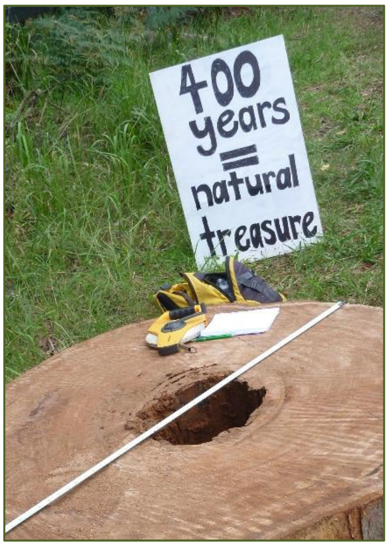


***Figure 36** Just after sampling – initial field measurements and a protestor's pre-emptive statement*

6. Old Wounds

The live portion of a tree trunk is called the Cambium layer and occurs at the boundary between the wood (the Xylem) and the bark (the Phloem). The Cambium is a layer of undifferentiated cells from which both the bark and wood grows.

When bark is removed from a trunk, it mostly detaches along the cambium layer and kills the exposed section of trunk. This 'scar' is then slowly mended by the remaining cambium around the edge of the scar with the creation of new tissue (called callus regrowth), which extends in to the centre from either side. This process is called occlusion and follows a pattern like drawing curtains – from the sides inwards. Regrowth does not extend from the very top or bottom of the scar (**Figure 40**).

The rate of regrowth across a scar surface can vary greatly according to the species, age of the tree, its landscape context, the quality of the soil, and the local climate. Regrowth rates are of great interest to specialists such as arborists and archaeologists who may need to determine the origin and age of a particular scar or trauma site.

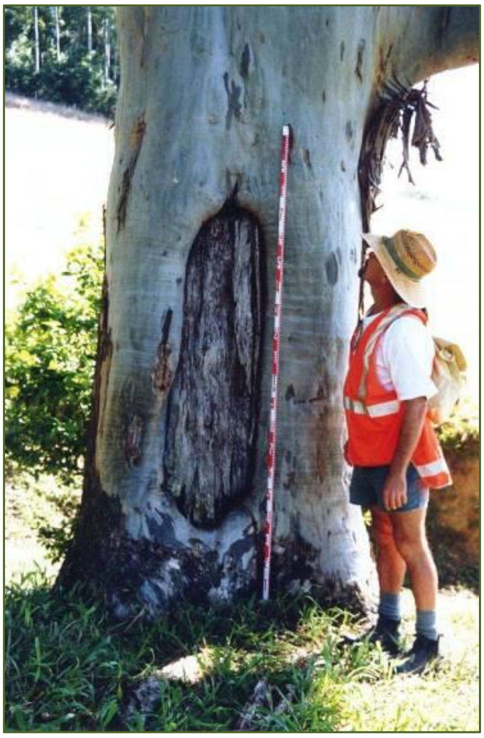


Figure 37 *An Aboriginal scarred tree at Moonee, near Coffs Harbour NSW (photo by Kerry Navin, 1991)*

An example where an appreciation of scar regrowth rates is important is the interpretation by archaeologists of human-made scars on trees. Scars made by Aboriginal people and early European settlers can provide valuable insight into Australia's past. Aboriginal people harvested bark for a myriad of purposes, including for habitation, vessels, canoes and twine. They purposefully scarred trees to mark important places and trails. The early Europeans used bark for roofing and blazed trees for surveying and route finding. Distinguishing natural from human-made, and Aboriginal from European is often problematic and an accurate estimate of age can allow a definitive interpretation. Most initial and in-field identifications of heritage scarred trees still rely on the characteristics of shape and/or traces of the original trauma. This can be unreliable because many natural causes mimic the appearance of human-made scars. If there is local information available on rates of regrowth, the process of identification can be more accurate.

Figure 38 *The Bum Tree included this fully occluded scar on its western side. This scar was on the opposite side to the road and may have been caused by fire or during early European land clearance. The sample, however, was situated above this area and does not provide a section through regrowth over this scar*

The Bum Tree sample includes an example of scar occlusion and its analysis can provide a valuable contribution to the heritage evaluation of tree scars. The location of the scar on the sample section is shown in **Figure 43** and is situated at around ring 90 (approximately 210 years before tree death (1804)

There is nothing to suggest that this scar was man-made, mostly because of its narrow width and considerable height above ground level. It is possibly a scar created by lightning strike, which are typically long and narrow and extend from the tree canopy to the ground.

How a tree heals a scar

A healthy tree will slowly heal a scar by incrementally growing across the scar from either side (lateral overgrowth). This growth is sourced from the live cambium at either side of the scar. This growth is called 'callus regrowth', and occurs at the same time and as part of the same process of producing annual growth rings.

The pattern of regrowth is typically simultaneous from either side, like drawing curtains, with each side finally meeting along a central lineal axis. When both sides of the callus regrowth have met, the scar is said to be occluded.

Some scars never occlude. This happens when the exposed wood is repeatedly burnt, eroded or attacked by borers, and the resulting hollow excludes the possibility of the two sides meeting.

Regrowth does not extend from the top or bottom of the scar, and the scar does not move up the trunk with age. The scar will appear to change shape and get smaller as the regrowth extends across the scar surface

In cross section, a clear pattern is evident of annular callus regrowth, curving over the scar edges and extending across the original scar surface. In some species, when both sides meet, the cambium layer may become continuous across the zone of occlusion, in others, the two sides will always remain separate (**Figure 39**).

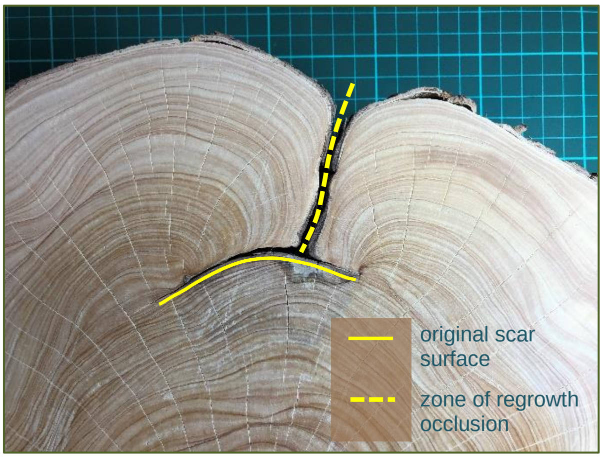


Figure 39 *A cross-section through a fully occluded scar on the trunk of a Lawson Cypress (*Chamaecyparis lawsoniana*). Note the regrowth incrementally extending across the scar surface from each side, and curving over the edge of last year's regrowth.*

It is not unusual, as in this case, for regrowth to be more vigorous on one side of the scar.

Note also the deterioration (evident as discolouration) of the original scar surface due to exposure to the weather prior to occlusion. Background scale in cm.

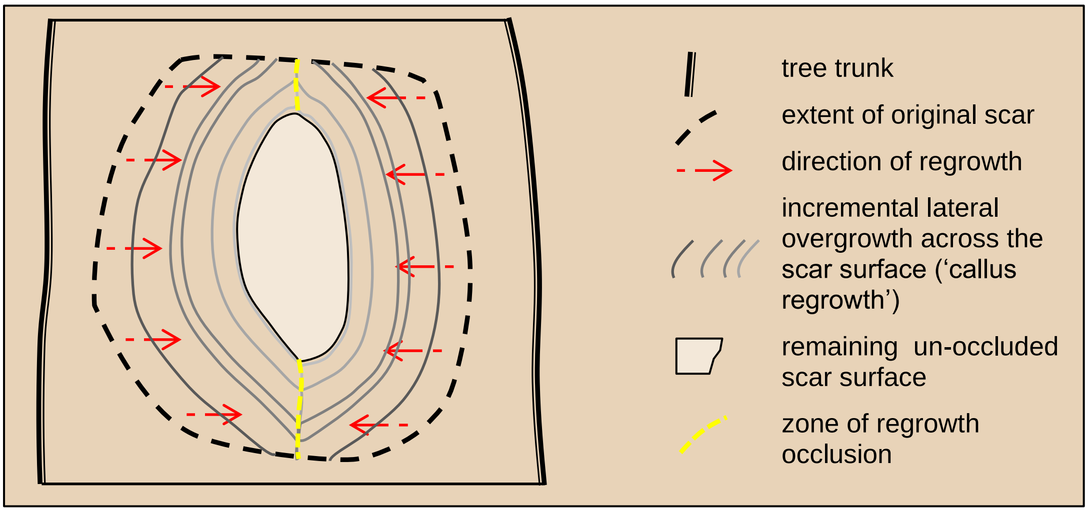


Figure 40 *The typical pattern of regrowth across a tree scar.*
Note how regrowth quickly hides the original size and shape of the scar.

In this context, it is interesting to note that scar surfaces made by fire (and lightning), may show no evidence of charcoal or burning. This is because most fire scars are caused when the cambium layer is killed from heat, with only the overlying bark being burnt or charred. When the dead bark falls away, an unburnt dead cambium layer is revealed. The exposed wood may subsequently be burnt by fire events, but the resulting charring does not relate to the original cause of the scar.

The location of the occluded scar within the Bum Tree sample is situated at around ring 90 which was laid down in approximately 1804, 210 years before tree death. The location and a detailed close up image of the scar cross section is shown in **Figure 43**. The surface width of the original scar, as it is revealed in the trunk section, is 206 mm. The pattern of lateral overgrowth is more evident, uniform and thicker on the left side than the right. At least fourteen growth rings are discernible on the left side, between the scar edge and the zone of occlusion, a distance of 105 mm. Assuming each ring is an indication of annual and continuous growth, this interpretation provides an annual lateral overgrowth rate across the scar surface of 7.5 mm.

The radial outgrowth (the extent of outward trunk growth) between the scarring event and full scar occlusion is 31 mm, based on the left side record. It should be noted that this measurement has been taken away from the regrowth callus which, due to its curved and cumulative growth pattern presents an atypical width (**Figure 43**). This measurement provides an annual radial outgrowth rate of 2.2 mm, given the same assumptions that each ring is an indication of annual and continuous growth. This compares with an overall annual radial outgrowth rate of 1.9 mm, calculated from the sampled whole-of-trunk sequence (using the median age of 361 years and a trunk radius of 685 mm).

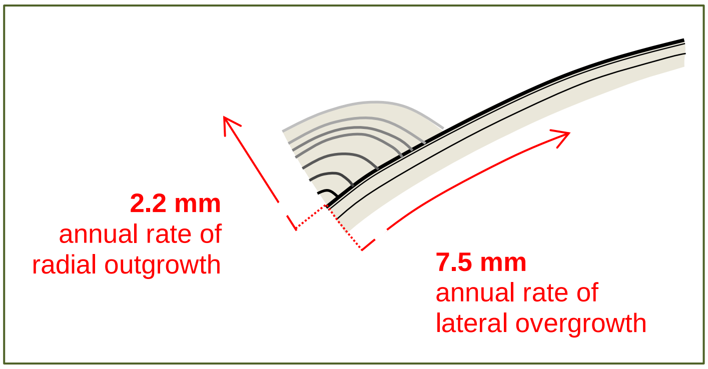


Figure 41 *Schematic cross-section illustrating estimated average callus regrowth rates across the scar evident in the Bum Tree trunk sample*

Implications for heritage scar identification

There are some interesting implications of the Bum Tree regrowth data. Before elaborating, it must be recognised that cross-comparing growth and regrowth rates across different trees, species, and locations can be problematic because individual plants can vary considerably in their response to landscape contexts, soils and micro-climates. This can be true even when comparing across the same species, soil type and landform. Despite this caution, the comparative application of known growth rates can provide an additional piece of information to be weighed when considering the identification of heritage scars.

For those trees with scar regrowth that may be consistent with the Bum Tree, the following characteristics can be predicted:

- All bark-removal scars made 100 years ago or earlier, and involving an original scar width of 1500 mm or less, will now be fully occluded and therefore difficult to recognise.
- A traditional Aboriginal origin for a scar is only a possibility if:
  - the scar is now fully occluded, or
  - for those instances where an un-occluded scar surface or space remains, and past regrowth has occurred across the scar surface (and not a subsequent trunk hollow): the scar displays an estimated width of lateral overgrowth (from one side and extending across the scar surface) of at least 750 mm (the expected regrowth over a period of 100 years).
- Note that it is less likely that scars younger than 100 years old will have a traditional Aboriginal origin (unless close to an Aboriginal Settlement, former Reserve or Mission).

An Example

Here is an example of how the Bum Tree scar regrowth data can be applied in the interpretation of heritage tree scars.

Figure 42 shows an almost fully occluded scar on a Blackbutt tree in a similar landscape context to the Bum Tree, on the Coila Lake sand barrier on the NSW South Coast[14]. The maximum width of lateral overgrowth across the scar was recorded to be 370 mm. The maximum width of the original scar was estimated to be around 850 mm.

Based on the Bum Tree annual lateral overgrowth rate of 7.5 mm, this scar would be estimated to be in the order of 50 years old and consequently too young to have a traditional Aboriginal origin. This relatively recent origin is supported by the relatively un-weathered and sappy (black stained) condition of the regrowth bark.

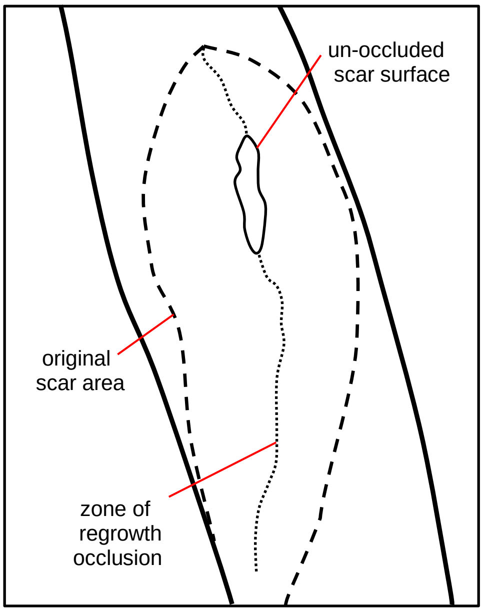


Figure 42 Photographs and a recorder's interpretation of a scar on a Blackbutt tree located on the Coila Lake sand barrier which was considered to have a potential Aboriginal origin when recorded in 2003.

Note person standing at base for scale

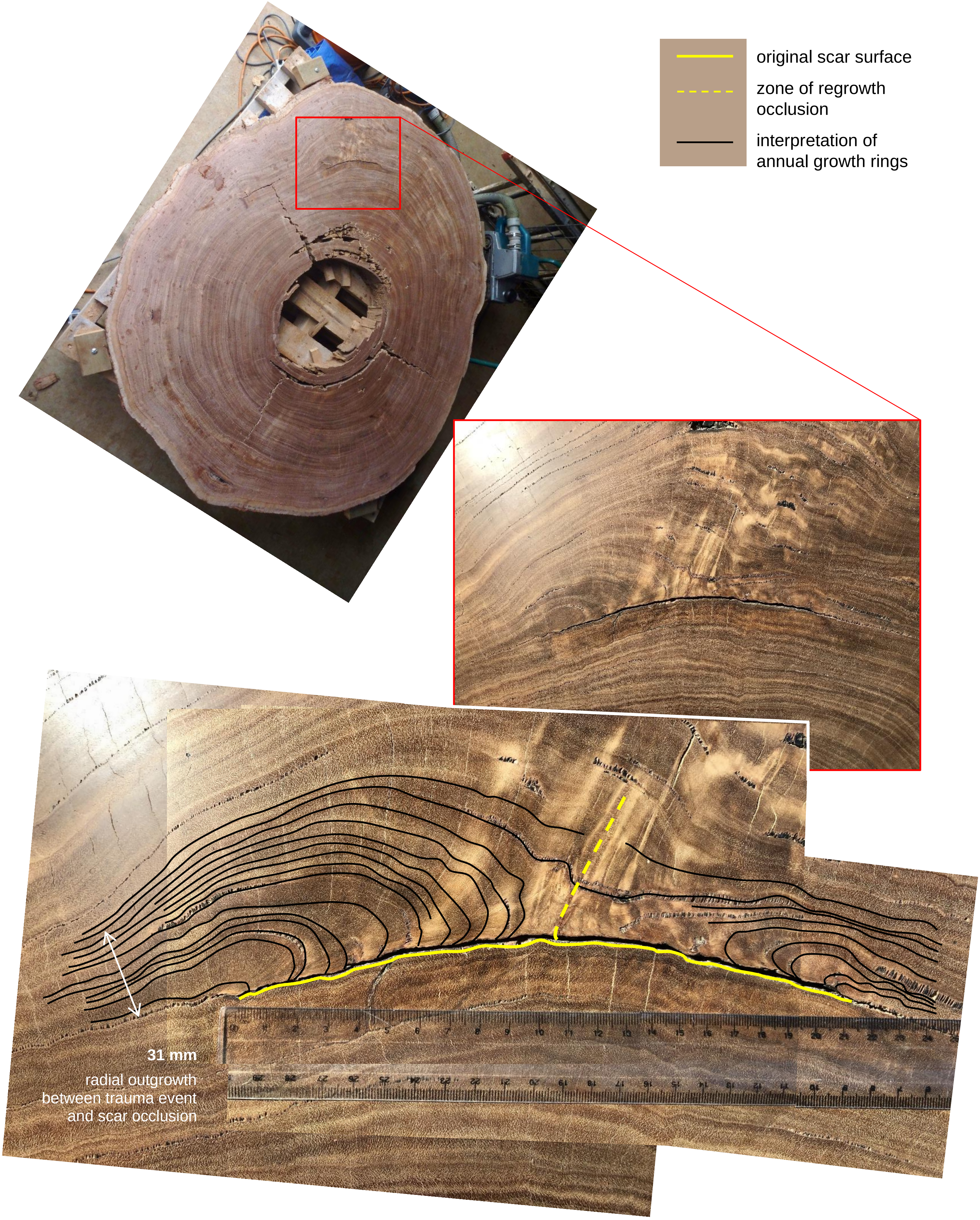


Figure 43 *The location and interpretation of an occluded scar in cross-section, preserved in the Bum Tree trunk sample. The surface width of the evident scar is 206 mm. At least fourteen growth rings are interpreted to be present between the scar edge and the zone of occlusion. Assuming each ring indicates a year's growth, this interpretation provides an annual scar regrowth rate of 7.5 mm. per year.*

7. Display

You can see salvaged portions of the Bum Tree at two local locations.

The Berry Museum

The polished trunk sample which was used in the tree-ring and carbon dating analysis is now on permanent display in the Berry Museum. The Berry and District Historical Society which runs the Museum was an original partner in this project and agreed to conserve the sample for public interpretation and future research. The museum has also archived documentation related to the Bum Tree and this project.

***Figure 44** Placement of the polished trunk sample in its permanent home at the Berry Museum (John Stone (left) and Robert Stone (right) from R and K Stone Mobile Welding)*

Shoalhaven Heads Pool Complex

Following its felling, a 3.1 m section of the lower portion of the Bum Tree trunk including the 'bum', was recovered in one piece and stored in the Shoalhaven City Council's Bomaderry works depot, awaiting a final decision on its future.

Following prompting by Robert Bell, the Shoalhaven Heads Community Forum lobbied the Shoalhaven City Council to place the trunk on public display, just inside the gates at the Shoalhaven Heads pool complex. This proposal was accepted by Council who's engineering team laid a concrete footing and constructed steel work to support the display.

***Figure 45** The salvaged basal portion of the trunk, including the 'bum' burl on public display at the Shoalhaven Heads Pool*

The trunk has been placed in its original orientation, and an interpretive sign has also been erected.

Mr Bell stated that 'It is an icon for tourists and who knows [tourists] might want to come and see the Bum Tree and have their photo taken with it.'[15]

The University of Wollongong's School of Earth, Atmospheric and Life Sciences may in the future place its portion of the trunk sample on display.

8. Legacy

Berry Landcare hope that the information provided by this project can inform future positive decisions on the management and conservation of old-growth trees on Australia' coastal plain, and in particular along its road-sides.

Figure 46 *The unprocessed and remaining portion of the trunk sample after the removal of the section for ring analysis.*

It is impossible to know if the scientific evidence we now know about the age of the Bum Tree would have changed its fate in 2014. After all, its natural, social, aesthetic and cultural values were all in evidence and presented to the decision makers at the time.

The argument that the safety of the driving public should be paramount is not in dispute. What is in question is the priority we place on conserving our rare and diminishing natural resources and spending resources wisely to find solutions. It is hard to believe that there were no feasible road safety alternatives to the loss of the Bum Tree. It would seem, however, that its felling was championed by giving priority to cost and expediency, rather than living legacy.

There are many Shoalhaven planning and strategy documents which stress the need to conserve old-growth trees and the habitat values of roadside vegetation. Where is the will and conviction to act on these commitments?

With continuing habitat loss, species extinction, ecological stress and climate change, it is probable that future Shoalhaven residents will regret the loss of ancient natural wonders, such as the Bum Tree, more earnestly than they welcome their high speed network of roadways and same-as-everywhere-else developed world.

The legacy of the Bum Tree is the knowledge that these large old-growth trees, in inconvenient places, are indeed ancient and more importantly, irreplaceable. A waiting period of 360 years to replace these assets is alien within a world which cycles around three, four and eight year political election and policy wheels.

A legacy also is the scientific contribution this analysis has provided, and the potential for future research which resides in its curated samples. The Bum Tree age range of between 334 and 388 years, and its associated growth and regrowth rates, contribute a set of baseline data with which the age of other trees and scars can be estimated. It is hoped that more and future scientific determinations will add to this dataset.

Figure 47 *The unprocessed trunk sample was accepted by the University of Wollongong for use as a resource for education and future research. Sam Hathaway operating the loader.*

Finally, it is hoped that the telling of the Bum Tree story will provide a legacy of education, and a greater awareness to ensure we conserve our ancient trees – alive.

9. Information Sources

Books and reports

Berry Corridor https://landcare.nsw.gov.au/groups/berry-landcare/projects/berry-corridor/ https://landcare.nsw.gov.au/groups/berry-landcare/projects/berry-corridor/corridor-nrm-management-plan/

Brookhouse, M., June 2006 *'Dendrochronological analysis of Eucalyptus rossii, E. melliodora and E. blakelyi sampled on the Gungahlin Drive Extension, ACT.'* Report to Navin Officer Heritage Consultants, School of Resources, Environment and Society, Australian National University.

Dept of Environment, Climate Change and Water 2010 *South Coast Regional Conservation Plan* NSW Dept of Environment, Climate Change and Water, Sydney.

Great Eastern Ranges Initiative https://www.ger.org.au/home https://www.ger.org.au/where-we-work/illawarra-to-shoalhaven

Long, A. 2005 *Aboriginal Scarred Trees in New South Wales: A Field Manual*. Department of Environment and Conservation (NSW).

Navin Officer Heritage Consultant 2003 *Tuross Sewer Project, Archaeological Survey of Rising Main Easement from Coila Lake to Sewerage Treatment Works at Bingie, NSW*. Report to Eurobodalla Shire Council.

Navin Officer Heritage Consultants 2007 *Gungahlin Drive Extension, Program of Cultural Heritage Impact Mitigation, Final Report.* Report to Roads ACT.

NSW Catchment Management Authority Southern Rivers 2013 *Southern Rivers Catchment Action Plan 2013-2033, State of NSW, Sydney.*

NSW Department of Planning 2007 *South Coast Regional Strategy 2006-2031. NSW Government, Sydney.*

NSW Government 2015 *Illawarra - Shoalhaven Regional Plan,* NSW Government, Sydney. https://www.planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/Illawarra-Shoalhaven/Illawarra-Shoalhaven-Regional-Plan/A-region-that-protects-and-enhances-the-natural-environment

Thom, B.G., Bowman, G. M., Gillespie, R., Temple, R. and M. Barbetti 1981 Radiocarbon dating of Holocene beach-ridge sequences in South-East Australia. *Monograph No.11, Department of Geography,* Royal Military College, Duntroon, ACT.

Media articles and releases

[pre 2014] *Power FM* 'Graffiti' by Rohan http://powerfm.com.au/nowra/index.php/shows/rohan/32723-tree-that-looks-like-a-bum

29 January 2014 5:49 pm *Illawarra Mercury* 'We get to the bottom of the Bum Tree story' by Simon Brown southcoastregister.com.au

29 January 2014 *Shoalhaven City Council Press Release* 'Council to commence Gerroa Road vegetation clearing works' https://www.shoalhaven.nsw.gov.au/My-Council/Media-Releases/articleType/ArchiveView/month/1/year/2014

30 January 2014 2:46 pm *ABC News* 'Unusual Shoalhaven 'bum tree' set for culling' by Jack Evans and Nick McLaren https://mobile.abc.net.au/news/2014-01-30/gerroa-bum-tree/5228174

12 February 2014 *South Coast Register* 'Gerroa jumps into fight over Bum Tree' by Robert Crawford https://www.southcoastregister.com.au/story/2082921/gerroa-jumps-into-fight-over-the-bum-tree/

17 February 2014 *Kiama Independent* 'Protesters mount Gerroa Road tree vigil' by Rob Crawford

13 March 2014 6:14 pm *Newcastle Herald* 'As it happened PHOTOS: Bum Tree comes down amid chants of 'shame!' by Robert Crawford https://www.newcastleherald.com.au/story/2150399/photos-bum-tree-comes-down-amid-chants-of-shame/

14 March 2014 *Gerroa Environmental Protection Society* 'Press Release' hhjones@westnet.com.au

18 March 2014 *2ST* Service Held to Mark Death Of Bum Tree http://www.2st.com.au/index.php/newsroom/54814-service-held-to-mark-death-of-bum-tree

19 March 2014 6:30 pm *South Coast Register* 'Bum Tree battle lost but war far from over' by Robert Crawford http://www.southcoastregister.com.au/story/2159035/bum-tree-battle-lost-but-war-far-from-over/?cs=203

21 March 2014 6:00 am *South Coast Register* 'Mayor condemns Bum Tree protesters' roadside cross' by Robert Crawford http://www.southcoastregister.com.au/story/2164638/mayor-condemns-bum-tree-protesters-roadside-cross/?cs=203

May 2014 *The Town Crier* 'Landcare Berry' [Article on 'the Bum Tree Affair'] https://www.berryalliance.org.au/wp-content/uploads/2017/05/town_crier_may_2014_-_web_version.pdf

6 August 2015 *South Coast Register* 6:02 pm 'Bum Tree to sit at Shoalhaven Heads pool' http://www.southcoastregister.com.au/story/3262870/bum-tree-to-sit-at-shoalhaven-heads-pool/

2 November 2015 *2ST* 'Bum Tree Finds Its Final Resting Place' http://www.2st.com.au/news/shoalhaven-news/87538-bum-tree-finds-its-final-resting-place

27 September 2019 *Berry Landcare Inc*. 'Media Releases: How old was the Bum Tree' https://landcare.nsw.gov.au/groups/berry-landcare/how-old-was-the-bum-tree/ and 'Seventeenth century informs the twenty first' https://www.facebook.com/Southerners2535/posts/10156708701206295

December 2019 The Town Crier 'How old was the Bum Tree?' https://www.berryalliance.org.au/wp-content/uploads/2019/11/December-2019-Edition.pdf

Attachments

A. Radiocarbon Age Determinations

Radiocarbon Laboratory

The Australian National University

^{14}C results

Submitter: Brookhouse

DATE: August 2, 2018

S-ANU#	Sample ID	internal ID	F14C	±	^{14}C age	±
58605 001		19332	1.4589	0.0034	>MODERN	
58606 002		19333	0.9738	0.0026	213	27
58607 003		19334	0.9809	0.0040	155	38
58609 004		19335	0.9775	0.0030	183	29
58610 005		19336	1.1015	0.0040	>MODERN	

B. Specialist Dendrochronology Report

Australian National University

Fenner School of Environment & Society

Age of the Gerroa Tree

Analysis of *E. pilularis* stem cross-section from Crooked River Road, NSW

Fenner School of Environment and Society
+61 2 6125 2579
matthew.brookhouse@anu.edu.au

The Australian National University
Canberra ACT 2601 Australia
www.anu.edu.au

CRICOS Provider No. 00120C

ANU College of Science

Contents

Brief

This analysis was undertaken to determine the origin date of a *Eucalyptus pilularis* specimen, hereafter referred to as the Gerroa Tree, felled at a roadside position on Crooked River Road, 2014, from tree-ring and radiocarbon data.

Sample material

The sample used in this analysis removed from an *E. pilularis* specimen felled at the near the intersection of Crooked River and Beach Roads, south of Gerroa, NSW. The Gerroa Tree (known locally as the 'Bum Tree') was felled in 2014. The single sample available for analysis comprises a cross-section cut from approximately 3.0 metres above ground level. Prior to felling, the Gerroa Tree was located on the boundary of a regrowth stand of mixed eucalypts and stood 1-2 metres from the verge of Crooked River Road.

The sample measures approximately 128 cm in diameter. The central portion of the sample is hollow as a consequence of bio-deterioration while the specimen was standing. The internal hollow measures approximately 80 cm in diameter.

Methods

The sample materials were delivered to the ANU's Fenner School field-services. Preparation had been completed previously and no further preparation was required to permit tree-ring identification.

Analysis was conducted in three stages – (a) interpretation tree-ring structure and measurement of tree-ring widths, (b) radiocarbon-based age estimation and (c) non-linear estimation of the origin data based upon radiocarbon dates and diameter increment data derived from tree-ring widths.

Interpretation of tree-ring structure and ring width measurement

Tree rings were identified on a single radial path comprising three segments. These segments were selected to maximise the length of the time series available for age estimation as well as minimise errors associated with locally-absent rings.

Identifiable rings form in the stems of woody plants in response to periodicity in the activity of the cambium. In eucalypts, this periodicity generally corresponds with seasonal variation in temperature during winter. Thus, in cool climates seasonality in temperature gives rise to an annual couplet of thin-walled cells formed during the early part of the growing season (earlywood), and thick-walled cells during the latter part of the growing season (latewood).

Identifiable rings may also form as a result of variation in the characteristics of xylem components vessel tracheids (water conducting cells). Variation in the concentration of vessels may reflect annual variability in climatic conditions. In south-east Australian eucalypts, high concentrations of vessels commonly correspond with periods of high evaporative demand and relatively rapid growth (Brookhouse and Brack 2006). Thus, relatively dense arrangements of vessels are typically present in wood formed during late spring and summer, whereas sparse arrangements of relatively small vessels are formed during autumn to early spring.

Examination of the sample revealed that, consistent with the low elevation at which it grew, the specimen exhibited indistinct earlywood/latewood couplets. However, banding of vessel tracheids was evident, permitting identification of growth zones

Once identification was complete, tree-ring positions were recorded on transparent film. This film was then scanned on a flatbed scanner at high resolution (1200dpi) and tree-ring widths were measured to the nearest 0.001mm using WinDendro Density©.

Radiocarbon-based age estimation

While alternating bands of low and high vessel concentration leads to the formation of growth zones that provide a reasonable basis for conducting ring counts in species grown at low elevation (Brookhouse and Brack 2006), this method becomes unreliable where the series under examination includes periods of slow growth. Specifically, during canopy senescence diameter growth slows such that ring widths approximate the width of a vessel tracheid, preventing age determination in the outermost sections of over-mature or ‘old-growth’ eucalypts (Banks 1990, Banks 1993, Woodgate, Peel et al. 1994). In these circumstances radiocarbon dating may be used to provide anchor points for undated ring-width sequences derived from wood formed during periods of relatively fast growth (Wood, Hua et al. 2010).

Samples were removed from the Gerroa Tree cross-section for radiocarbon dating at five positions. Sample powder was extracted using a 5 mm drill bit. Radiocarbon dating was performed using the single-stage accelerator mass spectrometer (AMS) at the Research School of Earth Sciences, ANU (Fallon, Fifield et al. 2010). Radiocarbon ages were reported consistent with conventions of Stuiver and Polach (1977). Specifically, conventional radiocarbon age is expressed in years prior to CE 1950 using the Libby half-life of 5568 years. Values for $\delta^{13}C$ were measured on the AMS and used to correct for plant-level isotopic fractionation.

Non-linear estimation of tree age

Internal hollows present an obvious limitation for age determination. Nevertheless, age estimation is possible on the basis of inverted non-linear increment modelling. In this analysis this process was conducted in two main steps – (a) fitting of an appropriate model describing the non-linear form of cumulative diameter increments, and (b) inverted estimation of age/date where tree diameter is equivalent to zero. These steps require conversion of ring-width data to cumulative diameter increments that include an estimation of the distance to the assumed position of the pith, or biological centre of the stem. In addition, estimation of the origin year relies upon correct dating. Where the absolute date of a ring series has not been confirmed through independent crossdating with tree-ring data from additional trees, cumulative increments must be calibrated against radiocarbon dates.

Following conversion to cumulative diameter increments – including an estimated distance to the pith – the origin year was estimated using a three-parameter exponential mechanistic growth function of the form;

Eq 1: $\theta_1 + \theta_2 * e^{-\theta_3 * ring}$

where θ_1, θ_2 and θ_3 respectively denote terms for the asymptote, temporal scaling factor and growth rate and ring is expressed as the number of rings prior to felling.

Preliminary examination of the data indicated that growth increased atypically in the latter part of the tree-ring series. Since this growth acceleration was likely to impact upon inverse estimation of the origin year, analysis was restricted to the innermost 150 rings.

Results

Ring width data

A total of 238 rings were identified along a 47.9 cm radial path. Although highly variable on an inter-annual timescale, decadal scale ring width is relatively stable throughout the earliest third of the measured time series (Figure 2). However, a long-term upward trend in ring width is evident during the central portion of the series following a short-term growth depression approximately 150 rings before the tree was felled. The upward trend reaches a maximum approximately 80 rings before sampling and ring width declines gradually thereafter. A period of consistently narrow rings widths are evident in the final 50 years of the measured ring-width series. While this growth depression is visually consistent with that typical of over-mature senescing forest trees a slight upward inflection in ring width is evident in the final 15 rings.

Non-linear modelling

Fitting of the mechanistic three-parameter exponential model described the cumulative diameter increment data well (r-square = 0.997). Parameter estimates (Table 1) derived from the model indicate that, in the absence of major growth perturbations, an asymptote of 209 cm for tree diameter at the sample height. Model inversion suggests an origin year of 1697 CE – 317 rings prior (± 6 rings; $\alpha = 0.05$) to felling – at the sample height.

Radiocarbon dating

Radiocarbon dates are available for only three of the five analysed samples. Because concentration of ^{14}C of the outermost two samples exceeds expected calibration values, both samples are likely to post-date 1950 CE (Table 2). This outcome is consistent with ring counts for both sample positions (ring -15, 1999 CE; ring -50, 1964 CE). Lesser consistency is evident between ring count and ^{14}C dates for the samples that predate the modern era. The most recent of the dated samples exceeds the ring-counted age by 81-157 years. Calendar dates for second oldest of the two earlier ^{14}C samples exceeds the ring counted age by 61-126 years and the oldest sample by 12 to 66 years. If applied to the inverse estimation of tree age, these error estimates increase the date of origin. Addition of the error range associated with the oldest of the ^{14}C samples pushes the year of origin to between 1631 and 1685 CE.

Discussion

Although much is known about the structure and annularity of tree rings in eucalypts, forest-inventory based studies haven't considered *E. pilularis*. Consequently, very little is known of the ring structure of the species. Inference based upon tree rings observed with the Gerroa Tree sample reflects observations of eucalypt species grown at low elevation elsewhere.

Consistent with low-elevation *E. obliqua* and *E. sieberi*, the Gerroa Tree sample exhibits variability in vessel arrangement (Brookhouse and Brack 2008). This feature has been shown to be annual in locations with seasonal moisture availability associated with variability in both rainfall and temperature (Brookhouse and Brack 2006). This is true even in locations where the latter does not independently limit growth.

Despite the reliability of variation in vessel arrangement elsewhere, ring-counted dating does not correspond with radiocarbon-derived dating. Specifically, the most recent radiocarbon date predates the ring counts by 81 years. Although the earlier radiocarbon

Age of the Gerroa Tree: Analysis of *E. pilularis* stem cross-section from Crooked River Road, NSW

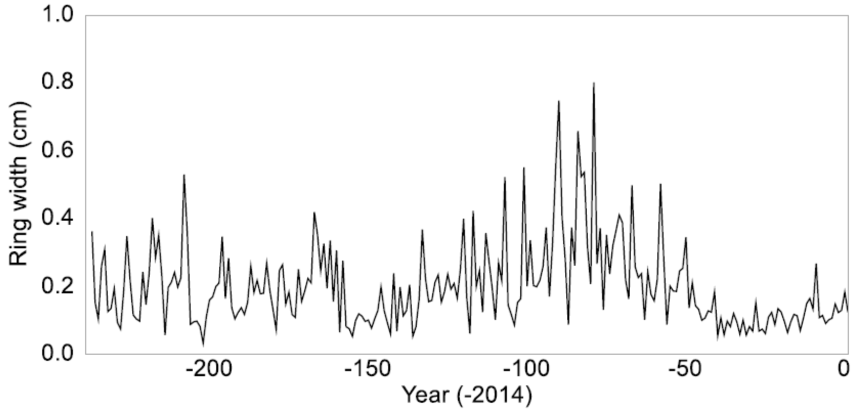


Figure 2: Measured ring-width series for the Gerroa Tree. Years denote assumed years prior to felling based upon tree-ring counts.

Table 1: Parameter estimates for mechanistic growth model

Parameter	Estimate	Std Error	Lower 95%	Upper 95%
Asymptote (θ_1)	208.6	24.13	161.3	255.9
Scale (θ_2)	0.456	0.054	0.351	0.562
Growth rate (θ_3)	0.0025	0.0003	0.0017	0.0032

Table 2: 14C results for samples reported consistent with (Stuiver and Polach 1977) and CI reported to α=0.05. Estimated ^{14}C ring years include minimum ring count between felling year and benchmark year (CE 1950). Comparative ring-counted year for each sample position is also reported.

Sample ID	Conventional ^{14}C age (CI)	Estimated ^{14}C ring year	Ring-counted year
003	155 (± 38)	-219 (± 38)	-100
002	213 (± 27)	-277 (± 27)	-238
004	183 (± 29)	-247 (± 29)	-150

dates are closer to the ring counted estimates, both predate the ring counted estimate. This result is consistent with previous studies for senescent eucalypts (Woodgate, Peel et al. 1994, Wood, Hua et al. 2010). Specifically, degradation of the canopy in the latter stages of eucalypt life-spans leads to the substantial reduction of diameter growth rates. This reduction is often sudden as a result of canopy failure and can lead to substantial under-estimation of tree age if based upon tree-ring counts that have not been crossdated against younger specimens. Indeed Woodgate, Peel et al. (1994) and Wood, Hua et al. (2010) reported several decades of growth may be excluded from ring counts based upon the outermost segments of old-growth eucalypts.

The dramatic reduction in growth and subsequent error in ring counts is a likely explanation for the mismatch between radiocarbon and ring-count based estimates in this analysis. Indeed the relative stability in the error between radiocarbon and ring-estimates in the earlier samples suggests that ring counts and measurements on the inner wood represent annual formations. With that in mind, non-linear modelling of the origin date based upon the innermost rings appears valid. That is, the estimated year of origin to between CE 1631-1685 appears to be an appropriate estimate of the age of the sample. However, considering the sample was taken at a position approximately 3.0 metres above ground level, this estimate should be considered as the latest possible range for the origin year. It is reasonable, based upon assumed height growth rates for forest-grown *E. pilularis*, to subtract a further five years from this range. This leaves a probable range of CE 1626-1680 for the germination of the seed that gave rise to the Gerroa Tree.

References

Banks, J. C. G. (1990). Tree ages and fire history for two old growth forest types in Glenbog State Forest, NSW. A report to the Joint Scientific Committee on the South-East Forests. Canberra, Department of Forestry, Australian National University.: 26.

Banks, J. C. G. (1993). Tree-ring analysis of two mountain ash trees, Eucalyptus regnans F. Muell. from the Watts and O'Shannassy catchments, Central Highlands, Victoria: a report to the Central Highlands Old Growth Forest project. Canberra, Australian National University: 15.

Brookhouse, M. and C. Brack (2006). "Crossdating and analysis of eucalypt tree rings exhibiting terminal and reverse latewood." Trees: structure and function 20(6): 767-781.

Brookhouse, M. and C. Brack (2008). "The effect of age and sample position on eucalypt tree-ring width series." Canadian Journal of Forest Research 38: 1144-1158.

Fallon, S. J., L. K. Fifield and J. M. Chappell (2010). "The next chapter in radiocarbon dating at the Australian National University: Status report on the single stage AMS." Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 268(7): 898-901.

Stuiver, M. and H. A. Polach (1977). "Discussion Reporting of 14C Data." Radiocarbon 19(3): 355-363.

Wood, S. W., Q. Hua, K. J. Allen and D. M. J. S. Bowman (2010). "Age and growth of a fire prone Tasmanian temperate old-growth forest stand dominated by *Eucalyptus regnans*, the world's tallest angiosperm." Forest Ecology and Management 260(4): 438-447.

Woodgate, P. W., W. D. Peel, K. T. Ritman, J. E. Coram, A. Brady, A. J. Rule and J. C. G. Banks (1994). A study of the old-growth forests of East Gippsland. Heidelberg, Department of Conservation and Natural Resources: 223.

C. Selected Media Releases and Articles

Shoalhaven City Council

Press Release 29 January 2014

Website capture from https://www.shoalhaven.nsw.gov.au/My-Council/Media-Releases/articleType/ArchiveView/month/1/year/2014

Council to commence Gerroa Road vegetation clearing works

January 29, 2014

Shoalhaven City Council will commence vegetation clearing works along a section of Gerroa Road in mid-February.

The $820,000 project will involve the clearing of vegetation within the road reserve and the construction of wider shoulders.

The works will take place along Gerroa Road between the turn off to Shoalhaven Heads to the south and the Shoalhaven/Kiama border in the north.

Mayor, Joanna Gash said the works were being undertaken to increase the safety of this well utilised road.

“The upcoming Gerroa Road works will see Council clear trees and remove vegetation up to six metres from the edge of the road,” said Clr Gash.

“While the colloquially known ‘bum tree’ is planned for removal as part of the scheduled works, Council will continue to investigate potential alternate options for the tree prior to the commencement of works.

“Obviously the number one focus of this project is on improving the safety of this road; however Council is willing to investigate options, in consultation with community groups, for using part of the tree in an alternative form.”

Council last night awarded the tender for the project to Nowra based company, A and D Tree Services.

The project is programmed for completion by 30 June 2014 and is 100 percent funded by the Nation Building Black Spot Program administered by the RMS.

Gerroa Environmental Protection Society 14 March 2014

via email: hhjones@westnet.com.au

Press Release - Gerroa Environmental Protection Society

Greater Glider casualty of the bum tree demise

After the bum tree was cut down this afternoon, Gerroa Environmental Protection Society president Warren Holder stumbled over a dead Greater Glider 15 metres from the tree's stump. It's tail was badly damaged and appeared to be cut off and the carcass was very was fresh. He walked back to the area where demonstrators we're watching the trees being felled and took the attached photos. A person from National Parks quickly demanded the carcass and left with it.

The following words were spoken by Howard H Jones (GEPS secretary)

The bum tree had numerous nesting hollows and the lopping operation required hollow logs to be covered and lowered to the ground to check to see if there were any animals inside. Unfortunately this sometimes required the operators to saw into the hollows with their chain saw to access the animals inside, so this could have been an unintended accident? It looks to us like a casualty of the demolition of this great tree. it's too much of a coincidence for it to be anything else, it wasn't near the road so couldn't have been road kill.

While Council has made an effort to save the animals living in the trees and did rescue a family of Greater Gliders and some Sugar Gliders this kind of operation is highly imprecise and we find this discovery very disturbing.

There may be other explanations for the find. The Greater Glider may have left the safety of the tree hollows out of fright from the loppers chainsaws, or because of the disturbance when the canopy of the tree was removed on the first day of lopping and, being unprotected and vulnerable, was attacked by a Powerful Owl, but this seems fairly unlikely as an owl would have at least partially devoured the carcass. Either way we believe that this and possibly other animals could well be casualties of this senseless roadside clearing.

There is emerging evidence the Greater Gliders may be in decline on the South Coast and we already know that the area of Greater Glider habitat at Seven Mile Beach is less that what is considered to sufficient to sustain a viable GG population. We have been trying to impress this concern on Council but they have dismissed our pleas. I think that council officers and Councillors proceeded with undue caution and, as they stated in last weeks SCRegister, they didn't consider this roadside clearing an environmental matter.

Howard H mobile 0434400466 or Warren Holder 0499333141 for further information

LANDCARE BERRY

At the time of "the Bum Tree Affair" and removal of trees along Gerroa Rd, Berry Landcare wrote two letters to SCC, one expressing concern about the extent of the clearing and the other on "The need to mitigate the impact of the current program of vegetation clearance within the easements of Gerroa and Crooked River Roads, and a call for the installation of fauna over and under-passes and arboreal nest boxes."

The letter made the following points:

- Berry Landcarers are local residents and Shoalhaven ratepayers;
- Our main goal is the effective conservation management of ecological and habitat values within the Berry Wildlife Corridor between Barren Grounds Nature Reserve with Seven Mile Beach National Park, with remnant vegetation connectivity having a vital habitat role in the future viability of flora and fauna populations;
- The Berry Wildlife Corridor recognised in the South Coast Regional Conservation Plan and the Southern Rivers Catchment Action Plan, and forms part of the South Coast Regional Strategy; one of ten biodiversity corridors identified in the Shoalhaven to Illawarra sector of the Great Eastern Ranges Initiative.
- The Gerroa and Broken River Road easements occur within this Corridor provides an important contribution to the viability and connectivity of the corridor through Seven Mile Beach National Park and nearby wetlands and littoral rainforest communities on adjacent freehold lands.
- Seven Mile Beach National Park is notable for its high density of arboreal mammals and large number of reptile and frog species. including a resident population of Greater Gliders (Petauroides volans)
- Shoalhaven City Council supports the conservation management of habitat values across its jurisdiction, having made a variety of positive policy statements and resolutions in its State of the Environment Report 2008/12 and its Roadside Environment Management Plan 2000.
- The issue of roadside vegetation is a complex one in which multiple and sometimes conflicting factors must be evaluated, including those of functionality and public safety.
- Concern that ecological and habitat values are not effectively represented in the evaluation process, and that broad scale policy objectives are neither given necessary emphasis or the resources to result in on-ground action and positive outcomes.
- A Review of Environmental Factors was produced for the Gerroa and Broken River Road easement clearing works, but was not made publically available, nor subject to a period of public comment or review.
- This alienated residents, landowners and road users from the decision process, severing Council's decision from its justifying analysis.
- Without a transparent process, or public exhibition of the REF, there was no assurance that the impact on habitat was necessary, properly evaluated or will be effectively mitigated.
- Future instances will occur in the Shoalhaven where the management of road side vegetation will require evaluation in a context of conflicting issues and interests, including the conservation management of ecological and habitat values, and wildlife corridor interconnectivity, which are now mainstream issues of interest to the general community.
- That Council instigate a transparent assessment process for future decisions on the clearance of significant native roadside vegetation, in which all issues are evaluated and presented in a document subject to public comment, prior to Council approval and the commencement of any works;
- That policy commits to the conservation management of natural heritage, ecological and habitat values are given due consideration; and effective actions are followed through to mitigate identified impacts on ecological and habitat values.
- The removal of a number of old growth trees from the road easement has reduced the number and distribution of tree hollows suitable for the habitation and nesting of arboreal wildlife, such as birds, possums and gliders, and has increased the distance between the edges of the remaining forest canopy on either side of the road easement. This has significantly compromised the ability of both terrestrial and arboreal fauna, and notably gliders, to pass between the forest habitats except via a hazardous on-ground traverse across the roadway. The latter, exposes animals to impact from cars, and predation by carnivores.
- These consequences will pose a significant risk to the long term viability of the glider colony, the glider population becoming more isolated, or split, in a territory too small and homogenous, and at risk from car impacts and animal predation.
- To mitigate the ecological impacts of the clearing program, and fulfil existing policy objectives and commitments made by Council regarding the conservation management of habitat and wildlife corridor values across the Shoalhaven, Berry Landcare recommends wildlife hazard advisory signage at regular intervals along the road where it parallels native vegetation; installation of nest boxes, especially those suitable for gliders, arboreal fauna overpasses and terrestrial fauna underpasses.
- Wherever the Berry Wildlife Corridor is traversed by public roads, signage should be erected at either end of the Corridor, which identifies the Corridor and warns of the potential for encountering wildlife;
- Berry Landcare remains dedicated to achieving positive outcomes for both the community and its environment and looks forward to learning of the Council's response to our recommendations and future liaison on the important issue of maintaining the viability of wildlife corridors across the Shoalhaven.

Working Bees for May:

Bong Bong Road: Sunday 11 May, 9 -11 am (Julia Woinarski 4464 2084); **Tindalls Lane - Boundary Road link:** Sunday 11 May, 2 - 4 pm - (Harvey Blue 4464 1880); **Moeyan Hill:** Saturday 17 May, 2 - 4 pm Bill Pigott (4464 3241 or wpigott@bigpond.net.au; **Princess Street Park:** Sunday 18 May, 2- 4 pm Diana Coxhead (0433 213 219); **Bundewallah:** Sunday 25 May, 2- 4 pm Will Armitage (4464 2241); **Mark Radium Park:** Friday 30 May, 9.0 - 10.00 am Rodney Cole (4464 1475)

Other work days will be advised by co-ordinators.

Information can also be found at Berry Landcare on Facebook

Media Release

27 Sep 2019

Berry Landcare Inc.

Contact: Kelvin Officer
kofficer@nohc.com.au
0427 255417

How old was the Bum Tree?

To many it was a loved local icon, a visual pun half-way along the 'sand track' and a natural wonder, to others a graffiti blight or a traffic hazard. To the endangered population of greater gliders in the Seven Mile Beach National Park, it was a home.

Affectionately known as the 'Bum Tree', its age was the subject of both wild and learned debate, and the origin of its posterial burl the realm of folklore. At breast height, the maximum diameter of the trunk was 1.7 metres.

In 2014, the Shoalhaven City Council determined that the old-growth tree on the road verge near the intersection of Beach and Gerroa Roads was impeding the safe operation of the intersection and should be removed. The decision prompted considerable opposition and debate. Despite its recognised ecological value, roadside vigils, and public discussion of alternatives, the felling of the tree proceeded on 14 March 2014.

In the midst of conflicting claims about the age and value of the tree, Berry Landcare began a project to salvage a sample 'slice' of the trunk and accurately determine the tree's age. The objective was to provide a record for future research, and reference data to assist future decisions in managing old-growth trees. The Shoalhaven City Council agreed to fund project costs.

After felling, close inspection of the stump revealed the tree originally had two trunks, and at some time in its early life, one of these had fallen, and the resulting overgrowth across the scar had formed the infamous burl.

Hundreds of volunteer hours then followed in preparing the sample and sanding the surface to a fine burnish to reveal its record of tree rings. An analysis of the rings, combined with radiocarbon dating, was then conducted by Dr Matthew Brookhouse at the Fenner School of Environment and Society, Australian National University.

The analysis concluded that the Bum Tree probably germinated sometime between 1626 and 1680 CE (Common Era), that is, between 334 and 388 years before it was felled in 2014. This places the tree well before European knowledge of the Australian continent and makes it a contemporary of the British monarch Charles II.

Berry Landcare project director, Kelvin Officer stated that

> "We hope that this age determination will better inform future management decisions about old-growth vegetation along the road verges of the Shoalhaven district. Rather than felling, greater effort in road design and resource allocation is justified in the retention of such ancient trees, for the benefit of our environment and our appreciation of it."
>
> "The Bum Tree was situated within the Berry Corridor, an important wildlife corridor between the coast and the hinterland, and the retention of similar habitat trees should be a high priority into the future."

The polished trunk sample will soon be on permanent display at the Berry Museum. The salvaged burl can be seen at the Shoalhaven Heads pool complex.

Berry Landcare encourage landholders to protect and connect their existing patches of bush. Landholders interested in funding support can contact Bush Connect Project Officer, David Rush by email: davidr@npansw.org.au or phone 0418 977 402.

1

Media Release

27 Sep 2019

Berry Landcare Inc.

Contact: Kelvin Officer
kofficer@nohc.com.au
0427 255417

Seventeenth century informs the twenty first

A local Landcare group on the NSW South Coast has dated an old-growth tree, removed from a road verge in 2014, to the seventeenth century, well before European knowledge of Australia.

Known locally as the 'Bum Tree', a distinctive burl at the base of the tree, offered a full moon to passing travellers. To many it was a loved local icon, a natural wonder, but to others a graffiti blight, or a traffic hazard. To the endangered population of greater gliders in the Seven Mile Beach National Park, it was a home.

Its removal by the Shoalhaven City Council to improve intersection visibility prompted local controversy, on-site vigils, and debate about the value and management of road-side vegetation.

Its age was the subject of conjecture and wild debate, and the origin of its posterial burl was the realm of folklore. At breast height, the maximum diameter of the trunk was 1.7 metres, easily the largest tree visible from the road between Gerroa and Shoalhaven Heads.

In the midst of a polarised debate with conservation pitched against traffic safety, Berry Landcare began a project to salvage a sample 'slice' of the trunk to accurately determine the tree's age. The objective was to provide a record for future research, and reference data to assist future decisions in managing old-growth trees. The Shoalhaven City Council agreed to fund project costs.

After felling, close inspection of the stump revealed the tree originally had two trunks, and at some time in its early life, one of these had fallen, and the resulting overgrowth across the scar had formed the infamous burl.

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> "The Bum Tree was situated within the Berry Corridor, an important wildlife corridor between the coast and the hinterland, and the retention of similar habitat trees should be a high priority into the future."

The polished trunk sample will soon be on permanent display at the Berry Museum and the savaged burl can be seen at the Shoalhaven Heads pool complex.

1

The Bum Tree on the verge of Gerroa Road in early 2014

Dr Matthew Brookhouse with the polished trunk sample at the Australian National University

2

Landcare BERRY

How old was the Bum Tree?

In 2014, the Shoalhaven City Council determined that an old-growth tree on the road verge near the intersection of Beach and Gerroa Roads was impeding the safe operation of the intersection and should be removed. The tree was known as the "Bum Tree' due to an odd postural shaped burl at its base. The decision prompted considerable opposition and debate. Despite its recognised ecological value, roadside vigils, and public discussion of alternatives, the tree was felled on 14 March 2014. Close inspection of the stump revealed the tree originally had two trunks, and at some time in its early life, one of these had fallen, and the resulting overgrowth across the scar had formed the infamous burl. It was also a home to Greater Gliders. Berry Landcare began a project to salvage a sample 'slice' of the trunk and accurately determine the tree's age.

Hundreds of volunteer hours then followed in preparing the sample and sanding the surface to a fine burnish to reveal its record of tree rings. An analysis of the rings, combined with radiocarbon dating, was then conducted by Dr Matthew Brookhouse at the Fenner School of Environment and Society, Australian National University.

The analysis concluded that the Bum Tree germinated sometime between 1626 and 1680, that is, between 334 and 388 years ago, well before European knowledge of the Australian continent. The polished trunk is now a permanent display at the Berry Museum. The salvaged burl can be seen at the Shoalhaven Heads pool complex.

The Bum Tree was situated within the Berry Wildlife Corridor, an important wildlife corridor between the coast and the hinterland. Berry Landcare encourages landholders to protect and connect their existing patches of bush. Landholders interested in funding support can contact Bush Connect Project Officer, David Rush by email: davidr@npansw.org.au or phone 0418 977 402.

For Worksite dates see landcare.nsw.gov.au/Berry Landcare.

Dr Matthew Brookhouse with the polished trunk sample at the ANU

End Notes

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[1] *Ms Valda Corrigan, NPWS, personal communication 14 March 2014*

[2] Boland, D.J., MIH Brooker, GM Chippendale, 1985 *Forest Trees of Australia*. Thomas Nelson Australia & CSIRO, Melbourne

[3] Brookhouse, M., June 2006 *'Dendrochronological analysis of* Eucalyptus rossii, E. melliodora *and* E. blakelyi *sampled on the Gungahlin Drive Extension, ACT.'* Report to Navin Officer Heritage Consultants, School of Resources, Environment and Society, Australian National University.

Navin Officer Heritage Consultants 2007 *Gungahlin Drive Extension, Program of Cultural Heritage Impact Mitigation , Final Report.* Report to Roads ACT.

[4] Banks, J.C.G. 1997 Tree ages and ageing in yellow box. In *Australia's ever-changing forests III : Proceedings of the third National Conference on Australian Forest History* (ed. J. Dargavel), pp. 17-28. Centre for Resource and Environmental Studies, Canberra.

[5] Brookhouse, M. and C. Brack 2006 "Crossdating and analysis of eucalypt tree rings exhibiting terminal and reverse latewood." Trees: structure and function 20(6): 767-781.

[6] Banks, J. C. G. 1990 Tree ages and fire history for two old growth forest types in Glenbog State Forest, NSW. A report to the Joint Scientific Committee on the South-East Forests. Canberra, Department of Forestry, Australian National University: 26

Banks, J. C. G. 1993 Tree-ring analysis of two mountain ash trees, *Eucalyptus regnans* F. Muell. from the Watts and O'Shannassy catchments, Central Highlands, Victoria: a report to the Central Highlands Old Growth Forest project. Canberra, Australian National University: 15; and

Woodgate, P. W., W. D. Peel, K. T. Ritman, J. E. Coram, A. Brady, A. J. Rule and J. C. G. Banks 1994 A study of the old-growth forests of East Gippsland. Heidelberg, Department of Conservation and Natural Resources: 223

[7] Wood, S. W., Q. Hua, K. J. Allen and D. M. J. S. Bowman(2010 "Age and growth of a fire prone Tasmanian temperate old-growth forest stand dominated by *Eucalyptus regnans*, the world's tallest angiosperm." Forest Ecology and Management 260(4): 438-447

[8] Fallon, S. J., L. K. Fifield and J. M. Chappell 2010 "The next chapter in radiocarbon dating at the Australian National University: Status report on the single stage AMS." Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 268(7): 898-901.

[9] Stuiver, M. and H. A. Polach 1977 "Discussion Reporting of 14C Data." Radiocarbon 19(3): 355-363

[10] Brookhouse, M. and C. Brack 2008 "The effect of age and sample position on eucalypt tree-ring width series." Canadian Journal of Forest Research 38: 1144-1158.

[11] Brookhouse, M. and C. Brack 2006 "Crossdating and analysis of eucalypt tree rings exhibiting terminal and reverse latewood." Trees: structure and function 20(6): 767-781.

[12] Woodgate, P. W., W. D. Peel, K. T. Ritman, J. E. Coram, A. Brady, A. J. Rule and J. C. G. Banks 1994 A study of the old-growth forests of East Gippsland. Heidelberg, Department of Conservation and Natural Resources: 223

[13] References as for footnotes 12 and 7

[14] Navin Officer Heritage Consultants 2003 *Tuross Sewerage Project* Report to Eurobodalla Shire Council, p.18 – 19.

[15] *South Coast Register* 6 August 2015 'Bum Tree to sit at Shoalhaven Heads pool' http://www.southcoastregister.com.au/story/3262870/bum-tree-to-sit-at-shoalhaven-heads-pool/